UNIVERSITY OF MISSOURI

Campus Facilities Safety and Health Program

Campus Facilities Safety

8/1/2011

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Table of Contents

Part 1 Overview

1.0 Safety and Health Mission Statement

Our mission is the elimination of work-related injuries and illness

The program is overseen by three division oversight committees composed of trades/support, supervisory and managerial staff, and a departmental committee in each of CF six departments:

- Members of the Safety Standards Committee review safety-training needs, draft policy and standards, develop work rules and oversee the safety manual;
- Members of CF's leadership group, department directors and managers, approve, implement and enforce safety policies;
- Members of the Safety Steering Committee review accidents, perform safety audits and oversee safety meetings within their respective units;
- Members of Department Safety Committees -- containing some members who also serve on the Standards, Steering and CF leadership committees -- implement the program and promote safety action and communication.

Trades and support staff are especially responsible for practicing safety on the job; supervisors for maintaining a positive safety attitude, instilling this attitude in their subordinates and ensuring that the highest degree of safety is practiced on the job; senior managers for the leadership, improvement and effectiveness of the three-part safety program. A safe workplace requires a heightened awareness of safety and cooperation at all job levels. Our goal is to ensure maximum safety and health in the workplace. By working together this can be achieved.

A safe and healthy workplace is our utmost concern!

Gary Ward
Associate Vice Chancellor-Facilities

1.1 Safety Goals and Objectives

Goal 1: Eliminate Injuries

Develop and maintain a required incentive/recognition safety program through:
- Policies and standards adopted by MU and Campus Facilities
- Policy and standards generated by individual CF units
- Training proposals reviewed and accepted by CF directors

Train all employees in:
- Safe work practices/procedures
- Recognizing and controlling hazards
- Tool and equipment safety
- Individual-needs topics
- Various standards and regulations

Develop and maintain safety communications
- Determine responsibilities for each workforce
- Develop and maintain a “safety alert” process
- Maintain a safety organization chart
- Determine accountability
- Develop Maintain a safety W eb-page

Maintain a “New Employee” safety-orientation course

Maintain a Campus Facilities Standards Committee to:
- Develop policy
- Develop safe work rules
- Suggest training
- Review safety standards

Maintain a Campus Facilities Safety Steering Committee to:
- Investigate accidents
- Review monthly accident and compensation reports
- Assess unsafe acts and conditions
- Assist management in controlling hazards
- Assist in developing a safety manual

Maintain a Risk Management/Risk Assessment Management Team to:
- Determine the consequences of unsafe acts or procedures
- Establish disciplinary action for unsafe acts or procedures
- Suggest and approve policy
- Control hazards

Goal 2: Periodically update Plans for Safety Goals

Establish unit goals (by unit personnel)
Establish department goals (by CF Safety Steering Committee)

Goal 3: Maintain an Employee-Involved Safety Program

Present and implement concepts targeting at-risk and critical behaviors
Provide safety leadership at all levels

Goal 4: Develop Policies and/or Standardize Procedures

Create safety sub-committees for departmental special issues
Solicit input and review from the C.F. Safety Steering Committee

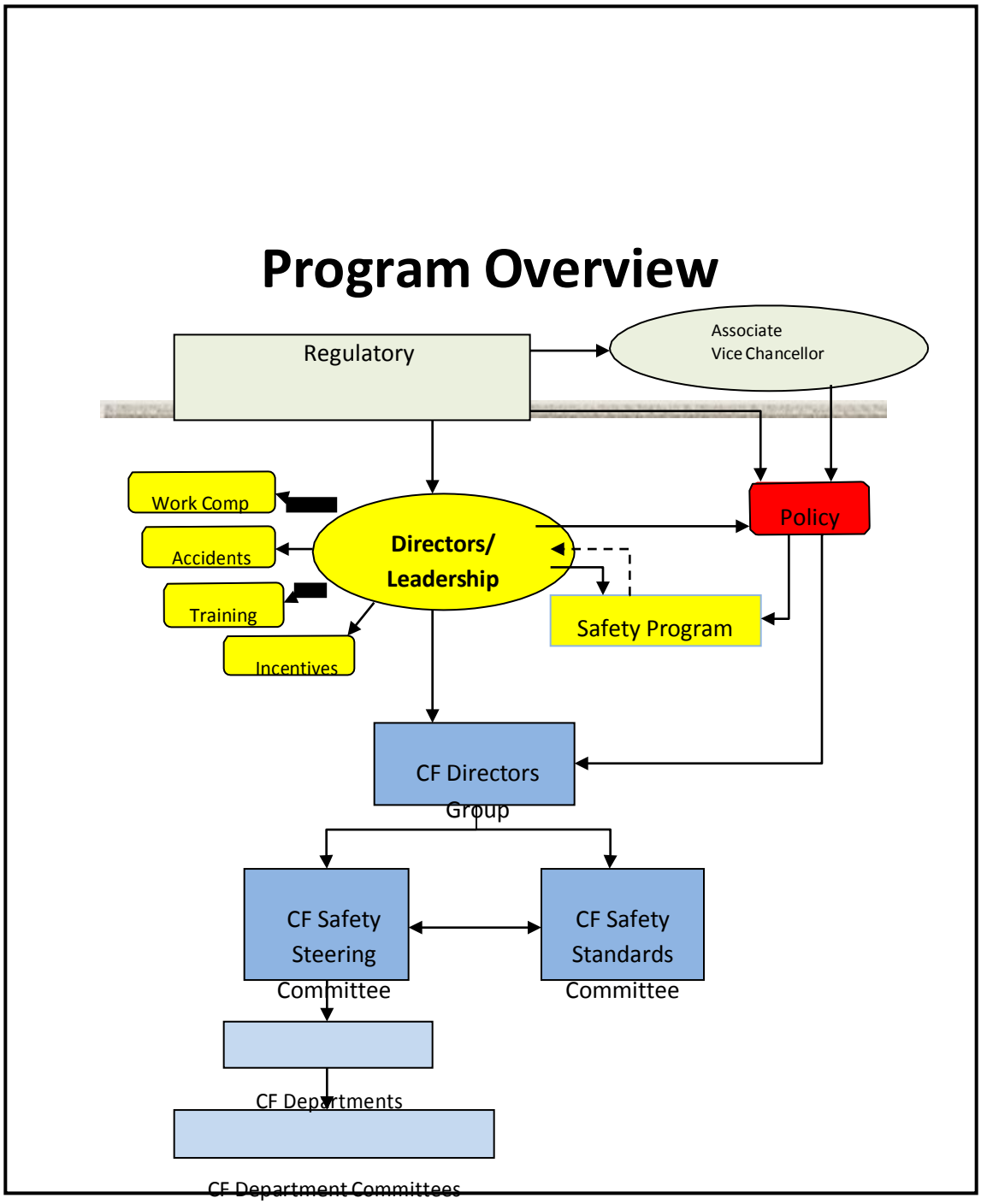
Goal 5: Develop a Manual of Safe Work Practices

Document common work and analysis procedures
Define hazards and controls for specific tasks
Document engineering controls, work rules or administrative controls, and the personal protective equipment required for tasks

Goal 6: Reduce Worker Compensation Costs

Identify and correct known and potential hazards
Analyze accidents, incidents, and near-miss reports
Heighten safety awareness through monthly reports
Reduce injuries

1.2 Scope of Responsibilities



Senior Management (Associate Vice Chancellor/Directors/Associate Directors):

- Provide leadership and financial direction for the Safety & Health Program
- Provide leadership and financial support to the safety program and safety committees
- Promote safety training and a "Safety First!" attitude in all appropriate meetings
- Review results of Safety Program
- Review safety policies when requested by the leadership group, steering committee, and standards committee
- Approve CF safety policies and procedures
- Hold Lost Time injury review meetings following all lost time injuries
- Directors to hold accident reviews following all injuries resulting modified duty

Middle Management (CF Leadership Group) -- Superintendents/Assistant Superintendents/Managers/Assistant Managers:

- Provide leadership and financial support to the Safety & Health Program
- Promote the concept of "safety first" and safety training in all departmental meetings
- Ensure that employees attend appropriate safety training
- Ensure that regular safety meetings are conducted at all department levels.
- Recommend safety training and/or safety policy to C.F. Safety Committee and the safety coordinator
- Enforce safety policies
- Review all accidents
- Approve safety policy

Supervisors

- Conduct a new-employee safety orientation
- Instruct subordinates in safety procedures and encourage safe work performance
- Maintain all safety equipment in proper working order
- Understand safety equipment functions, including equipment used by sub-contractors
- Encourage employee safety suggestions
- Attend accident investigations of all supervisees
- Seek assistance of CF's Safety Coordinator in evaluating safety hazards
- Secure work zones from pedestrian traffic
- Provide "on site" safety job briefings
- Counsel and discipline, as necessary, for infractions of safety policies
- Arrange for medical treatment and complete "report of injury" form found on the CF Safety webpage, supervisor investigation and when necessary lost time accident forms also on the CF Safety webpage
- Schedule lost time injury reviews through the Associate Vice-Chancellors office
- Schedule modified injury reviews with departmental directors

Crew Leaders

- Secure the workplace from pedestrian traffic
- Perform "on site" job-safety briefings
- Correct all immediate or potential hazards
- Follow all safety rules
- Report violations of the safety policies to their supervisors

General Workforce

- Work only within the scope of one's expertise or training
- Be aware of all safety instructions before beginning a task
- Follow all safety rules and safe-work practices
- Report unsafe conditions, tools, or equipment
- Report accidents and injuries to your supervisor
- Report all "near miss" incidents
- Take action when necessary to protect themselves and others from job hazards

C.F. Safety Coordinator

- Provide monthly accident and Worker Compensation information to C.F. Directors
- Oversee the Campus Facilities Safety Program
- Conduct safety training
- Coordinate departmental safety training with safety needs
- Assist departments in providing specialized, expert safety training
- Oversee department safety committees
- Perform safety and accident investigations
- Oversee activities of department safety representatives
- Coordinate Campus Facilities safety personnel
- Attend Campus Facilities monthly meetings
- Inform, coordinate and assist departments re safety needs, concerns and ideas
- Provide safety information
- Provide departments with Website support
- Oversee and update the safety manual
- Provide safety alerts
- Develop and oversee policy and safety rule interpretations
- Work with Environmental Health Services when necessary
- Work with Risk Management to reduce workers compensation cost
- Assist or conduct audits and inspections
- Supply expertise in controlling and eliminating hazards
- Maintain required records

1.3 Safety Committees

Definition:

A safety committee is a body of select C.F. employees delegated to consider, investigate, act on or report on matters and issues of worker safety, and to communicate on the same to the management of Campus Facilities. Safety Standards Committee members review safety-training needs, draft policy and standards, develop work rules and oversee the safety manual; CF's Leadership Group members, suggest, approve and enforce safety policies; and Safety Steering Committee members review accidents, perform safety audits and oversee safety meetings within their respective units.

The Safety Coordinator and an exempt and non-exempt employee of each CF department sit on the C.F. Safety Steering and the C.F. Safety Standards committees. These same exempt and non-exempt employees may serve simultaneously on both committees.

Standards Committee

Assist management in creating policy.

- Supply information for review to the Leadership Group
- Suggest safety rules, standards, and regulations for use in the Campus Facilities Safety Manual and for training
- Set deadlines for completing remaining policies, e.g. personal protective equipment, eyewear, workplace safety.

Safety Steering Committee

Represent all departments

- Review C.F. accident reviews
- Suggest safety measures to CF's Leadership Group
- Review "near miss" reports and other safety issues and suggest related safety action
- Perform accident reviews in committee member areas
- Clarify interactive policy for CF workforce, safety coordinator and management
- Perform safety audits
- Correct and track unsafe working conditions
- Oversee weekly/monthly department safety meetings
- Ensure that safety coordinator receives paperwork for safety meeting rosters

CF Leadership Group

Approves safety policies, rules and procedures

- Suggests policy changes
- Reviews departmental accident investigations
- Manages risks on the basis of work practices, resources and financial feasibility
- Coordinates with C.F. Safety Committee
- Determines consequences for infractions of safety rules
- Provide financial support for the Safety Program

Departmental Safety Committees

- Audit and inspect Safety & Health Program activities within the department.

- Determine the effectiveness of safety efforts via department records and reports and develop recommendations
- Conduct, review and analyze department accident and property-loss reports to determine:
    - Completeness and accuracy (recommend follow-up investigation, if necessary)
    - Accident patterns or trends
    - Recommended corrective action
- Review for needed changes all department safety and property inspection reports and analyses, and employee safety suggestions
- Assist the C.F. Safety Steering Committee in developing safety and property-inspection procedures and, when requested, assist department personnel with safety inspections
- Inform departmental managers of progress with both the Safety & Health Program and employee safety records
- Assist in developing departmental data with which to determine safety needs
- Identify and suggest corrective action for unsafe work practices and conditions
- Ensure that CF employees and visitors are informed of all health- and safety-related matters
- Maintain open channels of communication on matters of health and safety
- Provide means by which employees may advise managers on matters of safety (See Safety Suggestion Form in Appendix 1)

1.4 Safety Meetings

Safety Meeting Policy

Safety meetings should be brief and to the point. Quick 15 - to 20-minute meetings are most effective. Topics should concern only vital matters, i.e., accidents, hazards, unsafe working conditions, etc., but may involve issues that are normally addressed by departmental managers or safety committees, such as tools, equipment or machinery. Safety training, which requires careful planning, practice and expertise, should never be conducted in safety meetings.

Daily Worksite Safety Meetings

The purpose of a daily worksite safety meeting or worksite job briefing is to check out the day's work plan and, ON A DAILY BASIS, assess and correct safety hazards, address safety issues, and determine that everyone, that day, understands the task at hand.

Weekly Safety Meetings

Weekly meetings allow supervisors and crews to discuss safety concerns and other workplace topics of interest and to correct unsafe conditions (See CF Weekly Safety Meeting, Form ST53 Appendix 1.)

Monthly Departmental Safety Meetings

Monthly safety meetings allow the department committee members to discuss safety issues and coordinate safety procedures.

- *Departments must hold a minimum of two meetings per month with a combined total of one hour*

2.0 Recognizing Workplace Hazards Revised 8/3/2011

Categories of Hazards

- ***Imminently Harmful***. This hazard is to be reported to a manager or to the Safety Coordinator and corrected immediately. If the hazard cannot be eliminated without endangering employees and/or property, employees are to vacate the area so the hazard can be corrected by trained personnel.

- ***Serious, but not Immediately Harmful*.** This hazard is to be reported immediately to a manager, area employees are to be notified, warnings posted, and the hazard eliminated within five days.

- ***Potentially Hazardous*.** This hazard is to be reported, area employees cautioned, warnings posted, and the potential hazard should be controlled and/or eliminated within 30 days. If corrections cannot be made within 30 days the CF Safety Coordinator shall be notified. Equipment, substances, materials, procedures or processes shall be evaluated continually for their potential to create unsafe conditions.

Types of Hazards

- ***Air hazards***: Common air hazards, in the form of particulate, gas or vapors, are:
  - Dust: Solid particles formed by mechanical crushing, grinding, drilling, abrading or blasting processes
  - Fumes: Particles suspensions in a gas (Air)
  - Mists: Fine liquids suspended in the air. Usually caused by the breakup of a liquid, e.g., splashing, foaming, atomizing.
  - Fibers: Solid particles which are longer than they are wide.
  - Gases: Fluids without form that expand to occupy the space they are in, such as carbon monoxide from an internal combustion engine.
  - Vapors: Gases evaporating from substances that, at room temperature, are normally in a solid or liquid state, such as a solvent.

- ***Chemical Hazards***: Harmful compounds in a solid, liquid, or gaseous state. Harmful when breathed, ingested, or absorbed through the skin. The degree of risk depends on the nature, potency and length of exposure. Material Safety Data Sheets (MSDS) provide information on protection against such hazards.

- ***Biological Hazards***: Organisms that can enter the body and can impact human health. Personal hygiene, attention to minor cuts and scratches, and proper PPE reduces risk of exposure.

- ***Ergonomic Hazards***: Physical problems due to excessive vibration, eye strain, repetitive motion, and heavy lifting resulting from performing poorly design job tasks.

Physical Hazards: Include improper tools, low overhangs and tripping hazards. Machine guards, electrical and falling hazards are also included in this category.

Other Hazards: workers from other MU departments and non-workers

2.1 Identifying Job-site Hazards

Survey the workplace to identify actual and potential hazards (See Job Hazard Analysis Form, Job Safety Analysis Form and Worksite Inspection Checklist, Appendix 1). Look for:

- Overhead objects that might fall.
- Exposed pipes or beams at work level.
- Exposed liquid chemicals.
- Sources of heat, intense light, noise, or dust.
- Flying particles produced from equipment or materials.
- Tripping/falling/slipping
- Housekeeping clutter (JOBSITE JUNK)
- In-place engineering and work-practice controls
- Unguarded machinery or tools
- Sources of electricity
- Heavy equipment in operation – trenchers, loaders, etc.

Supervisors and Managers that supervise front line employees are required to fill out at least one job Safety Analysis (JSA) as directed by the Leadership Group. These forms are found on the CF Safety webpage and in appendix 1 of this document. Management personnel with assistance of departmental employee fill out a JSA. The JSA's are to be sent to the representative that will track the documents for that department. The representative will then send the completed JSA(s) to the CF Safety Coordinator for entry on the web. Non-routine, accident and near-miss reports, and employee request should be considered priority topics for the JSA's.

2.2 Conducting the Job-Site Safety Briefing

Employees must be aware of jobsite hazards. The person in charge of the operation is responsible for conducting the job briefing and pointing out jobsite hazards. Briefings should be conducted on the jobsite and in an area free of distractions:

- **Conduct the briefing in a jobsite** area free of distractions.
- **Explain the job at hand.** Discuss the job in detail and then seek input from members of the crew, who may suggest a better way to do the job.
- **Never assume that workers understand the job.** Allow questions and clarify any misunderstanding. Discuss emergencies, medical treatment, special phone numbers and emergency contacts. Limit discussion to the job at hand. Make sure crew members understand the safety points and issues.
- **Assign specific tasks to employees.** Know the skill levels of employees with whom you work. Are they qualified? Have they performed this task before? What can and can't they do? Do they need a partner? Should they work with a journeyman?
- **Everyone must know his or her assignment.** Emphasize that others cannot be relied on to know their needs and that there is no shame in admitting they have not mastered or do not fully understand certain aspects of the job. Co-workers would rather have the person seek help than risk injury to self or others.
- **Perform a hazard-assessment procedure to identify actual or potential hazards.** Look for actual or potential hazards. Anticipate hazards that might occur. Will the job itself create hazards? Can the job be done differently? Can hazards be reduced or eliminated? Ask for input. No individual can be aware of all hazards all of the time.
- **Identify the need for personal protective equipment.** Ensure that everyone follows safety rules and safe work practices and utilizes proper PPE.
- **Know emergency medical procedures and locations of first-aid kits and AEDs.** (See EHS Emergency Poster, Appendix 1.)
- **Make sure that everyone knows the job assignment.** Seek questions from crew members and search out points of confusion and overlooked hazards. Have members repeat instructions and procedures in their own words.
- **The more complex the job, the more important it is to be understood fully.**
- **If the job-plan changes significantly, conduct another briefing.**

3.0 Personal Protective Equipment

With the exception of respiratory equipment required when dealing with spilled or released hazardous material, this section covers the general rules, training, selection, types and uses, fit, care and maintenance of Personal Protective Equipment required for all other workplace hazards, Applicable OSHA Standards are 1910, Subpart 1, Appendix B; and 1910.120, Appendix B, 132, 133, 136 and 138. Do not rely on PPE devices alone to protect against hazards. Use PPE in conjunction with other safeguards, controls and practices. (See PPE Needs Checklist, Appendix 1.)

General Rules

- PPE shall be of safe design and construction.
- Use only defect-free PPE.
- Employee-owned PPE must meet design and safety standards and be inspected and authorized for use by the supervisor in charge.
- Assess the workplace through the Hazard Assessment Method to determine the presence of actual or potential hazards and the need for PPE. If hazards are present, take the following action:
    - Select appropriate, properly fitting equipment
    - Inform the employee(s) of the equipment selected.
    - Instruct the employee(s) on using the PPE

3.1 Protective Eyewear

Protective eyewear that conforms to standards of the American National Standards Institute is provided to employees at no cost and must be worn where eye hazards exist in the workplace. See your immediate supervisor for specific on-the-job rules and requirements. Always protect for the greatest hazards! (See Eyewear, Protective, CF Directive No. 207C; Eye and Face Protectors, Recommendations/Selection Guide; Eyewear, Prescription – Authorization/Order Form; Eyewear, Prescriptive – Optical Service Order Form Instructions; Eyewear, Protective – Employee Application)

Safety Glasses (with side shields) Safety glasses shall be equipped with permanent side shields. Such glasses provide protection from projectiles, such as chips, sparks, or other flying particles. Safety glasses do not fit tightly against the skin and therefore do not provide protection from chemical splash, spills or high concentrations of gases, vapors, mists or dusts.

Wear when:

- At all times when required by safety policy
- Transferring small quantities of non-corrosive liquids between containers
- The potential for electric arc or blast exists
- Performing automotive repair work
- Mowing lawns or trimming
- Chipping, grinding, sawing
- When recommended by the MSDS
- Overhead work or when lying on back

Chemical-Splash Goggles: Goggles equipped with shielded, indirect vents (or no vents) that protect against projectiles, chemical splashes, mists, dusts and spills. This goggle does NOT protect against high concentrations of gases and vapors. These devices can be worn over most safety glasses, but must seal against the face. Goggles with direct venting or perforated sides are NOT approved for chemical splash and shall not be used for such purposes. Wear when:

- Mixing liquid chemicals or transferring such between containers.
- Working with ANY amount of corrosive substance, e.g. when jumping, filling or cleaning an acid-filled car battery.
- Human blood or other potentially infectious material may splatter or spray
- Recommended by MSDS

Safety Goggles: Impact-Protection Goggle, Particulate Goggle (Direct-Vent Goggle). Such devices protect from projectiles and other air-borne objects, including dust, and can be worn in place of, or over, safety glasses. They shall NOT be used in place of chemical goggles.

Wear when:

- Engaging in activities where broken glass or other projectiles may result.
- Cutting grass or engaging in trimming operations.

- Chipping, grinding, sawing, machining or other power tool operations that might produce airborne projectiles – use the face shield over the goggles for additional protection in extreme situations)
- Falling particles or objects as in working above one's head or lying on one's back.

Specialized Eyewear with Shading Lenses: This eyewear has lenses of various colors that protect against light. Such lenses are combined in welding glasses, goggles, and helmets, and are also found in eyewear appropriate for use with lasers, as well as for sunglasses (not intended for indoor use). Lenses will protect against UV hazards during welding and outside daylight work, and against spectral hazards associated with lasers. Wear when:

- Wavelength-specific protection is required when using lasers
- Wavelength specific protection required with the use of plasma cutters
- Welding
- Performing outdoor work in sunlight
- Working around extreme temperatures

Plastic Face Shield: A shield that shall be worn only over approved goggles or safety glasses for eye protection. NEVER wear face shields as primary eye protection.

Wear when:

- Mixing or transferring liquid corrosive chemicals from one container to another, e.g. drain cleaners, battery acids
- Human blood or POTENTIALLY infectious material may be reasonably expected to splatter or spray.
- Chemical reactions may cause force or heat, e.g. battery acid.
- Sawing, chipping or grinding with power tools that create flying particles
- Recommended by the MSDS
- Use only NFPA-70E arc flash rated shields when working on or near electrical systems that have potential for arc flash.

Welding Glasses, Welding Goggles, and Welding Helmets: These are devices that incorporate tinted lenses to protect the wearer from intense UV and visible light produced during welding. The degree of lens tint depends on the type of welding and intensity of light produced. Welding eyewear protects the eyes, face, and ears from radiant energy, flying sparks and weld material. This eyewear, however, does not protect against chemical splashes, high gas, or vapor concentration. **Wear when** welding, cutting, burning, brazing or when helping with such operations. (See Welding Operation/Recommended Protection, Appendix 1.)

Contact Lenses. Current studies indicate no difference in eye injuries among non-contact wearers and contact lens wearers. Even so, contacts should not be worn where dust, vapor, mist, fumes, radiant heat, molten metal, or chemicals exist. Excessive heat subjects the eyes to being burned; and materials trapped behind contact lenses irritate the eyes. When eye irritation or discomfort develops, contacts should be removed immediately. Many contact lens wearers elect to wear prescription safety glasses in the workplace. Contact lens wearers may obtain prescription safety eye glasses under MU's prescription safety eyewear policy (See: Eyewear, Prescription – Authorization/Order Form; Eyewear, Prescriptive – Optical Service Order Form Instructions, Appendix 1.)

3.2 Protective Hand and Arm Equipment

Most hand and arm injuries can be classified under five main categories: 1) chemical burns, 2) heat burns, 3) cuts, 4) strains/sprains and 5) abrasions. Other types of hand and arm injuries result from harmful substances that can be absorbed into the skin; chemicals entering the bloodstream; irritating substances that may cause skin reactions; and punctures. Protective equipment conforming to ANSI/NFPA/NIOSH standards shall be worn wherever hand and arm hazards exist in the workplace and will be provided to employees at no cost. See your immediate supervisor for specific on-the-job rules and requirements. (See Hand and Arm Protection, CF Directive No. 215; Gloves, Protection – Examples, Appendix 1).

Situations where hand and arm protection is needed:

- Corrosive chemicals, such as drain cleaners or battery acids: when mixing or transferring between containers.
- Human blood: where contact with, or other potentially infectious materials may be expected.
- Chemical reactions, as in work with battery acid: where force and heat may result
- MSDS recommended
- Power tools, e.g. saws, chippers and grinders, power mowers, trimmers: when using
- Glass: where work activities may cause breakage.
- Machining
- Transfers of small quantities of non-corrosive liquids
- Electric arcs, shock, or blasts: when the potential exists
- Laser Use - Plasma cutters
- Welding Operations

Note: In the above situations, glove materials and types include leather, welder's gloves, aluminum-backed gloves, and other types of insulating materials. (See Gloves, Protection – Examples, Appendix 1.)

Gloves: Fit, Care and Maintenance

1. Check gloves for cracks and punctures, especially between fingers and at the finger tips.
2. Keep gloves clean and dry.
3. Make sure gloves fit properly -- a small glove tires the hand; a large glove is clumsy.
4. Determine the glove needed to protect against particular chemicals.
5. Cover all cuts before you put on your gloves.
6. Promptly replace worn or damaged gloves

3.3 Protective Equipment for the Head

Head protection – provided to employees at no cost -- must be worn when there is a danger of:

- Falling objects
- Exposed fixed objects, such as pipes or beams
- Exposed electrical conductors.

In general, protective helmets (hard hats) should:

- Resist penetration
- Absorb the shock of a blow
- Be water-resistant and fire resistant
- Come with instructions explaining the adjustment and replacement of the suspension and headband.

Note: Hard hats possess a hard outer shell and a shock-absorbing lining. The lining should incorporate a head band and straps that suspend the shell from 1 to 1 ¼ inches from the user's head. This design provides shock-absorption during impact and ventilations during wear.

Industry Classification of Hard Hats:

Industrial head protective helmets meeting the requirements of the 2003 standard are classified as Type I for top protection or Type II for lateral impact protection. Both types are tested for impact attenuation and penetration resistance. Type II helmet performance requirements include criteria for impact energy attenuation from impacts from the front, back and sides as well as the top; off-center penetration resistance, and chin strap retention.

The three classes indicate the helmets electrical insulation rating, unchanged from 1997:

- Class E (electrical) are tested to withstand 20,000 volts
- Class G (general) helmets are tested at 2200 volts
- Class C (conductive) provide no electrical protection

Labels indicating the manufacturer, ANSI standards and class designation should be affixed to the inside of all hard hats.

Caring for Hard Hats

- Keep paint, paint thinners, and cleaning agents away from hard hats. They can weaken the hat's shell and may eliminate electrical resistance.
- Limit the use of decals and stickers, which can hide signs of deterioration.
- Keep hard hats from sustained sunlight and extreme heat, which can reduce the hat's strength.

- Periodically clean hard hats by immersing them for one minute in hot, soapy water (approximately 140 degrees F, or 60 degrees C), followed by scrubbing and rinsing in clear hot water.

Discard Hard Hats When:

- The hat’s suspension system shows signs of cracking, tearing, or fraying
- The suspension system no longer holds the shell from 1 inch to 1 1/4 inches from the employee's head.
- The brim or shell is cracked, perforated, or deformed.
- The brim or shell shows signs of exposure to heat, chemicals, ultraviolet light, or other radiation: Loss of surface gloss, chalking, or flaking (a sign of advanced deterioration).
- In accordance with the hard hat manufacturers recommendations

3.4 Protective Equipment for Feet and Legs

Protective equipment designed to prevent injuries to the feet and legs -- or reduce the severity of such injuries -- and conforming to ASTM (American Society for Testing Materials) F 2412-05 and F 2413-05/OSHA 29 CFR, Part 1910.132/NFPA/NIOSH standards, shall be worn when required on the job and will be provided to employees at no cost. See your immediate supervisor for specific on-the-job rules and requirements. (See Footwear, Protective, Campus Facilities Directive No. 214D; Footwear, Protective Footwear – Procedures for Obtaining; Footwear, Protective – Voucher, MU/Campus Facilities, Appendix 1, regarding other types of footwear, and servicing, maintaining, replacing and purchasing safety footwear.)

Foot and Leg Hazards

- Heavy objects, e.g. tools, barrels, etc., that might fall or roll on one's feet
- Sharp objects that might pierce the soles or uppers of ordinary shoes.
- Molten metal that might splash onto feet or legs.
- Hot, cold or wet surfaces or conditions.
- Slippery surfaces.
- Explosive or hazardous atmospheres
- Exposed electrical conductors or components.

Types of Foot and Leg Protection:

Safety Shoes. Protect against all of the above. Foundry shoes protect against molten metal. Shoe soles may be made of leather, and have a rubber or wooden core to protect against slipperiness, oil, heat, chemicals or electrical hazards.

Toe guards or caps, which must be made of steel, aluminum or plastic and be integral to the shoe, protect the toes from impact and compression.

Metatarsal guards, must be made of aluminum, steel fiber or plastic and be integral to the shoe, protect the instep area from impact and compression. Shoes must be sturdy and comply with ASTM standards.

Electrically Conductive Shoes protect against the buildup of static electricity in explosive atmospheres by essentially grounding the wearer. Such shoes must be worn in hazardous locations, such as manufacturing facilities or grain elevators where static electricity buildup on the body could spark and cause an explosion or fire. Wearers must be instructed not to use foot powder or wear socks made of silk, wool, or nylon with conductive shoes. Powder insulates and retards the conductive ability of the shoes, while silk, wool and nylon produce static electricity.

Note: Conductive shoes are not general-purpose shoes and must be removed after the task is completed. These shoes should never be worn where electrical hazards exist. Nonconductive shoes are required in such situations.

Electrically Non-conductive Shoes protect the wearer against open circuits of up to 600 volts in dry conditions in the workplace by preventing the worker's feet from completing an electrical circuit to the ground. These shoes should be used in conjunction with other insulating equipment to prevent a worker's body from providing a path for electrical energy.

Note: Non-conductive shoes should never be worn where explosive hazards exist. Electrically conductive shoes are required in such situations.

Repairs and Additions to Safety Footwear. Repairs (e.g. insoles) and additions (e.g. insoles that do not meet toe and foot clearances), shall meet ASTM standards and maintain the protective integrity of the footwear.

Foot-and-shin guards. Used in combination with toe guards when greater protection is needed.

Leggings. Protect the lower legs and feet from heat hazards, such as molten metal or welding sparks. Safety snaps allow leggings to be removed quickly

4.0 Work Programs

Table of Contents

4.1 Electrical Safety

Electricity is a serious workplace hazard, capable of causing both employee injury and property damage. It is the policy of the University Of Missouri (MU), Campus Facilities (CF) to protect all employees, students, and other personnel from potential electrical hazards. This will be accomplished through compliance with the work practices described herein along with effective application of engineering controls, administrative controls, and the use of personal protective equipment.

The MU CF Electrical Safety Program is founded on the principle of avoiding energized work unless it is absolutely necessary. Live parts will be de-energized before an employee works on or near them unless one of the following conditions applies:

- **De-energizing introduces additional or increased hazards.** Examples of "additional or increased" hazards would include interruption of life support equipment, deactivation of emergency alarm systems, or shutdown of hazardous location ventilation systems. This work requires an energized work permit.

- **De-energized is not possible due to equipment design. Energized work permit is required. Examples of this would be an emergency generator transfer switch.**

- **De-energizing is not possible due to operational limitations.** Examples of this situation would include testing and troubleshooting of electrical circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

- **Live parts are operating at less than 50 volts to ground and there is no increased exposure to electrical burns or to explosion due to electrical arcs.**

Live parts are to be de-energized in accordance with the CF Lockout/Tagout Program. If live parts are not placed in an electrically safe condition, the work practices described in this document must be used to protect employees.

When working on or near live parts (including testing and troubleshooting) the appropriate Personal Protective Equipment shall be selected from the NFPA 70E Table), 130.7(C)(16) in conjunction with either 130.7 (C) (15) (A) (b) or 130.7 (C) (15) (B)Arc Flash Hazard for Alternating (ac) and Direct Current (dc) Systems (Appendix D of this document). If unable to determine the necessary level of protection using these tables, an Arc Flash Electrical Analysis must be performed by an Electrical Engineer.

4.1.1 PURPOSE

This program has been established in order to:

- Ensure the safety of employees who may work on or near electrical systems.
- Ensure that CF personnel understand and comply with safety standards related to electrical work.
- Ensure that CF personnel follow uniform practices during the completion of electrical work.

4.1.2 SCOPE

This program applies to all work performed by Campus Facilities employees regardless of job site location.

4.1.3 REFERENCES

- NFPA 70E, "Standard for Electrical Safety in the Workplace", 2015 edition
- OSHA 29 CFR 1910.331 through 1910.335, "Electrical Safety-Related Work Practice
- Campus Facilities Lockout/Tagout Program

4.1.4 RESPONSIBILITIES

Safety Coordinator

- Receive Energized Work Permits (after work has been completed), and route to committee for review.
- In special circumstances may convene electrical safety committee when necessary.
- Evaluate work being performed to determine compliance with this program.
- Provide or assist in task specific training for electrical work qualifications.

- Recordkeeping of all electrical work permits and training records.
- Periodically review and update this written program.
- Provide or coordinate general training for CF on the content of this program.
- Evaluate the overall effectiveness of the electrical safety program on a periodic basis.
- Assist department supervisors in implementing the provisions of this program.

Managers

- Determine the applicability of the electrical safety program to activities conducted within their respective areas of jurisdiction.
- Designate individuals responsible for the implementation of the electrical safety program within their areas.
- Actively support this program as part of the CF overall safety effort.
- Provide or assist in task specific training for electrical work qualifications.

Supervisors

- Ensure employees comply with all provisions of the electrical safety program.
- Ensure employees receive training appropriate to their assigned electrical tasks and maintain documentation of such training.
- Develop and maintain a listing of all qualified employees under their supervision.
- Ensure employees are provided with and use appropriate protective equipment.

Employees

- Follow the work practices described in this document, including the use of appropriate protective equipment and tools.
- Attend all training required relative to this program.
- Immediately report any concerns related to electrical safety to supervision.

Electrical Safety Committee

- Meet on a periodic basis to review electrical safety issues at CF.
- Review all energized electrical work permits (after work has been completed).
- Promote consistency in how electrical tasks are completed within the various work units of CF.
- Recommend methods of controlling electrical hazards through the application of engineering.

4.1.5 DEFINITIONS

The following terms are defined in order to allow a better understanding of this program:

- **Arc rating**: The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in (cal/cm^2) and is derived from the determined value of the arc thermal performance value (ATPV) or energy of breakopen threshold (Ebt) (should a material system exhibit a breakopen response below the ATPV value). arc rating is reported as either ATPV or Ebt whichever is the lower value.
- **Arc Flash suit:** A complete Arc-rated clothing and equipment system that covers the entire body, except for the hands and feet. (Such a suit typically includes pants, jacket, arc-rated hood with a face shield).
- **Arc-rated apparel:** Arc resistant apparel; describes a broad category of clothing designed to protect employees from electrical arc events during completion of energized tasks
- **Electrically safe work condition:** A state in which the conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary.
- **Energized:** Electrically connected to or having a source of voltage.
  Exposed (as applied to energized electrical conductors or circuit parts): Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to electrical conductors or circuit parts that are not suitable guarded, isolated, or insulated.

- **Flash protection boundary**: When an arc flash hazard exist, an approach limit at a distance from a prospective arc source within which a person could receive a second degree burn if an electrical arc flash were to occur..
- **Incident energy:** The amount of thermal energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. Incident energy is typically expressed in calories per square centimeter (cal/cm^2).
- **Incident energy analysis:** A component of an arc flash risk assessment used to predict the incident energy of an arc flash for a specified set of conditions.
- **Limited approach boundary:** An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exist.
- **PPE:** An acronym for “Personal Protective Equipment”.
- **Qualified person:** One who has demonstrated skills and knowledge related to the construction and operation of the electrical equipment and installation and has received safety training to identify and avoid the hazards.

- **Restricted approach boundary:** An approach limit at a distance from an exposed energized electrical conductors or circuit within which there is an increased likelihood of electrical shock, due to electrical arc-over combined with inadvertent movement, for personnel working in close proximity to the energized electrical conductor or circuit parts. (due to electrical arc-over combined with inadvertent movement) for personnel working in close proximity to the live part.
- **Unqualified person:** Any person who does not meet the definition of a qualified person.
- **Working near (live parts):** Any activity within a Limited Approach Boundary. Not listed
- **Working on (energized electrical conductors or circuit parts**).): Intentionally coming in contact with energized electrical conductors or circuit parts with the hands, feet, or other body parts with tools, probes, or with test equipment, regardless of the personal protective equipment a person is wearing. There are two categories of "working on": *Diagnostic (testing)* is taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical changes to the equipment; *repair* is any physical alteration of electrical equipment (such as making or tightening connections, removing or replacing components, etc.)

4.1.6 TRAINING

Employees who are exposed to an electrical hazard must be trained initially and attend refresher training every 3 years.

The level of electrical safety training provided is dependent on whether the employee is classified as a "qualified person" or "unqualified person". Unqualified workers will be trained on electrical hazards that may be in their areas of responsibility.

A "qualified person" shall be trained and knowledgeable in all of the following topics:

- Construction and operation of equipment on which work is assigned.
- Skills and techniques necessary to distinguish exposed energized parts from other parts of electrical equipment.
- Skills and techniques necessary to determine the nominal voltage of exposed live parts.
- The approach distances specified in this document and the corresponding voltages to which the qualified employee will be exposed.

- The process necessary to determine the degree and extent of electrical hazards along with the PPE and job planning necessary to perform the task safely.

A person can be considered qualified with respect to certain equipment and methods but unqualified for others.

An “unqualified person” shall be trained in the inherent hazards of electricity and any related work practices that are necessary for their safety.

Training for qualified and unqualified persons will be coordinated by the CF Safety Coordinator and the department managers and supervisors. Training will be customized to reflect the scope of work performed within CF.

Training must be provided before the employee is assigned duties that involve work near or on electrical systems.

Training records shall be maintained in the CF TED data base.

4.1.7 WORKING ON OR NEAR LIVE PARTS >50 Volts

Energized Electrical Work Permit

If live parts are not placed in an electrically safe condition, work to be performed shall be considered energized electrical work and will be performed by written permit, risk Assessment has been completed and a the job briefing checklist has been completed only unless 8.1.3 applies.

A copy of the *“CF Energized Electrical Work Permit*”, “Risk Assessment“ and “Job Briefing checklist” *can be found in* ***Appendix A*** of this document. The intent of this permit is to ensure that all appropriate safety precautions including a Risk Assessment are taken prior to starting energized electrical work.

Work related to testing, troubleshooting, and voltage measuring may be completed without a permit provided appropriate safe work practices and PPE are used.

The permit is to be originated by the individual requesting that the energized work be completed. The requestor is responsible for completing Part I of the permit.

The qualified persons completing the task are responsible for completing Part II of the permit.

Two Campus Facilities managers or supervisors that have received NFPA 70E training must approve the permit prior to beginning the work.

The permit must be posted outside the flash boundary where the work is taking place for the duration of the task.

Copies of all energized electrical work permits must be provided to the CF Safety Coordinator upon completion of the task.

Approach Boundaries to Live Parts

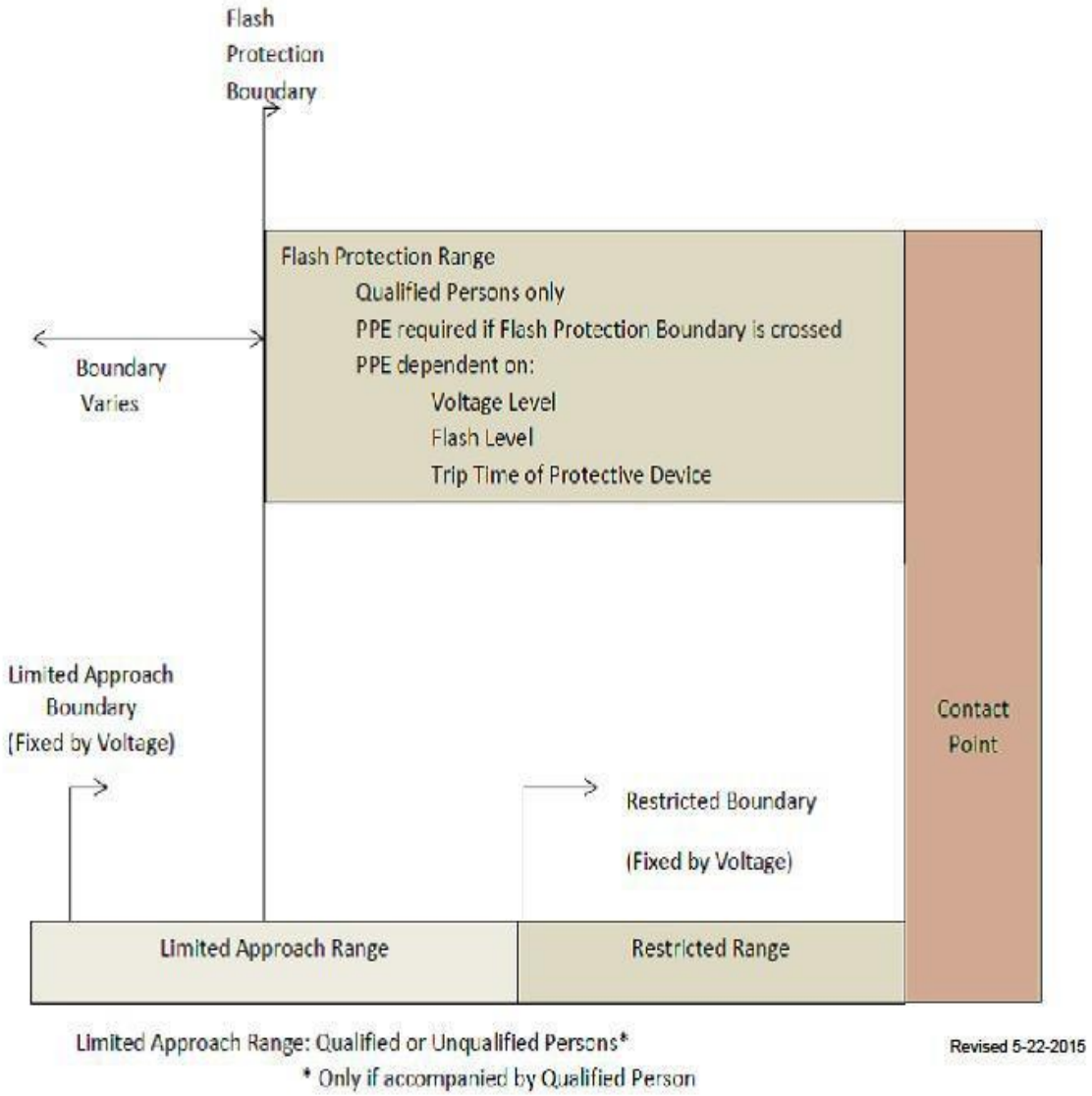
Observing a safe approach distance from exposed energized parts is an effective means of maintaining electrical safety. As the distance between an individual and live parts increases, the potential for an electrical injury decreases.
Safe approach distances will be determined for all tasks in which approaching personnel are exposed to live parts.

Safe approach distances to fixed live parts can be determined by referring to ***Appendix B****, "Approach Boundaries to Live Parts for Shock Protection".* This appendix can be used to identify the Limited and Restricted Approach Boundaries associated with various system voltages.

Unqualified persons may only cross the Limited Approach Boundary when they are under the direct supervision of a qualified person.

Qualified persons may not cross or take any conductive object closer than the Restricted Approach Boundary unless one of the following condition apply:

- The qualified person is insulated or guarded from the energized parts and no uninsulated part of the qualified person's body crosses the Restricted Approach Boundary.
- The energized parts are insulated from the qualified person and from any other conductive object at a different potential.



Other Precautions for Personnel Activities:

Employees shall not reach blindly into areas that might contain exposed live parts.

Employees shall not enter spaces containing live parts unless illumination is provided that allows the work to be performed safely.

Conductive articles of jewelry and clothing (such as watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal frame glasses) shall not be worn when working on or near energized parts.

Conductive materials, tools, and equipment that are in contact with any part of an employee's body shall be handled in a manner that prevents accidental contact with live parts. Such materials and equipment include, but are not limited to, long conductive objects such as ducts, pipes, tubes, conductive hose and rope, metal-lined rules and scales, steel tapes, pulling lines, metal scaffold parts, structural members, and chains.

When an employee works in a confined space or enclosed space (such as a manhole or vault) that contains exposed live parts, the employee shall use protective shields, barriers, or insulating materials as necessary to avoid contact with these parts. Doors, hinged panels, and the like shall be secured to prevent them from swinging into employees.

Melting or flammable materials such as pens or pencils, lighters shall not be taken within the approach boundary.

4.1.8 PERSONAL PROTECTIVE EQUIPMENT

General Requirements

Employees working in areas where electrical hazards are present shall be provided with, and shall use appropriate protective equipment that is designed and constructed for the specific body part to be protected and for the work to be performed.

CF will provide electrical protective equipment required by this program at no cost to employees. Such equipment shall include rated Arc Flash apparel, eye protection, head protection, hand protection, insulated footwear, and face shields where necessary. ***CF is not responsible for providing under layers.***

All protective equipment shall be maintained in a safe, reliable condition by the employee to whom it is issued.

Employees shall wear nonconductive protection for the eyes, head, face, neck, and chin whenever there is danger of injury from exposure to electric arcs or flashes or from flying objects resulting from an electrical explosion.

Employees shall wear rubber insulating gloves where there is danger of hand and arm injury due to contact with live parts or possible exposure to arc flash burn.

Where insulated footwear is used as protection against step and touch potential, dielectric overshoes shall be required. Insulated soles shall not be used as primary electrical protection.

Arc-rated face shields shall be used for electrical work. Safety glasses or goggles must always be worn underneath face shields.
Additional illumination may be needed when using tinted face shields as protection during electrical work.

Flash Protection Boundary

Personal protective equipment shall be provided to and used by all employees working within the “Flash Protection Boundary”.

For systems that are 600 volts or less, the Flash Protection Boundary shall be a minimum of four feet. *The formula in **Appendix C** can be used to determine the exact Flash Protection Boundary for systems under 600 volts.*

For systems that are above 600 volts, the Flash Protection Boundary shall be determined through engineering analysis.

The specific protective equipment to be worn within the Flash Protection Boundary can be determined by either of the following two methods in conjunction with the decision tree *(**Appendix H** of this document)*:

(1) Complete a detailed incident energy analysis under engineering supervision that determines the incident exposure energy of each employee. Appropriate protective clothing can then be selected based on the calculated exposure level and NFPA 70E Table H.3 (b). Criteria for completing such an analysis can be obtained from the CF Safety Coordinator.

(2) *Determine the hazard level of the task by referring to NFPA 70E Table 130.7 (C) (15) (A) (b) and 130.7(C) (15) (B), "Hazard/Risk Category Classifications" (**Appendix D** of this document).* Appendix D also includes Use of Rubber Insulating Gloves and Insulated/Insulating Hand Tools. *Once the hazard level of the task has been determined, the required PPE can then be ascertained (**Appendix E** of this document).*

CF departments shall develop and maintain a listing of the specific PPE requirements for each energized electrical task conducted by their employees.

Arc Rated Apparel & Underlayers

Arc-rated apparel shall be visually inspected before each use. Arc-rated apparel that is contaminated or damaged shall not be used. Protective items that become contaminated with grease, oil, flammable liquids, or combustible liquids shall not be used.

The garment manufacturer's instructions for care and maintenance of arc-rated apparel shall be followed.

When arc-rated apparel is worn to protect an employee, it shall cover all ignitable clothing and allow for movement and visibility.

Arc-rated apparel must cover potentially exposed areas as completely as possible. Arc-rated shirt sleeves must be fastened and arc-rated shirts/jackets must be closed at the neck.

Non-melting, flammable garments (i.e. cotton, wool, rayon, silk, or blends of these materials) may be used as underlayers beneath arc-rated apparel.

Meltable fibers such as acetate, nylon, polyester, polypropylene, and spandex shall not be permitted in fabric underlayers next to the skin. (An incidental amount of elastic used on non-melting fabric underwear or socks shall be permitted).

Arc-rated garments worn as outer layers over arc-rated apparel (i.e. jackets or rainwear) must also be made from arc-rated material.

Flash suits must permit easy and rapid removal by the user.

Rubber Insulating Equipment

Rubber insulating equipment includes protective devices such as gloves, sleeves, blankets, and matting.

Insulating equipment must be inspected for damage before each day's use and immediately following any incident that could have caused damage.

An air test must be performed on rubber insulating gloves before each use.

Insulating equipment found to have defects that might affect its insulating properties must be removed from service until testing indicates that it is acceptable for continued use.

Where the insulating capability of protective equipment is subject to damage during use, the insulating material shall be protected by an outer covering of leather or other appropriate material.
Rubber insulating equipment must be tested according to the schedule contained in ***Appendix G Table 130.7 (C)(7)(c)***and/or manufacturer's guidelines***.***

Rubber insulating equipment must be stored in an area protected from light, temperature extremes, excessive humidity, ozone, and other substances and conditions that may cause damage.

Repairs to rubber insulating equipment shall only be performed by a certified facility.

Insulated tools and materials

Only insulated tools and equipment shall be used within the Limited Approach Boundary of exposed energized parts.

Insulated tools shall be rated for the voltages on which they are used.

Insulated tools shall be inspected and tested per manufacturer's recommendations.

Repairs to insulated tools shall only be performed by a certified facility. Insulated tools shall be designed and constructed for the environment to which they are exposed and the manner in which they are used.

Fuse or fuse holder handling equipment, insulated for the circuit voltage, shall be used to remove or install a fuse if the fuse terminals are energized.

Ropes and handlines used near exposed energized parts shall be nonconductive.

Portable ladders used for electrical work shall have nonconductive side rails.

4.1.9 ALERTING TECHNIQUES

Barricades shall be used in conjunction with safety signs to prevent or limit access to work areas containing live parts and Flash Protection Boundary. Conductive barricades shall not be used where they may cause an electrical hazard. Barricades shall be placed no closer than the Limited Approach Boundary.

If signs and barricades do not provide sufficient protection, an attendant will be assigned to warn and protect pedestrians. The primary duty of the attendant shall be to

keep unqualified persons out of the work area where an electrical hazard exists. The attendant shall remain in the area as long as there is a potential exposure to electrical hazards.

4.1.10 CONTRACT EMPLOYEES

Safety programs used by contractors on CF jobsites must meet or exceed all applicable guidelines of this Safety Program.

Contractors will be required to comply with applicable Safety and Health regulations such as OSHA, NFPA, EPA.

Contractors may be required to submit copies of their Safety Program to CF upon request.

4.1.11 ENFORCEMENT

Compliance with safety rules is considered a condition of employment for Campus Facilities employees. Supervisors and/or individuals in the CF Personnel Department reserve the right to issue disciplinary action to any CF employee, up to and including termination, for failure to follow the guidelines of this program.

Energized Electrical Work Permit **Appendix A**

Part I: To be completed by requestor or supervisor of the job
Job Location:
Job Location Contact (Name & Title): Phone:
Description of Circuit & Equipment:
Justification of why the circuit cannot be de-energized or the work delayed until the next scheduled outage:
Part II: To be completed by the qualified person (s) completing the work.
1. Detailed description of work procedure:
2. Description of safe work practices to be employed:
3. Voltage exposure:
4. What is the PPE category or results of incident energy analysis?
5. What are the flash protection boundaries?
6. PPE required to perform work:
7. Method used to restrict access to area:
8. Hazard Assessment Completed? Yes / No
9. Do you agree the above work can be done safely? Yes / No Qualified person signatures: _____ Date: _____ _____ Date: _____ _____ Date: _____
Part III: To be completed by supervisors
Approvals: _____ Date: _____ Approvals: _____ Date: _____
Note: Attach additional pages as necessary. This completed form shall be kept for two years after completion of work.

Appendix B: Approach Boundaries to Live Parts for Shock Protection for Alternating-Current Systems

(All dimensions are distance from live part to employee)

Nominal System Voltage (phase to phase)	Limited Approach Boundary (fixed circuit parts only)	Restricted Approach Boundary (includes inadvertent movement adder)	
Less than 50 V	Not Specified	Not Specified	
50 V to 150 V	3 feet, 6 inches	Avoid Contact	
151V to 750 V	3 feet, 6 inches	1 foot	
751 V to 15 kV	5 feet	2 feet, 2 inches	
Over 15 kV or movable conductor	See NFPA 70 E Table 130.4(D)(a)		

See Table 130.4(D)(b) for Direct-Current systems

- **Limited Approach Boundary:** Distance from an exposed live part within which a shock hazard exists. An unqualified person may not cross this boundary unless they are continuously escorted by a qualified person.
- **Restricted Approach Boundary:** Distance from an exposed live part within which there is an increased risk of shock (due to electrical arc-over combined with inadvertent movement) for personnel working in close proximity to the live part. This boundary may only be crossed by a qualified person who is safely insulated or guarded from the live parts.

- **Flash Protection Boundary (not listed in table):** Distance from exposed live parts within which a person could receive a second degree burn if an electrical arc flash were to occur. This boundary may only be crossed by a qualified person wearing the appropriate PPE. For systems that are 600 volts are less, the Flash Protection Boundary shall be a minimum of four feet. An engineering analysis must be performed to determine the Flash Protection Boundary for systems that are above 600 volts.

Appendix C: Formula for Calculation of Flash Protection Boundary

$$D_c = [2.65 \times MVA_{bf} \times t]^{1/2}$$

OR

$$D_c = [53 \times MVA \times t]^{1/2}$$

Where:

D_c = Distance in feet from an arc source for a second-degree burn

MVA_{bf} = Bolted fault capacity available at point involved (in mega volt-amps)

MVA = Capacity rating of transformer (mega volt-amps). For transformers with *MVA* ratings below 0.75 MVA, multiply the transformer *MVA* rating by 1.25.

t = Time of arc exposure (in seconds).

Examples:

#1 Transformer 1000 kVA = 1.0 mVA, and breaker trip setting instantaneous of 0.1 seconds

$Dc = (53 \times 1 \times 0.1)^{1/2}$

$Dc = (5.3)^{1/2}$

Dc = 2.3 feet

#2 Transformer 1000kVA = 1.0 mVA, and breaker trip setting at short time delay of 0.5 seconds

$Dc = (53 \times 1 \times 0.5)^{1/2}$

$Dc = (26.5)^{1/2}$

Dc = 5.1 feet

Flash Protection Boundary increases with breaker trip setting

APPENDIX D

1 Table 130.7(C)(15)(A)(b) Arc-Flash Hazard PPE Categories for Alternating Current (ac) Systems

Equipment	Arc Flash PPE Category	Arc-Flash Boundary
Panelboards or other equipment rated 240 V and below Parameters: Maximum of 25 kA short-circuit current available; maximum of 0.03 sec (2 cycles) fault clearing time; working distance 455 mm (18 in.)	1	485 mm (19 in.)
Panelboards or other equipment rated >240 V and up to 600 V Parameters: Maximum of 25 kA short circuit current available; maximum of 0.03 sec (2 cycles) fault clearing time; working distance 455 mm (18 in.)	2	900mm (3 ft)
600-V class motor control centers (MCCs) Parameters: Maximum of 65 kA short-circuit current available; maximum of 0.03 sec (2 cycles) fault clearing time; working distance 455 mm (18 in.)	2	15 111 (5 ft)
600-V class motor control centers (MCCs) Parameters: Maximum of 42 kA short-circuit current available; maximum of 0.33 sec (20 cycles) fault clearing time; working distance 455 mm (18 in.)	4	4.3 m (14ft)
600-V class switchgear (with power circuit breakers or fused switches) and 600 V class switchboards Parameters: Maximum of 35 kA short-circuit current available; maximum of up to 0.5 sec (30 cycles) fault clearing time; working distance 455 mm (18 in.)	4	6m (20 ft)
Other 600-V class (277 V through 600 V, nominal) equipment Parameters: Maximum of 65 kA short circuit current available; maximum of 0.03 sec (2 cycles) fault clearing time; working distance 455 mm (18 in.)	2	1.5 m (5 ft)
NEMA E2 (fused contactor) motor starters, 2.3 kV through 7.2 kV Parameters: Maximum of 35 kA short-circuit current available; maximum of up to 0.24 sec (15 cycles) fault clearing time; working distance 910 mm (36 in.)	4	12m (40ft)
Metal-clad switchgear, 1 kV through 15 kV Parameters: Maximum of 35 kA short-circuit current available; maximum of up to 0.24 sec (15 cycles) fault de-Ming time; working distance 910 mm (36 in.)	4	12m (40ft)
Arc-resistant switchgear Type 1 or 2 [for clearing times of < 0.5 sec (30 cycles) with a perspective fault current not to exceed the arc resistant rating of the equipment], and metal-enclosed interrupter switchgear, fused or unfused of mc:-resistant-type construction, tested in accordance with IEEE C37.20.7. 1 kV through 15 kV	*NIA* (doors closed)	*NIA* (doors closed)
Parameters: Maximum of 35 kA short-circuit current available; maximum of up to 0.24 sec (15 cycles) fault clearing time; working distance 910 mm (36in.)	4 (doors open)	12m (40ft)

Other, 1 kV throucll 15 kV		
Parameters: Maximum of 35 kA short-circuit current available; maximum of up to 0.24 sec (15 cycles) fault clearing time; working distance 910 mm (36 in.)	4	(40ft)

Note: For eqmpment rated 600 volts and below, and protected by upstream current-hm1tmg fuses or current-hm1tmg c1rcmt breakers s1zed at 200 amperes or less, the arc flash PPE category can be reduced by one number but not below arc flash PPE category I.

Table 130.7(C)(l5)(B) Arc-Flash Hazard PPE Categories for Direct Current (dc) Systems

Equipment	Arc Flash PPE Category	Arc-Flash Boundary
Storage batteries, de switchboards, and other de supply sources 100 V > Voltage < 250 V Parameters: Voltage: 250 V Maximum arc duration and working distance: 2 sec @ 455 mm (18 in.)		
Short-circuit current < 4 kA	1	900 mm (3 ft)
4 kA ≤ short-circuit current < 7 kA	2	1.2 m (4 ft)
7 kA ≤ short-circuit current < 15 kA	3	1.8 m (6 ft)
Storage batteries, dc switchboards, and other de supply sources 250 V ≤ Voltage ≤ 600 V Parameters: Voltage: 600 V Maximum arc duration and working distance: 2 sec @ 455 mm (18 in.)		
Short-circuit current 1.5 kA	1	900 mm (3 ft)
1.5 kA ≤ short-circuit current < 3 kA	2	1.2m (4ft)
3 kA::; short-circuit current < 7 kA	3	1.8 m (6ft.)
7 kA ::; shmt-circuit current < 10 kA	4	2.5 m (8 ft)

Note: Apparel that can be expected to be exposed to electrolyte must meet both of the following conditions:
(1) Be evaluated for electrolyte protection in accordance with ASTM Fl296, Standard Guide for Evaluating Chemical Protective Clothing
(2) Be arc-rated in accordance with ASTM Fl891, Standard Specification for Arc Rated and Flame Resistant Rainwear, or equivalent

(16) **Protective Clothing and Personal Protective Equipment (PPE).** Once the arc flash PPE, category has been identified from Table 130.7(C)(15)(A)(b) or Table 130.7(C)(15)(B), Table l30.7(C)(I6) shall be used to determine the required PPE for the task. Table 130.7(C)(16) lists the requirements for PPE based on arc flash PPE categories 1through 4. This clothing and equipment shall be used when working within the arc flash boundary.

Informational Note No. 1: See Informative Annex H for a suggested simplified approach to ensure adequate PPE for Electrical Workers within facilities with large and diverse electrical systems.

Informational Note No. 2: The PPE requirements of this section are intended to protect a person from arc flash hazards. While some situations could result in bums to the skin, even with the protection described in Table 130.7(C)(l6), burn injury should be reduced and survivable. Due to the explosive effect of some arc events, physical trauma injuries could occur. The PPE requirements of this section do not address protection against physical trauma other than exposure to the thermal effects.

Use of Rubber Insulating Gloves and Insulated/Insulating Hand Tools

Tasks Performed on Energized Equipment	Rubber Insulating Gloves	Insulated/Insulating Hand Tools
Panelboards or Other Equipment Rated 240 V and Below – Note 1		
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	N	N
Circuit breaker (CB) or fused switch operation	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	Y	Y
Remove/install CBs or fused switches	Y	Y
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard	Y	Y
Panelboards or Switchboards Rated >240 V and up to 600 V (with molded case or insulated case circuit breakers) – Note 1		
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	N	N
CB or fused switch operation	Y	N
Work on energized electrical conductors and circuit parts, including voltage testing	Y	Y
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the panelboard or switchboard	Y	Y
600 V Class Motor Control Centers (MCCs) – Note 2 (except as indicated)		
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	N	N
Reading a panel meter while operating a meter switch	N	N
CB or fused switch or starter operation	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	Y	Y
	Y	N

Insertion or removal of individual starter “buckets” from MCC – Note 3	Y	N
Application of safety grounds, after voltage test	N	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts) – Note 3	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts) – Note 3	Y	Y
Work on energized electrical conductors and circuit parts of utilization equipment fed directly by a branch circuit of the motor control center		
600 V Class Switchgear (with power circuit breakers or fused switches) – Note 4		
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	N	N
Reading a panel meter while operating a meter switch	N	N
CB or fused switch operation	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	Y	Y
Insertion or removal (racking) of CBs from cubicles, doors open or closed	N	N
Application of safety grounds, after voltage test	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Other 600 V Class (277 V through 600 V, nominal) Equipment – Note 2 (except as indicated)		
Lighting or small power transformers (600 V, maximum)		
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	Y	Y
Application of safety grounds, after voltage test	Y	N
Revenue meters (kW-hour, at primary voltage and current) Insertion or removal	Y	N

Cable trough or tray cover removal or installation	N	N
Miscellaneous equipment cover removal or installation	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	Y	Y
Application of safety grounds, after voltage test	Y	N
Insertion or removal of plug-in devices into or from busways	Y	N
NEMA E2 (fused contactor) Motor Starters, 2.3 kV Through 7.2 kV		
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	N	N
Reading a panel meter while operating a meter switch	N	N
Contactor operation	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	Y	Y
Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	Y	Y
Insertion or removal (racking) of starters from cubicles, doors open or closed	N	N
Application of safety grounds, after voltage test	Y	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Insertion or removal (racking) of starters from cubicles of arc-resistant construction, tested in accordance with IEEE C37.20.7, doors closed only	N	N
Metal Clad Switchgear, 1 kV Through 38 kV		
Perform infrared thermography and other non-contact inspections outside the restricted approach boundary	N	N
Reading a panel meter while operating a meter switch	N	N
CB operation	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	Y	Y
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	Y	Y
	Y	Y

Work on control circuits with energized electrical conductors and circuit parts >120 V, exposed	N	N
Insertion or removal (racking) of CBs from cubicles, doors open or closed	Y	N
Application of safety grounds, after voltage test	N	N
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Opening voltage transformer or control power transformer compartments		
Arc-Resistant Switchgear Type 1 or 2 (for clearing times of <0.5 sec with a perspective fault current not to exceed the arc resistant rating of the equipment)		
CB operation with enclosure door closed	N	N
Insertion or removal (racking) of CBs from cubicles, doors closed	N	N
Insertion or removal of CBs from cubicles with door open	N	N
Work on control circuits with energized electrical conductors and circuit parts 120 V or below, exposed	Y	Y
Insertion or removal (racking) of ground and test device with door closed	N	N
Insertion or removal (racking) of voltage transformers on or off the bus door closed	N	N
Other Equipment 1 kV Through 38 kV		
Metal-enclosed interrupter switchgear, fused or unfused		
Switch operation of arc-resistant-type construction, tested in accordance with IEEE C37.20.7, doors closed only	N	N
Switch operation, doors closed	N	N
Work on energized electrical conductors and circuit parts, including voltage testing	Y	Y
Removal of bolted covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Opening hinged covers (to expose bare, energized electrical conductors and circuit parts)	N	N
Outdoor disconnect switch operation (hookstick operated)	Y	Y
Outdoor disconnect switch operation (gang-operated, from grade)	Y	N
Insulated cable examination, in manhole or other confined space	Y	N

Insulated cable examination, in open area	Y	N

Informational Note No. 3: The arc rating for a particular clothing system can be obtained from the arc-rated clothing manufacturer.

Table 130.7(C)(l6) Personal Protective Equipment (PPE)

PPE Category	**PPE**
1. **Arc-Rated Clothing, Minimum Arc Rating of 4 cal/cm²** (see Note 1) Arc-rated long –sleeve shirt and pants or arc-rated coverall Arc-rated face shield (see Note 2) or arc flash suit hood Arc-rated jacket, parka, rainwear, or hard hat liner (AN) **Protective Equipment** Hard Hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Heavy duty leather gloves (see Note 3) Leather footwear (AN	
2. **Arc-Rated Clothing, Minimum Arc Rating of 8 cal/cm²** (see Note 1) Arc-rated long-sleeve shirt or arc-rated coverall Arc-rated flash suit hood or arc-rated face shield (see Note 2) and arc-rated balaclava Arc-rated jacket, parka, rainwear, or hard hat liner (AN) **Protective Equipment** Hard Hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Heavy duty leather gloves (see Note 3) Leather footwear	
3. **Arc-Rated Clothing Selected so That the System Arc Rating Meets the Required Minimum Arc Rating of 25 cal/cm²** (see Note 1) Arc-rated long-sleve shirt (AR) Arc-rated pants (AR) Arc-rated coverall (AR) Arc-rated arc flash suit jacket (AR) Arc-rated arc flash suit pants (AR) Arc-rated arc flash suit hood Arc-rated gloves (see Note 1) Arc-rated jacket, parka, rainwear, or hard hat liner (AN) **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather Footwear	

Table 130.7(C)(16) *Continued*

PPE Category	**PPE**
4. **Arc-Rated Clothing Selected so That the System Arc Rating Meets the Required Minimum Arc Rating of 40 cal/cm²** (see Note 1) Arc-rated long-sleve shirt (AR) Arc-rated pants (AR) Arc-rated coverall (AR) Arc-rated arc flash suit jacket (AR) Arc-rated arc flash suit pants (AR) Arc-rated arc flash suit hood Arc-rated gloves (see Note 1) Arc-rated jacket, parka, rainwear, or hard hat liner (AN) **Protective Equipment** Hard hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather Footwear	

An: as need (optional). AR: as required. SR: selection required.

Notes:

1. *Arc rating* is defined in Article 100
2. Face shields are to have wrap-around guarding to protect not only the face but also the forehead, ears, and neck, or alternatively, an arc-rated arc flash suit hood is required to be worn.
3. If Rubber insulting gloves with leather protectors are used, additional leather or arc-rated gloves are not required. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirement.

(D) Other Protective Equipment.

1. Insulated Tools and Equipment. Employees shall use insulated tools or handling equipment, or both, when working inside the restricted approach boundary of exposed energized electrical conductors or circuit parts where tools or handling equipment might make accidental contact. Insulated tools shall be protected from damage to the insulting material.

Informational Note: See 130.4(B), Shock Protection Boundaries

a. Requirements for Insulated Tools. The following requirements shall apply to insulated tools:

1. Insulated tools shall be rated for the voltages on which they are used.
2. Insulated tools shall be designed and constructed for the environment to which they are expose and the manner in which they are used.
3. Insulated tools and equipment shall be inspected prior to each use. The inspection shall look for damage to the insulation or damage that can limit the tool from performing its intended function or could increase the potential for an incident (e.g., damaged tip on a screwdriver).

Appendix E
Protective Clothing and Personal Protective Equipment

NFPA70E
2015 Edition
Table 130.7(C)(16)

Table 130.7(C)(16) Protective Clothing and Personal Protective Equipment (PPE)

Hazard/Risk Category	Protective Clothing and PPE
PPECategory 1	
Arc-rated Clothing, Minimum Arc Rating of 4 (Note 1)	Arc-rated long-sleeve shirt (Note 3) Arc-rated pants (Note 3) Arc-rated coverall (Note 4) Arc-rated face shield or arc flash suit hood (Note 7) Arc-rated jacket, parka, or rainwear (AN)
Arc-rated Protective Equipment	Hard Hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather gloves (AN) (Note 2) Leather work shoes (AN)
PPE Category 2	
Arc-rated Clothing, Minimum Arc Rating of 8 (Note 1)	Arc-rated long-sleeve shirt (Note 5) Arc-rated pants (Note 5) Arc-rated coverall (Note 6) Arc-rated arc flash suit hood (Note 10) Arc-rated jacket, parka, or rainwear (AN)
Arc-rated Protective Equipment	Hard Hat Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Leather gloves (AN) (Note 2) Leather work shoes
PPE Category 3	

Arc-rated Clothing, Minimum Arc Rating of 25 (Note 1)	Arc-rated long-sleeve shirt (AR) (Note 8) Arc-rated pants (AR) (Note 8) Arc-rated coverall (AR) (Note 8) Arc-rated arc flash suit jacket (AR) (Note 8) Arc-rated arc flash suit pants (AR) (Note 8) Arc-rated arc flash suit hood (Note 8) Arc-rated jacket, parka, or rainwear (AN)
Arc-rated Protective Equipment	Hard Hat Arc-rated hard hat liner (AR) Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Arc-rated gloves (Note 2) Leather work shoes
PPE Category 4	
Arc-rated Clothing, Minimum Arc Rating of 40 (Note 1)	Arc-rated long-sleeve shirt (AR) (Note 9) Arc-rated pants (AR) (Note 9) Arc-rated coverall (AR) (Note 9) Arc-rated arc flash suit jacket (AR) (Note 9) Arc-rated arc flash suit pants (AR) (Note 9) Arc-rated arc flash suit hood (Note 9) Arc-rated jacket, parka, or rainwear (AN)
Arc-rated Protective Equipment	Hard Hat Arc-rated hard hat liner (AR) Safety glasses or safety goggles (SR) Hearing protection (ear canal inserts) Arc-rated gloves (Note 2) Leather work shoes

AN = As needed (optional)
AR = As required
SR = Selection required
Notes:

1. See Table 130.7(C)(11). Arc rating for a garment or system of garments is expressed in cal/cm^2.
2. If rubber insulating gloves with leather protectors are required by Table 130.7(C)(9), additional leather or arc-rated gloves are required.
3. The arc-rated shirt and pants used for Hazard/Risk Category 1 shall have a minimum arc rating of 4.
4. Alternate is to use arc-rated coveralls (minimum arc rating of 4) instead of arc-rated shirt and arc-rated pants.
5. Arc-rated shirt and arc-rated pants used for Hazard/Risk Category 2 shall have a minimum arc rating of 8.
6. Alternate is to use arc-rated coveralls (minimum arc rating of 8) instead of arc-rated shirt and arc-rated pants.
7. A face shield with a minimum arc rating of 4 for Hazard/Risk Category 1 or a minimum arc rating of 8 for Hazard/Risk Category 2, with wrap-around guarding to protect not only the face, but also the forehead, ears, and neck (or, alternatively, an arc-rated arc flash suit hood), is required.
8. An alternate is to use a total arc-rated clothing system and hood, which shall have a minimum arc rating of 25 for Hazard/Risk Category 3.
9. The total clothing system consisting of arc-rated shirt and pants and/or arc-rated coveralls and/or arc flash coat and pants and hood shall have a minimum arc rating of 40 for Hazard/Risk Category 4.
10. Alternate is to use a face shield with a minimum arc rating of 8 and a balaclava (sock hood) with a minimum arc rating of 8 and which covers the face, head and neck except for the eye and nose areas.

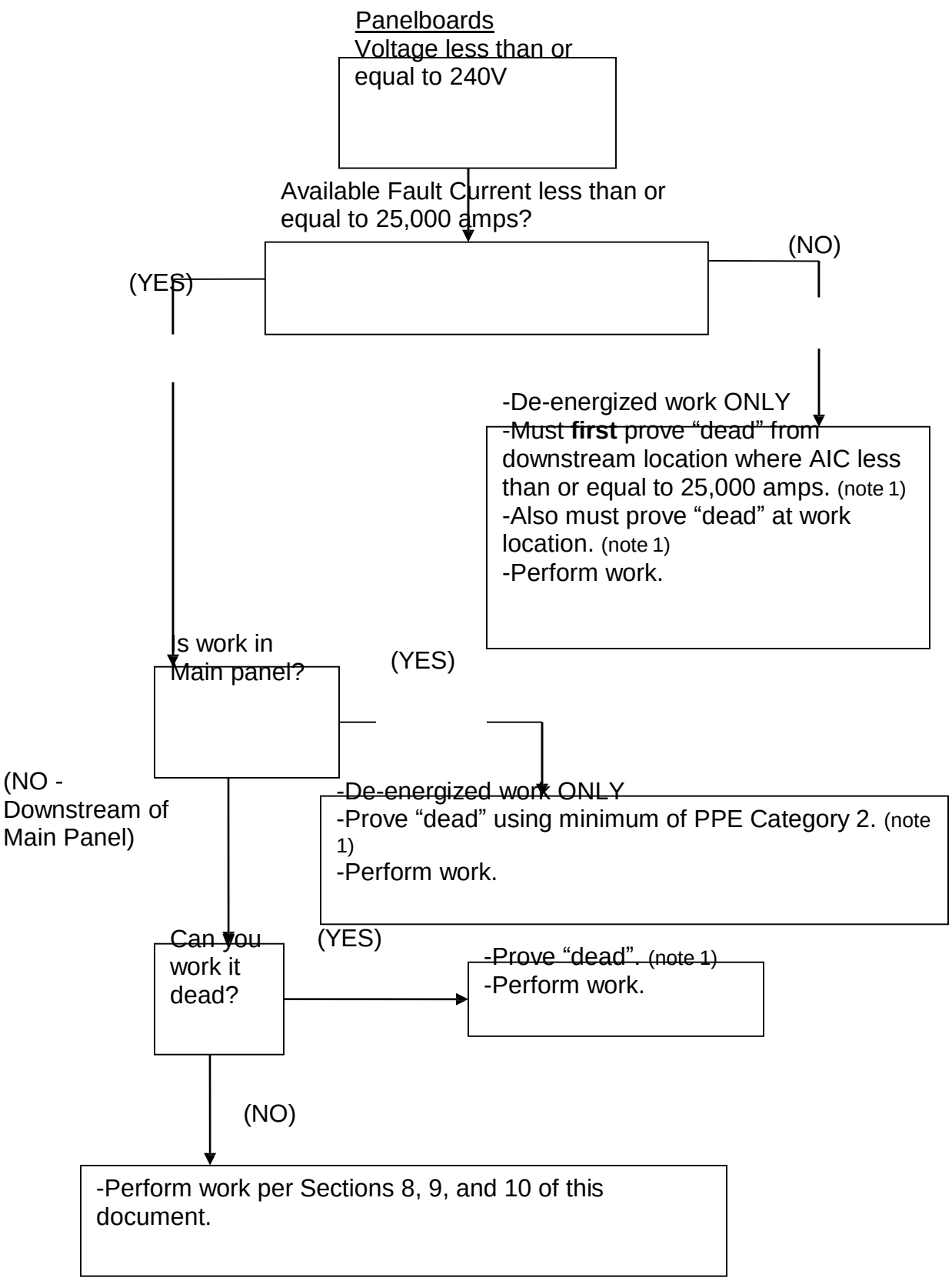
Appendix G: Inspection Schedule for Rubber Insulating Equipment

Table 130.7(C)(7)(c) Rubber Insulating Equipment, Maximum Test Intervals

Rubber Insulating Equipment	When to Test	Governing Standard for Test Voltage*
Blankets	Before first issue; every 12 months thereafter**	ASTM F479
Covers	If insulating value is suspect	ASTM F478
Gloves	Before first issue; every 6 months thereafter**	ASTM F496
Line Hose	If insulating value is suspect	ASTM F478
Sleeves	Before first issue; every 12 months thereafter**	ASTM F496

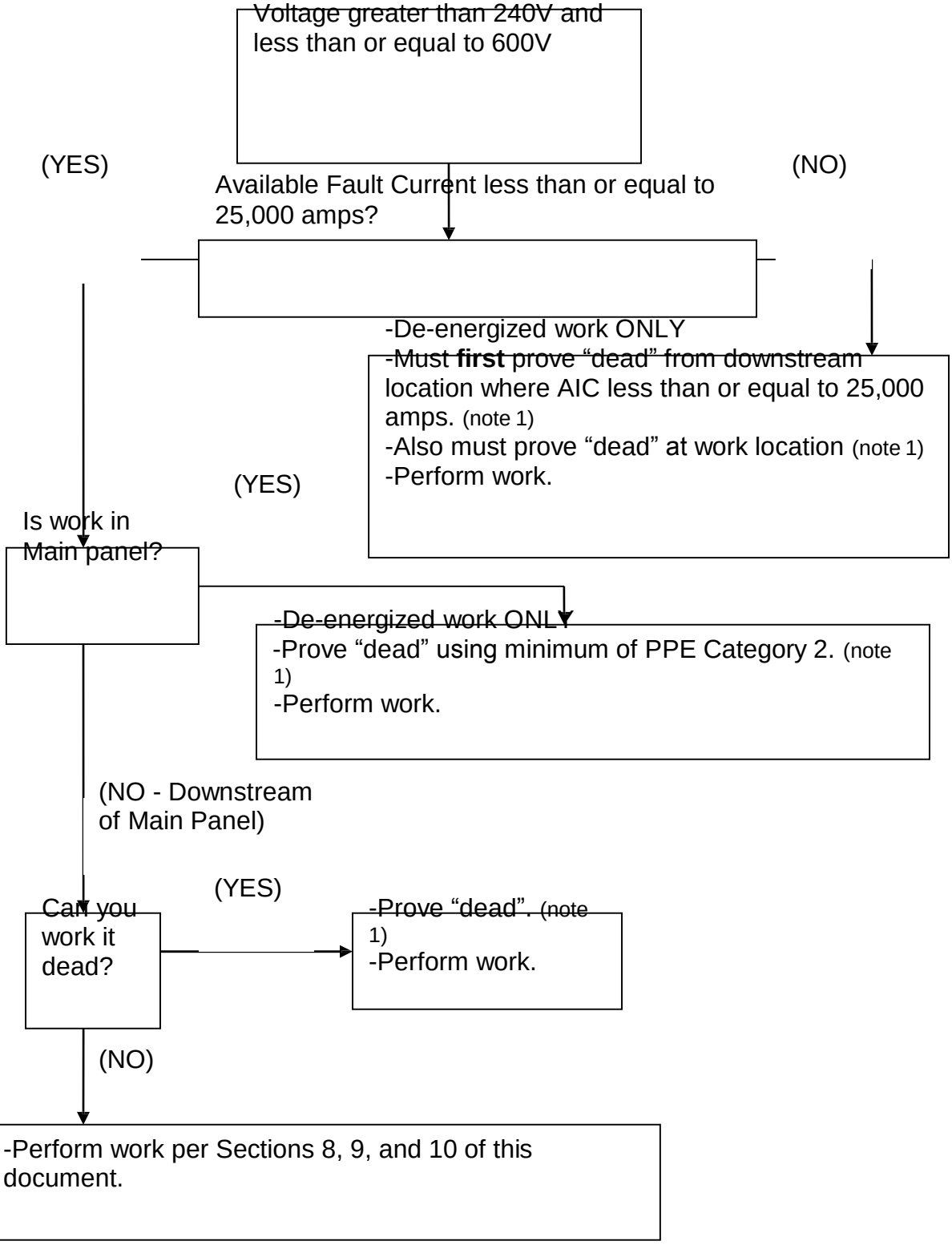
* ASTM F478, *Standard Specification for In-Service Care of Insulating Line Hose and Covers;* ASTM F479, *Standard Specification for In-Service Care of Insulating Blankets*; ASTM F496, *Standard Specification for In-Service Care of Insulating Gloves and Sleeves.*

** If the insulating equipment has been electrically tested but not issued for service, it is not permitted to be placed into service unless it has been electrically tested within the previous 12 months.



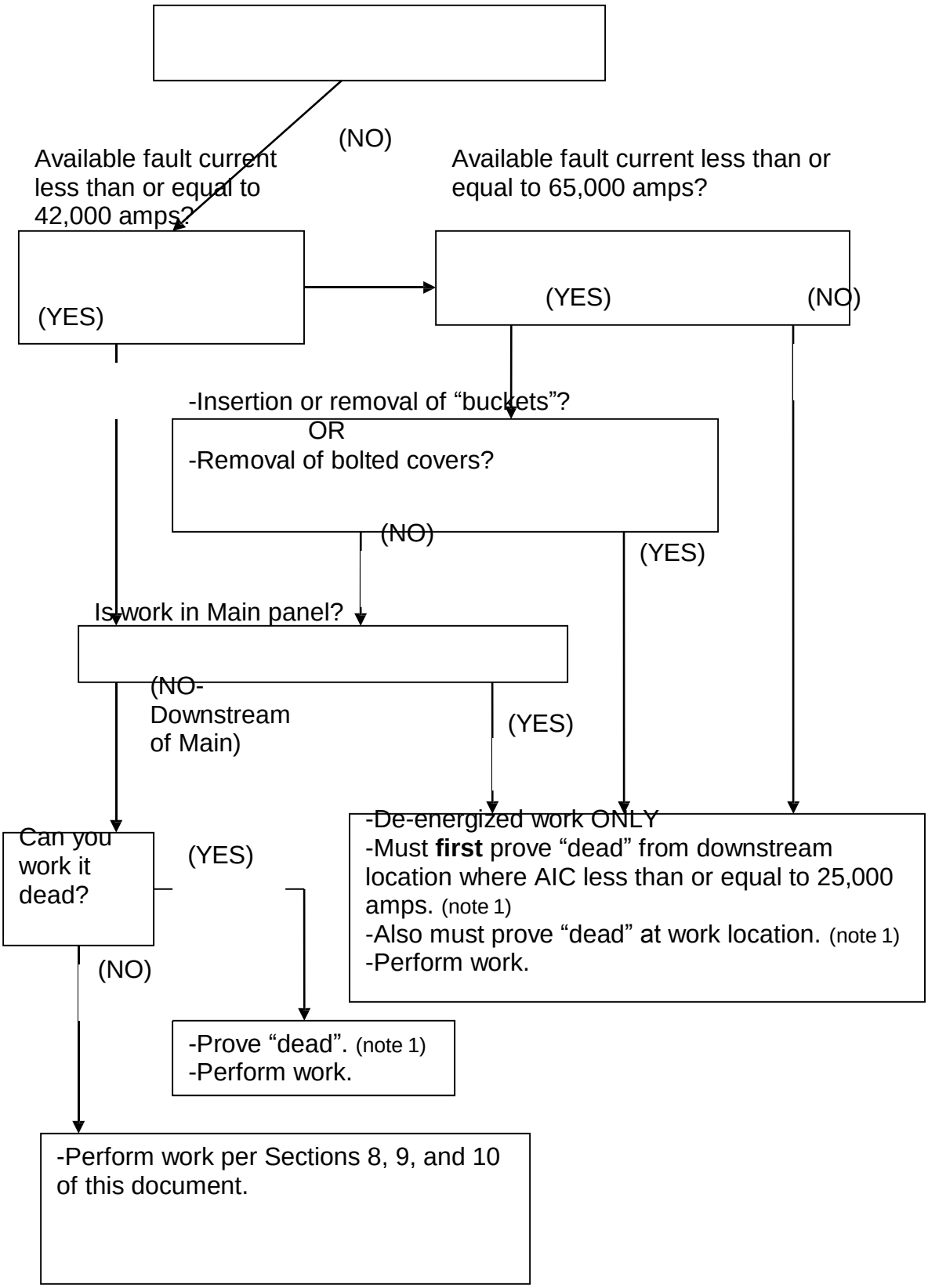
Note 1 - "Prove Dead" requires PPE appropriate for location and task. Use section 9 of this document.

Panelboards and Switchboards



Note 1 - "Prove Dead" requires PPE appropriate for location and task. Use section 9 of this document.

600V Class (480V)MCC's



Rev 3/10/15

Note 1 - "Prove Dead" requires PPE appropriate for location and task. Use section 9 of this document.

600V Class Switchgear

Available fault current less than or equal to 35,000 amps?

(YES)

(NO)

-De-energized work ONLY
-Must **first** prove “dead” from downstream location where AIC less than or equal to 25,000 amps. (note 1)
-Also must prove “dead” at work location. (note 1)
-Perform work.

Is work in Main panel?

(YES)

-De-energized work ONLY
-Prove “dead” using minimum of PPE Category 2. (note 1)
-Perform work.

(NO)

Can you work it dead?

(YES)

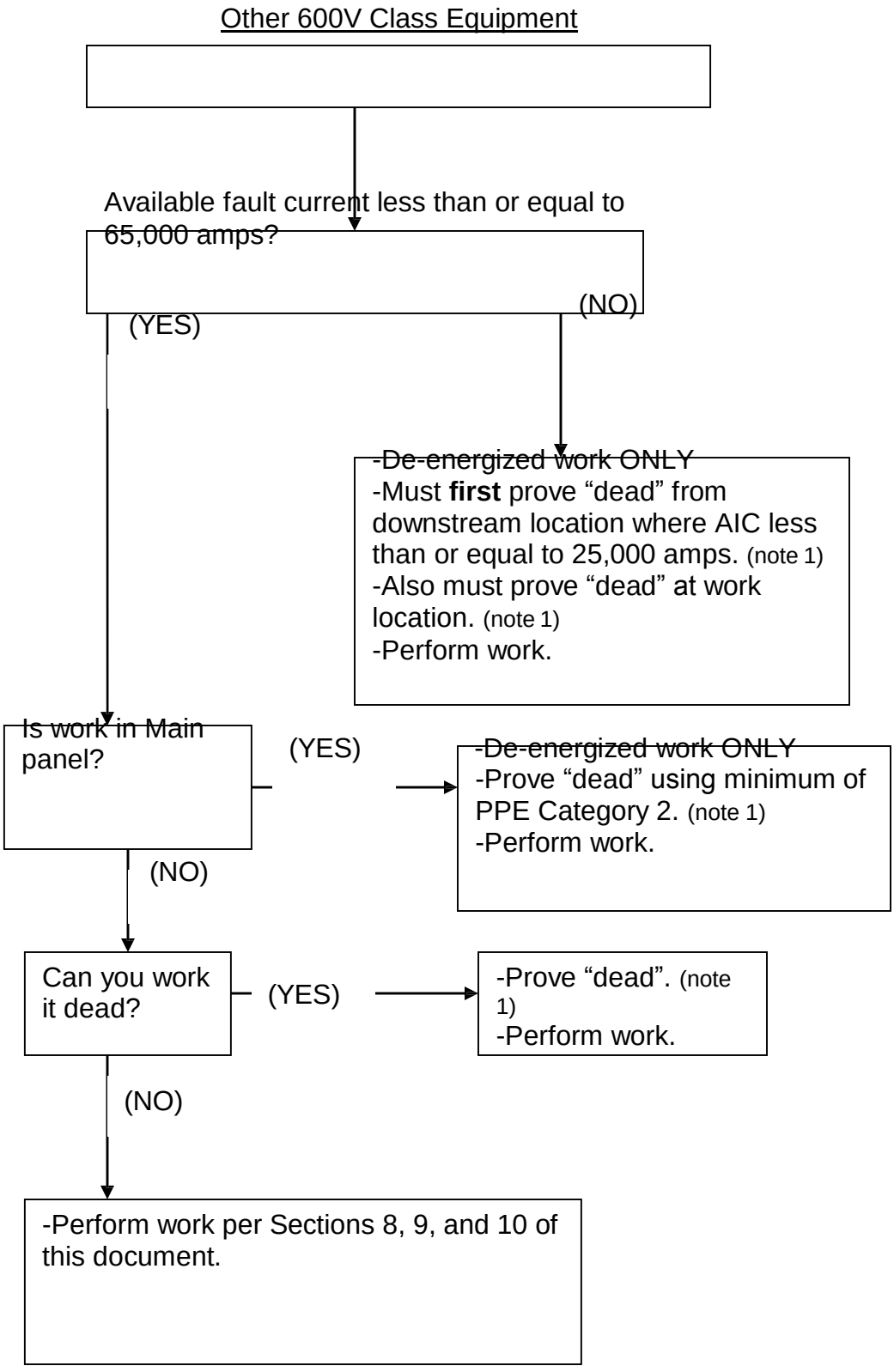
-Prove “dead”. (note 1)
-Perform work.

(NO)

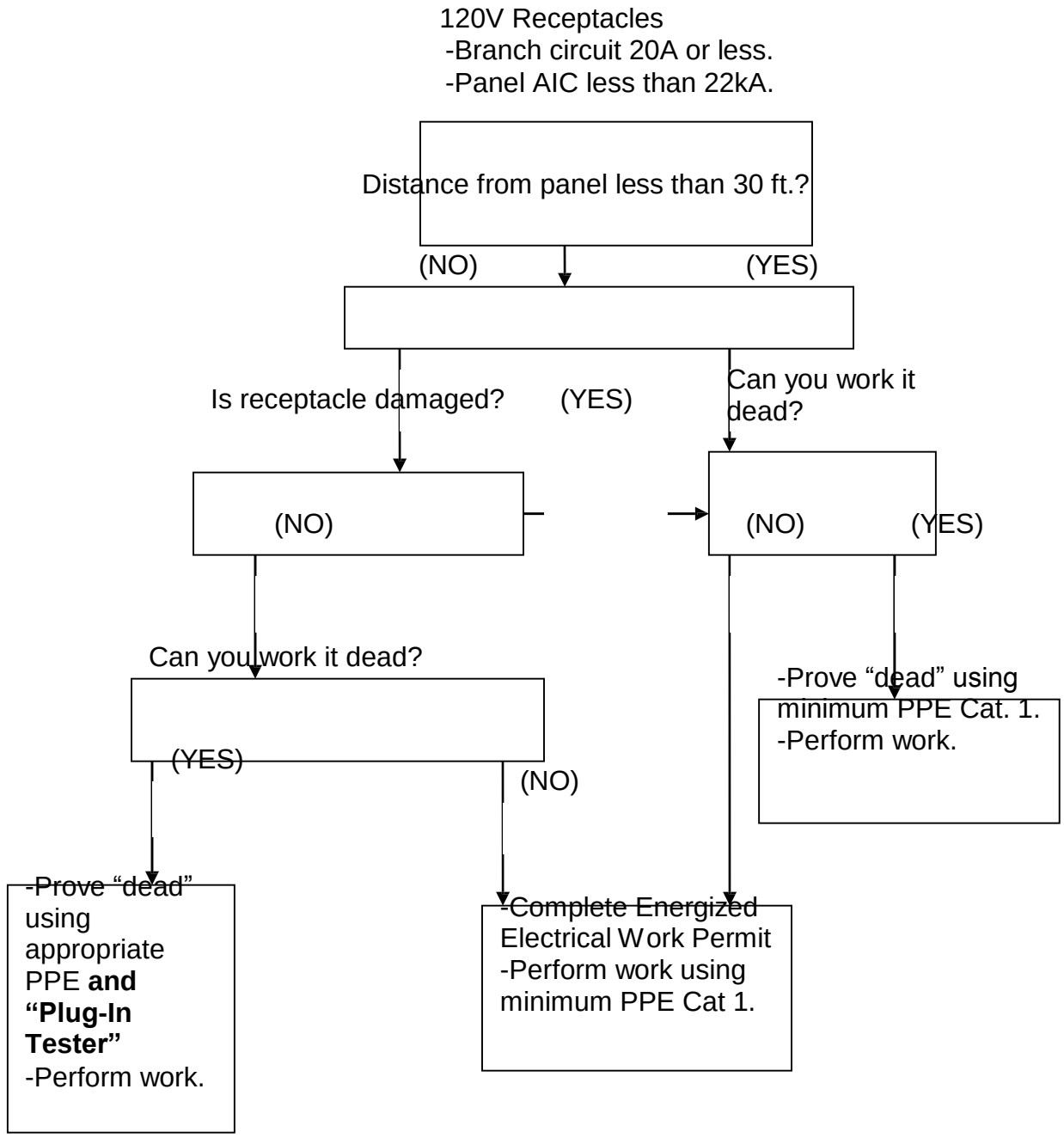
-Perform work per Sections 8, 9, and 10 of this document.

Rev 3/10/15

Note 1 - “Prove Dead” requires PPE appropriate for location and task. Use section 9 of this document.

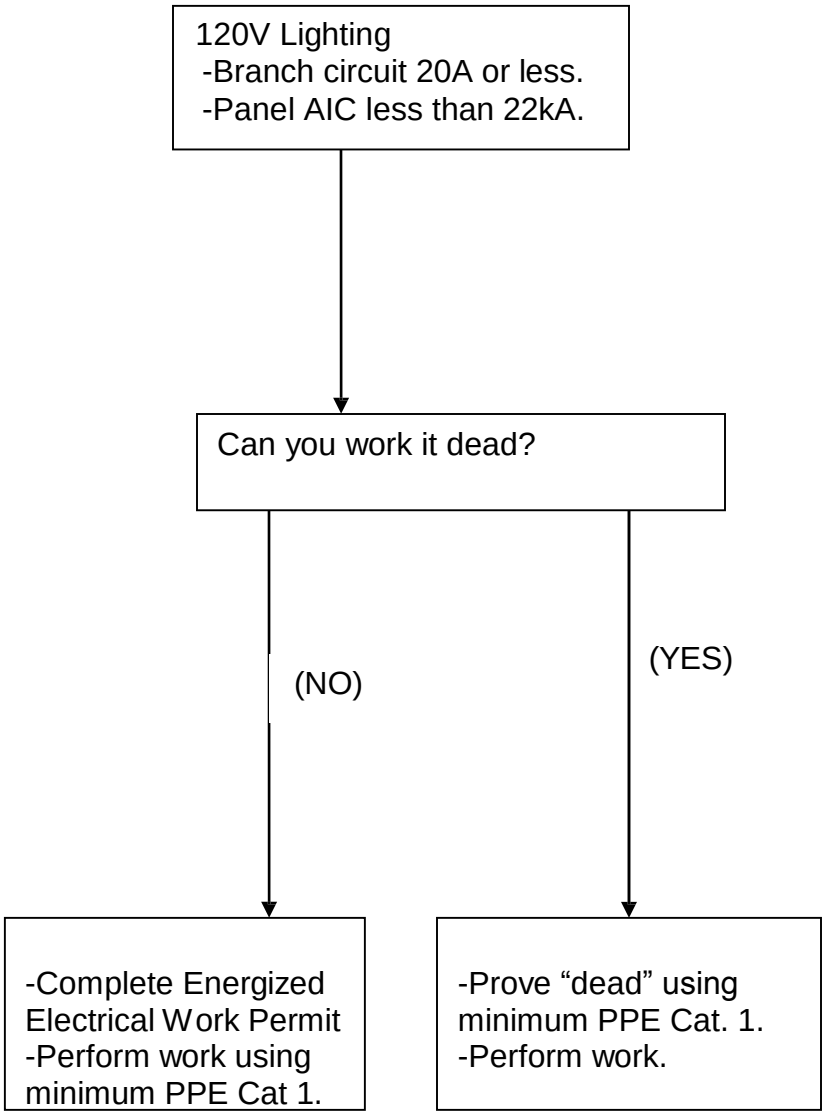


Note 1 - "Prove Dead" requires PPE appropriate for location and task. Use section 9 of this document.

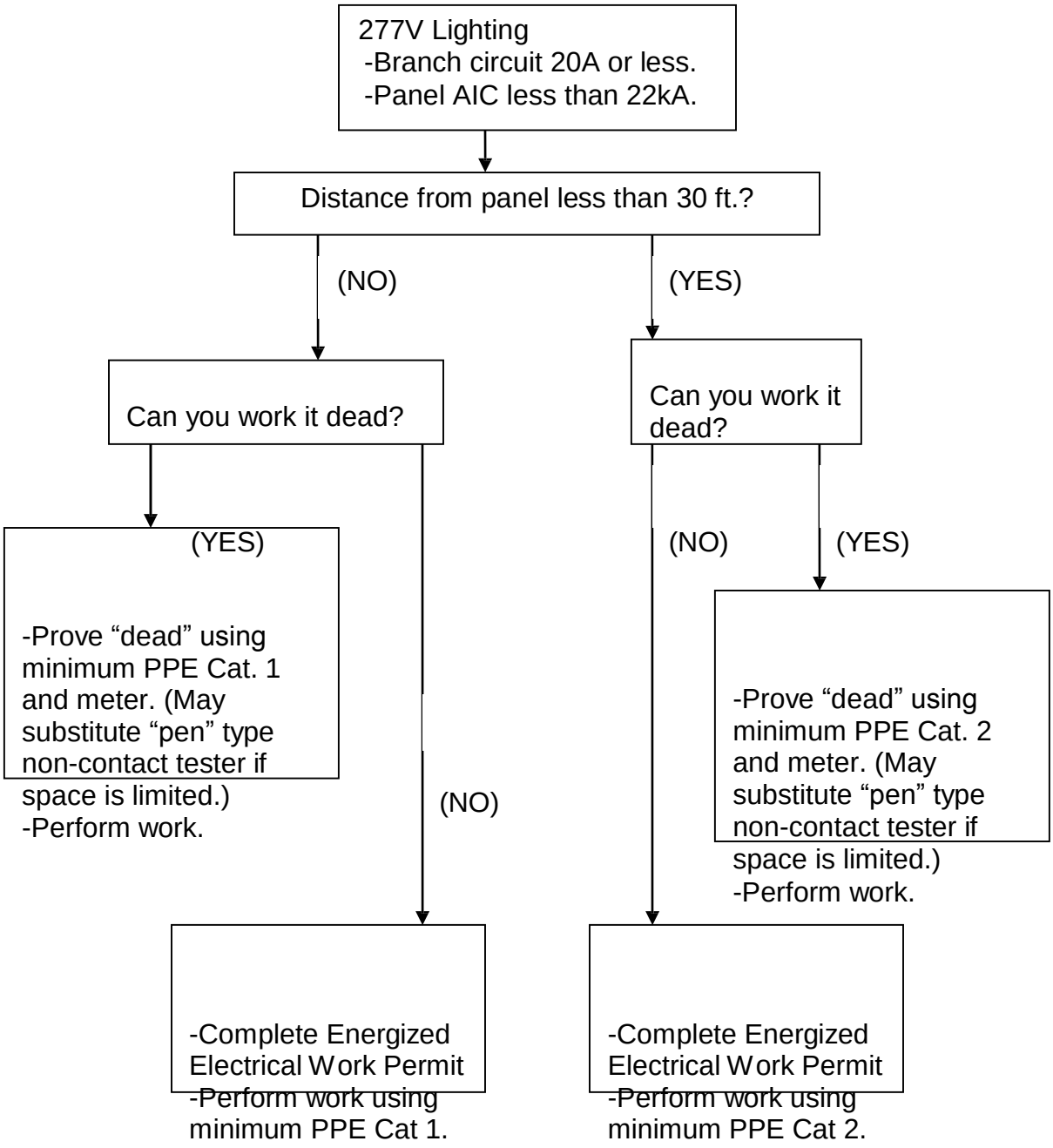


Rev 3/10/15

Note 1 - "Prove Dead" requires PPE appropriate for location and task. Use section 9 of this document.

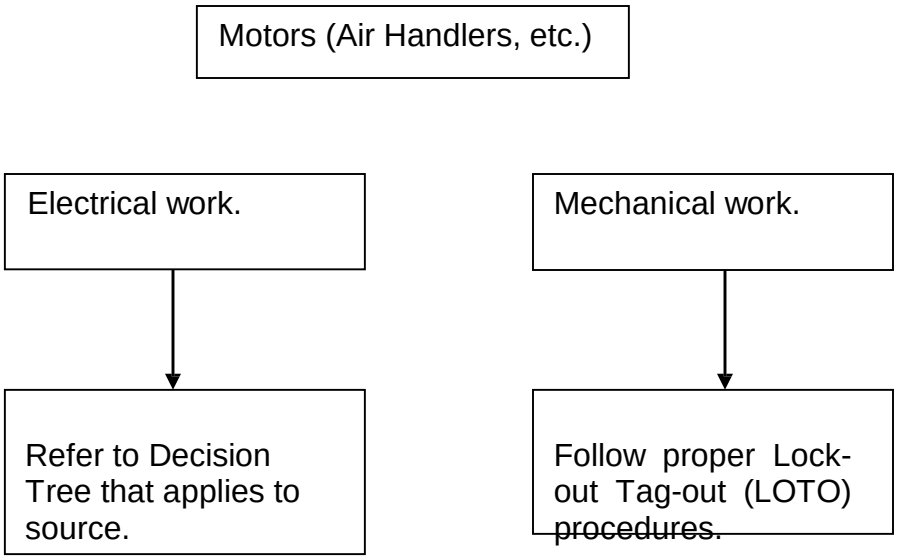


Note 1 - “Prove Dead” requires PPE appropriate for location and task. Use section 9 of this document.



Rev 3/10/15

Note 1 - “Prove Dead” requires PPE appropriate for location and task. Use section 9 of this document.



Note 1 - "Prove Dead" requires PPE appropriate for location and task. Use section 9 of this document.

4.2 High Visibility Apparel

4.2.1Scope

Campus Facilities Employees performing construction, maintenance or repair work on or adjacent to roadways, parking garages or parking lots, designated construction zones and other areas that employees may be struck by moving vehicles or mobile equipment.

4.2.2 Purpose

To prevent worker injuries and/or fatalities-The National Institute for Occupational Safety and Health determined in a 2001 report that 100 workers were killed and 20,000 were injured on highway and street construction job sites. The U.S. Bureau of Labor Statistics estimates that 2,500 of the 20,000 injuries were visibility related. NIOSH also found that traffic related injuries are only half of all work zone injuries. The other half resulted from being struck by construction and other mobile equipment.

During daylight hours all Campus Facilities employees working in the following areas shall wear at least minimum florescent orange or florescent green shirts, provided by the departments:

- Adjacent to Roadways and Streets
- Parking Lots
- Parking Garages

During daylight hours all Campus Facilities employees working in the following areas shall wear at a minimum ANSI Class II high visibility clothing or vest:

- Working in Street or Roadways Designated Construction Areas Excavations
- Working around Mobile Equipment
- Overhead Lifting Operations

During nighttime hours all Campus Facilities working in the following areas shall wear at a minimum in lighted areas Class II clothing or reflective vest:

- Adjacent to Roadways and Streets
- Parking lots
- Parking Garages
- Designated Construction Areas
- Excavations
- Working around Mobile Equipment
- Overhead Lifting

Other specific task that may put Campus Facilities employees at risk of being struck by moving vehicles or mobile equipment must be evaluated on a case-by-case basis to determine the need for high visibility clothing.

Apparel shall be kept clean to maintain visibility.

4.3 Confined Space

4.3.1 Purpose

The purpose of this program is to ensure that Campus Facilities is complying with safe procedures for Permit Required Confined Space entry as referenced in Occupational Safety and Health Administration (OSHA) 1910.146. This program applies to all work operations at University of Missouri where Campus Facilities employees must enter a permit-required confined space as part of their job duties.

The CF Safety Training and Development Coordinator is the Program Administrator having overall responsibility for the Permit Required Confined Space Program.

Copies of the written program are maintained in the Campus Facilities Safety & Health Program book in the CF Safety Training and Development Coordinator's office in the General Services Building and in each CF Department.

4.3.2 Scope

Under this program, Permit-Required Confined Spaces are identified at the University of Missouri and training is provided for CF employees according to their responsibilities in this program. CF employees receive instructions for safe entry into our specific type of confined spaces, including testing and monitoring, appropriate personal protective equipment, rescue procedures, and employee responsibilities.

This program is designed to ensure that safe work practices are utilized during all activities regarding the Permit Required Confined Space to prevent personal injuries, illnesses and fatalities that could occur.

4.3.3 Definitions

Authorized entrant: an employee who is trained and authorized to enter a Permit-Required Confined Space.

Attendant: an employee who is stationed outside a confined space who monitors the authorized entrants and is trained in attendant's duties for confined space entry.

Confined Space:

- is large enough and so configured that an employee can bodily enter and perform assigned work; and
- has limited or restricted means for entry or exit; and.
- is not designed for continuous employee occupancy.

Permit Required Confined Space: (a confined space which also)

- contains or has potential to contain a hazardous atmosphere, or

- contains a material with potential for engulfment of an entrant, or

- has 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

- contains any other recognized serious health or safety hazard.

Non-Permit Required 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.

Permit-Required Confined Space Entry Permit: a written or printed document which allows entry into a permit-required confined space and one that is completed prior to an authorized entrant entering and performing work inside a permit-required confined space. The Permit must be initiated by the Entry Coordinator.

Entry Coordinator: a Campus Facilities Supervisor, Lead Person, Safety representative or designee who is trained and authorized to determine acceptable entry conditions; one who authorizes entry and oversees entry operations and terminates entry into a Permit-Required Confined Space.

Hazardous Confined Space: (anyone of the following)

- an oxygen deficient atmosphere containing less than 19.5% or an oxygen enriched atmosphere greater than 23.5% oxygen.

- a flammable gas, vapor or mist in excess of 10% of the Lower Explosive Limit(LEL)

- an airborne combustible dust at a concentration that meets or exceeds the Lower Flammable Limit (LFL). This concentration may be approximated when dust conditions obscure vision at a distance of 5 feet or less.

- an airborne concentration of any material for which a permissible exposure limit (PEL) or Immediately Dangerous To Life (IDLH) value is published in the OSHA regulations and which could result in an employee exposure greater than it's permissible exposure limit.

- atmospheric condition that is imminently dangerous to life or health.

- an unexpected release of energy to equipment or machinery.

- a space which may present the danger of being trapped in a liquid or solid.

- a space which may house physical dangers such as debris or slip, trip and fall hazards.

Immediately Dangerous to Life or Health: any condition which poses an immediate or delayed threat of life; may result in irreversible adverse health effects; or would

interfere with an individual's ability to escape unaided from a permit-required confined space.

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

4.3.4 Responsibilities/Procedures

1. Hazard Evaluation for Permit-Required Confined Spaces at the University of Missouri

To determine if there are permit-required confined spaces in University of Missouri, the CF Program Administrator, Campus E H & S representative or adequately trained department personnel will conduct a hazard evaluation of our work spaces and post appropriate signs at each location. This evaluation will provide information necessary to identify the existence and location of permit-required confined spaces in our workplace that must be covered by the Permit-Required Confined Space Entry Program. This written hazard evaluation is kept in the Campus Facilities Safety office.

2. Preventing Unauthorized Entry

To provide a safe work environment for employees working in confined spaces and to prevent potential exposure to employees who may accidentally enter a confined space, the following procedures will be implemented to inform all employees of the existence, location, and danger posed by confined spaces in the University of Missouri:

- warning signs posted to identify Permit-Required Confined Spaces as referenced in the attachment.
- warning signs, a written Permit, locked access and a trained attendant to keep unauthorized persons out of permit-required confined spaces during any work in such space.

3. Permit Process

The CF Entry Coordinator is responsible for authorizing entry and issuing entry permits for work in Permit-Required Confined Spaces. The file of cancelled permits and related documents are kept in each department. The procedures for preparing, issuing, and canceling entry permits includes the following elements:

- Entry Coordinator reviews the work space with all entrants and attendant prior to entry, authorizes and issues Confined Space Entry Permit.
- the completed permit will be reviewed with entrants and the attendant.
- duration of entry is valid only for period indicated on permit.
- the Entry Coordinator will terminate the Confined Space Entry Permit when work has been completed or a prohibited condition occurs.
- at the end of the work or entry, the Entry Coordinator shall cancel the permit and return it to the department Supervisor.

4. Pre-Entry Evaluation

To ensure the safety and health of our employees and before allowing authorized workers to enter a Permit-Required Confined Space, conditions are evaluated in that space by a trained CF employee to determine if the conditions are safe for entry. Any employee who enters the space has the opportunity to observe the pre-entry and any subsequent atmospheric testing. The authorized entrant also has the option of requesting a reevaluation of the space if they feel that the evaluation was not adequate.

Campus Facilities follows the procedures to evaluate each permit space before entry according to OSHA requirements. This includes testing the internal atmosphere with a calibrated direct-reading instrument for oxygen content, flammable gases and vapors, and potential toxic air contaminants. Also a periodic test of the atmosphere in the space is done to ensure that continuous ventilation is preventing the accumulation of a hazardous atmosphere.

5. Basic Requirements for Entering a Permit-Required Confined Space

- Entry must be planned and authorized by the completion of an entry permit.
- All hazards must be identified and, where applicable, controlled by:
    - Purge-Flush and Vent
    - Ventilation
    - Lockout/Tagout
    - Inerting
    - Personal protective equipment
    - Blanking, Blocking, Bleeding
    - External Barricades
- Confined space Identification Signs
- If the only potential hazard in the space is a hazardous atmosphere which can be maintained safe by ventilation (meaning all other hazards are locked out and/or eliminated), then space may be entered without attendant and retrieval equipment (refer to Alternate Procedures on page 6).
    - *The Location, Certification of Hazard Elimination and Atmospheric Monitoring Results sections must be documented on the Permit and the permit must be signed.*

6. Entry Steps

Identify the work to be performed.

Identify who will perform the work.

Determine when the work will be performed.

Determine the types of hazards associated with the space.

If the only potential hazard is atmospheric, ventilate the space as necessary and document information on the permit.

If there are other potential hazards present, continue filling out the permit for the space.

Obtain and visually inspect the necessary equipment before entering the space.

Assemble the necessary personnel: attendant, entrant(s), entry coordinator.

Review the permit requirements with all key personnel involved with the entry.

Review the communication procedures with all entry participants.

Verify procedures for notifying rescue personnel.

Initiate lockout/tagout procedures and isolate the space. Clean and/or

purge the space to remove hazardous contents. Ventilate the space if

necessary to maintain satisfactory atmosphere. Verify atmospheric

conditions according to the permit requirements. Enter the space and

perform the work.

Monitor the space continuously and record results every two hours.

Exit the space and account for all entrants.

Close out the permit.

Perform appropriate maintenance as required to equipment used during the entry.

Turn in the cancelled permit to the supervisor.

7. Testing a Confined Space for the Presence of a Hazardous Atmosphere

Select a properly calibrated air testing device that is capable of detecting potential air contaminants within the space.

Check the confined space atmosphere before entry is made and then continuously during the entry.

Always perform air tests before, during and after ventilating a confined space.

Slowly check the entire depth of the space. Some hazardous gases are lighter than air and will be near the top (for example, methane) while other hazardous gases are heavier than air and will be near the bottom (for example, hydrogen sulfide).

Record monitoring results on permit.

8. Conditions of Entry

The following conditions of entry must be satisfied:

Condition	Minimum Requirements
Oxygen	Minimum 19.5% and Maximum 23.5%
Flammable Gases	No greater than 10% for lower flammability limit (LEL)
Hydrogen Sulfide (H_2S)	No greater than 20 parts per million (ppm)
Carbon Monoxide (CO)	No greater than 35 parts per million (ppm)
Other Toxic Substances	No greater than substance's permissible exposure limit (PEL)
Flammable Dusts	Must not reduce visibility to 5 feet or less
Engulfment Hazards	No engulfment hazard may be present
Hazardous Flows	Must be secured and locked/tagged out
Hazardous Energies	Must be secured and locked/tagged out
External Hazards	External hazards must be controlled

- Entrants shall wear retrieval equipment unless the use of retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant.
- Retrieval equipment must include a full body harness attached to a retrieval line. The opposite end of the retrieval line must be fastened at a point on the exterior of the confined space.
- When the space is deeper than five feet, the retrieval line must be connected to a mechanical lifting device designed for human lifting.
- Attendant shall be stationed at the opening.
- Attendant and/or entrant shall test and monitor continuously throughout entry for the presence of a hazardous atmosphere.

9. Ventilating a Confined Space

Confined spaces must be ventilated to:

- Eliminate a hazardous atmosphere that has been detected through air testing.
- Reduce high temperatures.
- Improve environmental conditions.

Provide ventilation by supplying clean fresh air into the space.

- Never use pure oxygen.
- Discharging air into the space is more efficient than exhausting air from the space. Fans used to exhaust flammable atmosphere must be explosion proof.

Place the blower so that vehicle exhaust and/or air discharged from the space does not enter the blower intake.

Ventilate the entire space.

- Use a blower of sufficient capacity to meet the minimum conditions and requirements for entry.
- Allow sufficient time for complete ventilation.
- Create turbulence by discharging air into corners.

10. Alternate Procedures for Entry

A permit-required confined space may be entered without an attendant and retrieval equipment if the following conditions are satisfied:

- All physical hazards (for example, hazards capable of causing death or serious injury) are eliminated. This means that the only hazard posed by the permit space is an actual or potential hazardous atmosphere and that forced air ventilation alone is sufficient to maintain that the permit space is safe for entry. If entry is required to eliminate hazards, the space must be entered according to permit-required confined space procedures.
- The work does not introduce hazards.
- Continuous ventilation is necessary to maintain safe atmosphere for entry.
- Hazard elimination must be certified in writing on the permit with date, location of the space and signature of Entry Coordinator.
- If hazards are observed or perceived, the space must be immediately evacuated and re-evaluated for entry on a new permit form.
    - Perform work safely and remain alert for hazards.

- The Alternate procedures must be documented on the permit and the permit must be kept on file (Refer to Section IV. 5 above).

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11. Equipment

To ensure the safety and health of employees, the Campus Facilities Department provides appropriate equipment to all employees who work in or near permit confined spaces as follows:

- To facilitate non-entry rescue, retrieval systems or methods will be used when an authorized entrant enters a permit confined space unless the retrieval equipment would increase overall risk of entry or would not contribute to rescue of the entrant. Each authorized entrant will use a chest or full body harness, with a retrieval line attached at the center of the entrants back near shoulder level, above the entrants head, or at another point which Campus Facilities can establish presents a profile small enough for the successful removal of the entrant. Wristlets may be used instead of the chest or full body harness if University of Missouri can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.

The following additional equipment is provided to all employees who work in or near permit-required confined spaces:

- Additional lighting, ventilation equipment, personal protective equipment, rescue equipment, atmospheric testing equipment, ladders, etc.

All equipment is maintained in excellent working condition and all Confined Space entrants are trained in the correct usage of this equipment.

12. Duties: Authorized Entrants

Those persons who have completed the training and are authorized to enter permit-required confined spaces to perform work. Duties and responsibilities include:

- Read and abide by the Permit conditions and special procedures. Be knowledgeable of hazards associated with confined spaces.

- Identifying and recognizing the signs and symptoms and consequences of hazard overexposure.

- Ensuring that atmospheric monitoring has been conducted and that appropriate personal protective equipment and rescue equipment has been made available.

- Properly use required personal protective equipment including donning full body harness with retrieval line rescue equipment prior to entry when applicable.

- Maintain communication with the attendant and notify the attendant of self-evacuation from the confined space.

- Inform the attendant whenever he/she feels there is a danger or when a prohibited condition is noted.

- Exit the confined space as quickly as possible when the attendant or Entry Coordinator orders evacuation, an alarm is activated or danger is perceived.

13. Duties: Attendants

Attendants are those persons who have completed the training and are authorized to be permit-required confined space attendants.

Duties and responsibilities include:

- Remain outside the confined space at all times during entry operations including during any emergency inside the confined space.

- Having means for summoning emergency help from outside the confined space at all times.

- Maintain communication with entrants.

- Maintain accurate accounting of all entrants authorized to work in the confined space.

- Monitor activities inside and outside the confined space to ensure that it is safe.

- Ensure that rescue equipment is available and adequate for rescue.

- Warn entrants when conditions occur which may interfere with or cause a safety hazard for the entrants.

- Order the entrants to evacuate the confined space immediately if the attendant recognizes an unsafe condition that could endanger the entrants.

14. Duties: Entry Coordinator

Entry Coordinators are those persons who have completed the training and have been designated as a permit-required confined space Entry Coordinator. Duties and responsibilities include:

- Know the hazards faced during confined space entry.

- Ensure that authorized entrants and attendants are designated and trained in their responsibilities prior to entry.

- Verify that all safety conditions and requirements of the Confined Space Entry Permit have been evaluated and met.

- Ensure that all hazardous conditions are rendered safe prior to entry.

- Terminate entry and cancel the permit when work has been completed or when a prohibited condition occurs.

- Verify that all rescue equipment and personal protective equipment is available and used.

- Determine throughout entry that all entry operations remain consistent with terms of the entry permit.

4.3.5 Training Program

Every Campus Facilities employee who faces the risk of confined space entry is provided with training so that they acquire the understanding, knowledge and skills necessary for the safe performance of the duties assigned to them as described in the program. The CF Program Administrator or authorized designee with skills and knowledge will conduct the Permit-Required Confined Space training. All training related materials and records are kept in CF Training Department.

Classroom training, videos, handouts and hands-on practice are used for this training. New employees are trained before their initial assignment of duties. When changes occur in permit-required confined space areas, additional training will be done. If there is a reason to believe that an employee has deviated from a previously trained upon procedure or that their knowledge seems inadequate, refresher training will be done for that employee. Refresher training will be conducted every three years or more often as necessary.

4.3.6 Rescue and Emergency Services

University of Missouri utilizes the Columbia City Fire Department to perform rescue and emergency services in the event of a Permit Confined Space incident. To familiarize this service with our facility and emergency needs, access is provided to the Fire Department to all permit spaces from which rescue may be necessary so the rescue team can develop appropriate rescue plans and practice rescue operations. Campus Facilities also informs the rescue team of the hazards they may confront when called on to perform rescue at the site.

4.3.7 Multiple Employer Entry Procedures

When outside employers/contractors enter our facility to perform work in Permit-Required Confined Spaces, entry and work operations are coordinated through Campus Facilities to ensure that the contractor is made aware of confined spaces and any hazards involved.

4.3.8 Post-Operations Procedures

Upon completion of work in a permit required confined space, methods used to cease operations in the space and cancel the permit are as follows:

- Entry Coordinator terminates entry and cancels permit.

- The space is sealed or closed to prevent unauthorized entry.

- Once the entry permit has been cancelled, a new entry permit must be implemented using the Permit-Required Confined Space Entry procedures outlined in this program to reenter the confined space.

4.3.9 Review-Procedures

Canceled Confined Space Entry Permits from the past 12 months are retained. Campus Facilities Safety Coordinator performs a single annual review covering all entries performed during a 12-month period. If no entry is performed during a 12-month period, no review will be performed.

4.3.10 Enforcement

Constant awareness of and respect for Permit-Required Confined Space entry hazards, and compliance with all safety rules are considered conditions of employment. Supervisors and individuals in the CF Safety and CF Personnel Department reserve the right to issue disciplinary action to any CF employee, up to and including termination, for failure to follow the guidelines of this permit entry program.

4.3.11 Responsibilities

Managers

Work Group Managers have the primary responsibility to maintain a safe work environment within their jurisdiction, by monitoring and exercising control over their assigned areas.

Ensure that health and safety responsibilities are carried out in their work groups. This includes assuring compliance with applicable Confined Space Entry procedures.

Ensure implementation of the Confined Space Entry Program.

Provide financial support for the Confined Space Entry Program.

Environmental Health and Safety

Provide guidance for proper selection and use of appropriate air monitoring equipment, ventilation equipment and ancillary safety devices as required.

Periodically assist with audit operations, documentation, and training to ensure compliance with the program.

Assist each work group in identifying confined spaces and entry restrictions.

Assist in providing training and training programs.

Safety Coordinator

Develop the written Confined Space Entry Program with assistance from the Standards Committee and revise the policy, when necessary.

Be thoroughly informed of the Confined Space Program, rules and procedures and how it specifically applies to their responsibilities and authority.

Perform investigations of any confined space related incidents.

Administer training as needed in conjunction with the supervisors.

Work in conjunction with managers and supervisors in determining and labeling of confined spaces.

Make revisions to this program as necessary.

Supervisors

Be thoroughly informed of the Confined Space Entry Program, rules and procedures and how it applies to their areas of responsibility and authority.

Periodically review work practices to ensure compliance.

Take prompt corrective action when unsafe conditions, practices, or equipment is reported or observed.

Identify areas and locations that are confined spaces and report to the CF Safety Coordinator.

Identify personnel who may enter confined spaces, and ensure that they are trained.

Inspect and ensure proper maintenance of equipment.

Ensure permits are properly completed.

Ensure identified confined spaces are properly posted with warning signs.

Maintain records of employee training and equipment maintenance.

Contact CF Safety Coordinator with any questions concerning the classification of a space or any entry questions.

Maintain copies of entry permits.

Update CF Safety Coordinator with additions and deletions to confined space list.

Conduct periodic inspections of confined space entry procedures in order to maintain safe and healthful conditions and address any deficiencies that are identified.

Employees

Follow all provisions of the Confined Space Entry Program and procedures.

Do not perform any function or operation that is considered hazardous, or is known to be hazardous without proper instruction and authorization.

Report all unsafe conditions, practices, or equipment to the supervisor or Safety Coordinator.

Only use equipment and materials approved or provided by the supervisor.

Properly wear or use prescribed protective equipment.

Inspect, properly store and maintain equipment used for confined space entry.

Immediately report equipment malfunctions to supervisor.

Follow all provisions of the confined space entry program and procedures.

References

OSHA 1910.146 Permit-Required Confined Space.

Attachments:

Campus Facilities Permit Required Confined Space Entry Permit

2. Example of Permit-Required Confined Space sign

Date: December 4, 2003
Revised: December 11, 2003
Revised: June 10, 2004
Revised: June 14, 2004
Revised: July 1, 2004
Revised: August 2, 2004
Revised: August 3, 2004
Revised: August 5, 2004
Revised: August 11, 2004
Revised: September 10, 2004
Revised: September 14, 2004
Revised: January 20, 2006
Revised: January 25, 2006
Revised: April 1, 2011

Emergency Numbers:
COLUMBIA FIRE: 911
CF SAFETY: 573-884-3224
EHS: 573-882-7018
CF COMMUNICATIONS: 573-882-3301

Do Not Destroy This Permit
After Cancellation, This Entry Permit Must be Retained by Supervisor for at Least One Year

CONFINED SPACE ENTRY PERMIT

http://www.cf.missouri.edu/safety/forms/confined_space.pdf

Location of Confined Space _____

Purpose of Entry _____

Date of Entry _____ Authorized Duration of Entry Permit _____

Authorized Entrants _____

_____

_____

Attendants _____

_____

Entry Supervisor Authorizing Entry _____

Signature Date & Time

Record Hazards of the Permit Space to be Entered				Check or list the measures used to isolate the permit space and to eliminate or control permit space hazards before entry.
Hazard	Yes	No	N/A	
Lack of Oxygen				□ A. Purge-Flush and Vent
Oxygen Enrichment				□ B. Ventilation
Combustible Gases/Vapors				□ C. Lockout/Tag Out
Toxic Gases/Vapors				□ D. Inerting
Chemical Contact				□ E. Blanking, Blocking, Bleeding
Electrical Hazards				□ F. External Barricades
Mechanical Hazards				□ G. Confined Space Identification/Signs
Temperature				
Engulfment				
Entrapment				
Others				

Test(s) To Be Taken	Permissible Entry Levels	Readings: Test 1	Test 2	Test 3	Test 4
Percent of Oxygen	19.5% to 23.5%				
Combustibles	<10% LEL				
Carbon Monoxide	≤ 35 ppm				
Hydrogen Sulfide	≤ 20 ppm				
Name or Initials of Tester					
Test Times					

Equipment Supplied to the employee				
Yes	No	N/A	Equipment	Description
			(i) Gas Test and Monitoring	Name_____ Model/Type_____ Serial/Unit No.
			(ii) Ventilating	
			(iii) Communications	
			(iv) Personal Protective Equipment	□ Safety Harness With Life Lines □ Respiratory □ Hard Hats □ Eye □ Ear □ Face □ Hand □ Foot □ Clothing
			(v) Lighting	
			(vi) Barriers/Shields	□ Pedestrian □ Vehicle □ Other
			(vii) Safe Ingress/Egress	□ Ladders
	Radio Service Desk to call 911		(viii) Rescue and Resuscitators- Emergency Inhalator	□ Lifelines □ Hoists □
			(ix) Other Safety Equipment	

THIS CONFINED SPACE ENTRY PERMIT HAS BEEN CANCELLED:
By _____ _____AM/PM
_____

Entry Permit Supervisor Time Date

PERMIT REQUIRED
CONFINED SPACE
DO NOT ENTER

4.4 Hot Work Program

SAFETY AND HEALTH PROGRAM

HOT WORK PERMIT PROGRAM

4.4.1 PURPOSE

To provide written procedures to prevent fires resulting from any temporary operation involving open flames or which produces heat and/or sparks. This includes, but is not limited to: brazing, cutting, grinding, soldering, thawing pipes, torch applied roofing and welding.

4.4.2 SCOPE

The following procedures specify the requirements for various hot work processes carried out by Campus Facilities Employees. This procedure does not apply to areas specifically designed and equipped for such operations, i.e. maintenance shop and designated welding areas. When conducting hot work in a University Hospital Center or Missouri University Research Reactor (MURR) their procedures will apply.

4.4.3 REFERENCES

National Fire Protection Association Standard 51B "Standard for Fire Prevention During Welding, Cutting and Other Hot Work". OSHA 29 CFR 1910.251-255 subpart Q, and OSHA 29 CFR 1926.350-351 subpart J.

4.4.4 DEFINITIONS

Hot Work: Any operation producing flame, sparks or heat including cutting, welding, brazing, grinding, sawing, soldering, thawing frozen pipes, applying roof covering etc.

Permit: A special permit, which authorizes "Hot Work" activities at a specific location and time. The permit will be properly filled out, displayed on site and filed with the supervisor that indicates that hot work has been approved for the location. Permits contain a checklist to be completed prior to commencing hot work activities and also at the conclusion of hot work.

Fire Watch: Trained person stationed in the hot work area who monitors the work area for the beginnings of potential, unwanted fires.

Special Hazard Occupancies: Any area containing Flammable Liquids, Dust Accumulation, Gases, Plastics, Rubber and Paper Products.

Permit Authorizing Individual (PAI): Designated employee competent to authorize hot work. This would be a designated employee who is trained in the Hot Work procedures and competent to authorize Hot Work.

Hot Work Operator (HWO): Formally trained and qualified in proper hot work procedures and techniques. This employee performs hot work as part of the job classification.

Designated Hot Work Area: any area where hot work is being performed on a regular basis. This area is exempt from permitting unless they warrant more stringent requirements. Designated areas must meet certain criteria found later in this document. These areas must be marked.

Designated Occasional Hot Work Area: any area where hot work is performed periodically or for extended periods of time. Permitting is required for this area but may be issued for specific time periods not to exceed 1 year. Designated areas must meet certain criteria found later in this document.

4.4.5 Training

All Campus Facilities employees who conduct Hot Work operations will receive initial training and annual refreshers

Hot Work Training will consist of:

1. Review the requirements referenced in OSHA and NFPA
2. The CF Hot Work Permit system and procedures
3. Responsibilities
    - Supervisors
    - Permit Authorizing Individual (PAI)
    - Hot Work Operator (HWO)
    - Fire Watch
        A. Duties
        B. Review of Fire Extinguisher use
        C. Emergency response
    - Operators
    - Contractors
4. Documentation/Permit
5. Personal Protective Equipment Requirements
6. Fire Extinguisher Training/Re-Training

4.4.6 Procedures

a. Where practicable all combustibles shall be relocated at least 35 feet from the work site. **Where relocation is impractical, combustibles shall be protected with flameproof covers, shielded with metal, guards, curtains, or wet down material to help prevent ignition of material.**
b. Ducts, conveyor systems, and augers that might carry sparks to distant combustibles **shall be protected or shut down.**
c. Where cutting or welding is done near walls, partitions, ceilings, or a roof of combustible construction, fire-resistant shields or guards shall be provided to prevent ignition.
d. 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 of heat. **Where combustibles cannot be relocated on the opposite side of the work and cannot be effectively monitored by a single fire watch person, an additional fire watch person shall be assigned on the opposite side of the work.**
e. Welding shall not be attempted on a metal partition, wall, ceiling or roof having a covering or on walls having combustible sandwich panel construction.
f. Cutting or welding on pipes or other metal in contact with combustible walls, partitions, ceilings, or roofs shall not be undertaken if the work is close enough to cause ignition by combustion.
g. Area where welding/hot works will be conducted, *all combustible dust accumulation should be eliminated and/or minimized as referenced in item a. above.*
h. Suitable fire extinguishers shall be provided and maintained ready for use.
i. A fire watch person (not the same person doing the work) shall be provided during and for at least 30 minutes past the completion of the welding project. The welder can move on to the next site and prepare to start; however, no welding can begin until the fire watch person

is present.

j. A Hot Work Permit must be used on all welding or cutting, brazing, flame soldering, grinding, flame roof application, tile and paint removal or any other activity that could cause flames or sparks outside of a Designated Hot Work area.
k. Contact the Campus Maintenance Fire Protection Service at 882-8211, (contact the power plant control room for hot work in the power plant), prior to any Hot Work in areas where fire alarms or fire suppression systems need to be shut off.
l. Cutting or welding shall not be permitted in the following situations:
    - In areas not authorized by management.
    - In the presence of potentially explosive atmospheres that may develop inside uncleansed or improperly prepared tanks or equipment which have previously contained such material or that may develop in areas with an accumulation of combustible dusts.
m. When hot work is complete:
    - The work area and any potentially affected surrounding areas are inspected for fire, fire damage or the potential for fire for a minimum of 30 minutes following completion of the hot work.
    - Smoke and fire alarms that were disabled because of hot work shall be reactivated.
    - Hot work permit is closed out.
    - Hot Work permit is submitted to Supervisor.

4.4.7 Hot Work fire prevention measures

A designated Hot Work area should be established to meet the following requirements:

- Floors swept and clean of combustibles within 35 ft. of work area.
- Flammable and combustible liquids exposed or in portable container and other flammable or combustible materials will be kept 35 feet from the work area.
- Mechanical ventilation shall be provided to minimize fumes, gases and dusts in work areas less than 10,000 cubic feet per welder, in rooms having a ceiling height less than 16 feet and in confined spaces or where the welding space contains partitions, balconies or other structural barriers. The mechanical ventilation must provide a minimum rate of 2,000 cubic feet per minute per welder. Specific chemicals such as fluorine, zinc, cadmium, stainless steel, and lead require special ventilation requirements. Respiratory protection may be needed unless an adequate monitored air flow away from the welder and others present can be established and maintained to minimize fumes, gases and dust.
- At least one 10 lb. dry chemical fire extinguisher should be within access of the 35 ft. of work area.
- Protective dividers such as welding curtains or non-combustible walls will be provided to contain sparks and slag to the combustible free area.
- No wall or floor openings are permissible within 35 feet of the designated Hot Work area unless a Fire Watch is available.

Requirements for Hot Work conducted <u>outside</u> the designated Hot Work area.

- A Hot Work Permit must be completed and complied with prior to welding operation.
- Portable welding curtains or shields must be used to protect other workers in the Hot Work area.
- Respiratory protection may be needed unless an adequate monitored air flow away from the welder and others present can be established and maintained to minimize fumes, gases and dust. Mechanical ventilation is required in areas less than 10,000 cubic feet per welder, in rooms or work spaces with ceilings less than 16 feet in height and in confined spaces. Mechanical ventilation must be provided at 2,000 cubic feet per minute per welder. Specific chemicals as listed above require special ventilation requirements.

- Combustible materials must be separated with flame proof tarps during Hot Work procedures.
- Fire Watch must be provided for all hot work operations.
- No wall or floor openings are permissible within 35 feet of the Hot Work area.

4.4.8 RESPONSIBILITIES

A) Managers

1) It is the responsibility of management to insure that this policy is implemented and enforced in those areas under their jurisdiction where applicable.

2) Management or a designated agent shall be responsible for the safe operations of hot work activity.

3) Management shall designate permit authorizing individuals (PAI)

4) Develop procedures and responsibilities to ensure all equipment is examined to ensure it is in a safe operating condition.

When found to be incapable of reliable safe operation, the equipment shall be repaired by a qualified person prior to being used.

5) Shall ensure that all individuals involved in the hot work operations, including contractors, are familiar with the provisions of this policy. Individuals involved in hot work operations shall be trained in safe operations of their equipment and in the safe use of the process.

B) Environmental Health and Safety

1) Assist with implementation of program upon request.

2) Advise as needed on any changes required to this program

C) Safety Coordinator

1) Be thoroughly familiar with the Hot Work procedures.

2) Assist in implementation of the Hot Work Program throughout CF.

3) Assist in the training on the provisions of this program as required.

D) Supervisors

1) Be thoroughly familiar with the Hot Work procedures.

2) Identify employees who may perform hot work as defined in this procedure.

3) Provide specific Hot Work training to employees who perform Hot Work operations.

4) Provide Hot Work Permits.

5) Maintain copies of Hot Work Permits.

6) Ensure compliance with procedures by employees.

7) Complete CF training program.

8) Other responsibilities assigned by Management concerning hot work operations.

E) Permit Authorizing Individual (PAI)

1) Shall consider the safety of the hot work operator and fire watch with respect to PPE.

2) The PAI shall determine site –specific flammable materials, hazardous processes, or other potential fire hazards that are present or likely to be present in the hot work location.

3) Shall ensure the protection of combustibles from ignition.

If combustibles or processes cannot be protected during hot work operations they shall not be performed.

4) Shall determine that fire protection and extinguishing equipment are available on site.

5) Shall that fire watch is onsite during hot work activities and at least ½ hour after hot work is completed.

F) Hot Work Operator (HWO)

1) Shall handle equipment safely and use it so not to endanger life of property

2) Shall have approval before starting hot work operations

3) Shall make sure all equipment is safe

4) Shall cease operations if unsafe conditions develop and shall notify management

G) Fire Watch

1) Shall be trained in the inherit hazards of work site and of the hot work.

2) Shall ensure that safe conditions are maintained during hot work operations.

3) Shall have authority to stop hot work operations if unsafe conditions develop.

4) Shall have fire-extinguishing equipment readily available and shall be trained in its use.

5) Shall be familiar with facilities and how to call emergency personnel if needed.

H) Contractors

1) Before starting any hot work, contractors and their clients shall discuss the planned project completely, including the type of hot work to be conducted and the hazards in the hot work area.

I) Mutual Responsibilities

1) Management, PAI, HWO, Fire watch, and contractors shall recognize their mutual responsibility for the safety of hot work operations.

4.4.9 Welding Operating Procedures

Referred in the attachments

4.4.10 ATTACHMENTS

1. CF Hot Work Permit
2. Operating Procedure – Electric Welding
3. Operating Procedure - Gas Welding

Hot Work Permit

Date/Time start:_____Date/Time end:_____ Location:_____

Work to be performed:_____

Requirements:	Yes	No	N/A
1. All movable fire hazards removed at least 35 feet away	☐		☐
2. Floors cleaned of combustible material at least 35 feet away	☐		☐
3. Guards, tarps, shields placed around non-movable fire haz.	☐		
4. Floor, wall, door openings or cracks closed/sealed	☐	☐	☐
5. Mechanical ventilation	☐	☐	☐
5. Fire extinguishers charged and ready for use and employee trained in its use.	☐		
6. Trained Fire watch person required during and for at least 30 minutes after completion of hot work	☐		
7. Personal protective equipment available for eye, face, body, hands	☐		
8. Confined space permit required?	☐	☐	☐
9. Contact Campus Maintenance Fire Protection Services at 882-8211 prior to starting work in buildings where fire alarms or fire suppression systems need to be shut off	☐	☐	☐

_____ _____

Fire Watch Name(s) **Name of Person Performing Hot Work**

_____ _____

Supervisor or PAE Authorizing Hot Work **Department Conducting Hot Work**

Permit must be maintained at work site during work. Return cancelled Permit to Department

Operating Procedure - Electric Welding

HOT WORK PERMIT REQUIRED

1. Perform Safety Check on all equipment

- Ensure fire extinguisher is charged and ready for use
- Ensure electrical cord, electrode holder and cables are free from defects (no cable splices are allowed within 10 feet of the electrode holder.
- Ensure proper PPE (welding hood, gloves, protective footwear, protective clothing, eye protection, etc.) are available and have no defects.
- Ensure the welding unit is properly grounded and all electrical connectors are safe.
- All defective equipment must be repaired or replaced before use.

2. Remove flammables and combustibles

- No welding is permitted on or near containers of flammable material, combustible material or unprotected flammable structures. (reference section IV, item 11)
- Place welding screen or suitable barricade around work area to provide a fire safety zone and prevent injuries to passersby (Do not block emergency exits or restrict ventilation)

3. Use an authorized Air Purifying Respirator (APR) if required

4. Ensure proper mechanical Ventilation to eliminate and/or minimize fumes, gases and dusts. (see section V)

5. Ensure adequate lighting

6. Set Voltage Regulator properly

When arc welding is to be suspended for any substantial period of time such as during lunch or overnight, all electrodes shall be removed from the holders so that accidental contact cannot occur and the machine power is shut off.

7. Uncoil and spread out welding cable

To avoid overheating, ensure proper contact of work leads and connections, remove any metal fragments from magnetic work clamps (to avoid electric shock do not wrap welding cables around a body part and avoid welding in wet conditions)

8. Fire watch for 30 minutes after welding & until all welds have cooled

9. Cancel the permit upon completion of the work

Operating Procedure - Gas Welding

HOT WORK PERMIT REQUIRED

1. Perform Safety Check on all equipment

- Ensure tanks have gas and fittings are tight. Cylinders should be kept away from radiators and heat sources. Cylinders must be stored upright and secured from falling over.
- Ensure fire extinguisher is charged and ready for use
- Ensure hoses have no defects
- Ensure proper PPE (welding hood, gloves, protective footwear, protective clothing, eye protection, etc.) are available and have no defects.
- All defective equipment must be repaired or replaced before use.

2. Remove flammables and combustibles

- No welding is permitted on or near containers of flammable material, combustible material or unprotected flammable structures. (reference section IV, item 11)
- Place welding screen or suitable barricade around work area to provide a fire safety zone and prevent injuries to passersby (Do not block emergency exits or restrict ventilation)

3. Use an authorized Air Purifying Respirator (APR), if required

4. Ensure proper mechanical ventilation to eliminate and/or minimize fumes, gases and dusts. (see section V)

5. Gas cylinders must remain outside of confined spaces during welding.

6. Follow Confined Space Permit requirements for work in confined space.

7. Open Valves on Oxygen and Gas tanks to desired flow. Under no condition shall acetylene be generated, piped (except in approved cylinder manifolds) or utilized at a pressure in excess of 15 psig or 30 psia.

8. At completion of work, shut cylinder valves & relieve hose pressure.

9. Store hoses and place valve protection caps on cylinders.

10. Fire watch for 30 minutes after welding & until all welds has cooled.

11. Cancel the permit upon completion of work

4.5 Lockout/Tagout

The University of Missouri - Columbia

Campus Facilities

BUILDING SERVICES ENERGY MANAGEMENT FACILITIES MANAGEMENT LANDSCAPE SERVICES MAINTENANCE PLANNING, DESIGN & CONSTRUCTION

The Control of Hazardous Energy

LOCKOUT / TAGOUT PROGRAM

Prepared by the Campus Facilities Safety Department

CAMPUS FACILITIES
MU

Forward

The compound terms ‘tagout’ and ‘lockout’ (as specialized within this context), which would normally appear as two words each, are spelled in this document as they appear in the O.S.H.A. Standards. Similarly, the outline numbering scheme is taken directly from the O.S.H.A. example.

4.5.1 Introduction

"Lockout/Tagout (LOTO)" refers to specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities.

4.5.2 Definitions

Authorized Employee: An employee whose job requires that machines or equipment be locked or tagged in order to perform service or maintenance.

Affected Employee: An employee required to use machines or equipment on which servicing is performed under the Lockout/Tagout standard or who performs other job responsibilities in an area where such servicing is required.

Other Employee: An employee who is or may be in an area where energy control procedures may be utilized.

Capable of being locked out: An energy-isolating device considered capable of being locked out if:

- Designed with a hasp or mechanism to which a lock can be affixed
- Has a locking mechanism built into it
- Locked without dismantling, rebuilding, or replacing the energy-isolating device or permanently altering its energy-control capability.

Energized: Connected to an energy source or containing residual or stored energy.

Energy isolating device: A mechanical device that physically prevents the transmission or release of energy including, but not limited to the following:

- Manually operated electrical circuit breaker
- Disconnect switch.
- Manually operated switches by which the conductors of a circuit can be disconnected from all un-grounded 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.

NOTE: Push Buttons, Selector Switches and other Control Circuit type devices are NOT energy isolating devices.

Energy Source: Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

Lockout: The placement of a lockout device on an energy-isolating device -- in accordance with the established procedures – that ensures the energy-isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout Device: Any device using positive means -- such as a lock, blank flanges and bolted slip blinds -- to hold an energy-isolating device in a safe position and thereby prevent machinery or equipment from being energized.

Normal production operations: Utilization of a machine or equipment to perform its intended production function.

Servicing and/or maintenance: Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, maintaining and/or servicing machine or equipment. This includes lubrication, cleaning or un-jamming of machines or equipment, and making adjustments or tool changes. This applies to any place where employees could be exposed to the unexpected energization or startup of the equipment, or release of hazardous energy.

Tag-out: 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.

Tagout Device: Any prominent warning, such as a tag and a means of attachment, which can be securely fastened to an energy-isolating device to indicate that the machine or equipment to which it is attached may not be operated until the tagout device is removed.

4.5.3 Program Administration

Scope of the Lockout/Tagout (LOTO) Program
This program outlines the procedures and rules to be followed by Campus Facilities employees for safely servicing and maintaining machines and equipment where exposure to the unexpected release of hazardous energy may occur. Procedures herein apply to all mechanical, hydraulic, pneumatic, chemical, thermal, or other energy systems and equipment that use or can store energy.

Purpose
The LOTO program intends to, at a minimum, meet all applicable provisions mandated by the Occupational Safety and Health (OSHA) standard, 29CFR 1910.147, which requires that machinery and/or equipment is shutdown, isolated from all potentially hazardous energy sources, and *tagged and locked out* before employees perform any servicing or maintenance where the *unexpected* energization or start-up could cause injury.

Responsibilities

The C.F. Safety Coordinator and LOTO Administrators
- Develop, maintain, and evaluate the procedures herein
- Uphold each department utilizing the Campus Facilities LOTO program to establish documented site-specific procedures for energy isolation. (See Appendix B)

Managers/Supervisors
- Ensure that employees understand and comply with LOTO procedures
- Conduct employee training with the departmental LOTO administrator
- Maintain supplies of locks, tags and lockout devices

LOTO-authorized Employees
- Comply with LOTO procedures

Other Affected Employees

- Understand and follow LOTO procedures
- Notify supervision of hazards not identified or controlled by LOTO procedures.

Outside Contractors

- Comply with Campus Facilities' LOTO program when work involves CF employees
- Inform Campus Facilities employees of contractor LOTO program
- Ensure that contractor personnel understand CF LOTO procedures.
- Ensure that C.F. employees understand and comply with the contractor's LOTO program.

Training

Employees affected by LOTO procedures will be formally trained and tested on the contents herein. Copies of written tests will be kept on file in the certifying department.
Authorized Employees: Shall receive training on the recognition of applicable hazardous energy sources; the type and magnitude of energy available in the workplace; and the methods and means of energy isolation and control.
Affected Employees: Shall receive training on the purpose and use of energy control procedures.
Other Employees (workers in areas where energy-control procedures may be implemented): Shall be trained about the procedure and about prohibitions relating to restarting or re-energizing locked out or tagged out machines or equipment.

Re-training

Purpose:

- Introducing new or revised control methods and procedures
- Re-establishing employee proficiency

Requirements for re-training:

- Change in job assignments.
- Change in machines, equipment, or processes that present new hazards
- Change in energy-control procedures
- Deviations by employees from energy-control procedures
- Noted inadequacies in LOTO knowledge and/or practices

Compliance

Campus Facilities employees shall comply with LOTO program procedures. Compliance will be enforced according to Campus Facilities discipline practices, with evaluations kept on file for five years.
Campus Facilities employees are responsible for taking all necessary LOTO precautions to protect personnel and equipment. In the event any system is felt to be unsafe, this concern shall be voiced to others in the work site, the supervisor, department LOTO representative or the C.F. Safety Coordinator. Work shall NOT begin until all parties are assured the system is *safely l*.

4.5.4 Lockout/Tagout Implementation

Conditions for implementing LOTO procedures

When machine guards or other safety devices must be removed or bypassed, resulting in exposure to hazards –or to the points of operation

When any part of the employee's body must come in contact with the point of operation of the machine or equipment.
When any part of the employee's body must enter a danger zone associated with a machine operating cycle.

What this program does not cover
Servicing and maintenance of equipment if the safeguarding provisions of Subpart O (Machine Guarding) and other applicable general industry standards are effective in preventing employee exposure to hazards:

- Unexpected energization
- Startup of machines or equipment
- Release of energy

Minor tool changes and adjustments, and other minor servicing activities if they take place during normal production operations that are routine, repetitive, and integral to the use of that production equipment, as long as employees are effectively protected by alternative measures, which provide effective machine safeguarding protection.

Hot tap operations that involve transmission and distribution systems for gas, steam, water, or petroleum products on pressurized pipelines if continuity of service is essential, shutdown of the system is impractical, documented procedures are followed, and employees are effectively protected by special equipment.

Work on cord- and plug-connected electrical equipment, if the equipment is unplugged from the energy source and the authorized employee has exclusive control of the plug. Exclusive control means that: The cord and plug must be in the possession of the person working on the equipment; OR The electrical cord and plug shall be within arm's reach and in sight of the authorized employee; OR The authorized employee shall affix a lockout boot to the plug.

4.5.5 Lockout/Tagout Policy

Locking

Equipment needing repair or maintenance shall be evaluated to identify all potential energy sources and to determine if all energy sources are effectively isolated by the LOTO procedure. If an energy-isolating device is capable of being locked out, the authorized employee shall utilize lockout.

Locks and Keys Padlocks used for lockout procedures shall be of the key type. There shall be only two keys for each "lockout" padlock. One key shall be in the possession of the authorized employee. The second key – to be used only in an emergency -- shall be secured and controlled by the planned administrator. The planned administrator shall be responsible for ensuring that Form 2, Emergency Lockout/Tagout Removal in Appendix B, has been completed before the second key is released for use.

Tagging

Tagout alone DOES NOT provide the degree of protection afforded by lockout procedures.

Tagging equipment without the use of a lockout device is permissible ONLY in instances where it is physically impossible to use a lockout device. If the equipment can be locked out , it shall be locked out.

TAGOUT WITHOUT LOCKOUT requires two forms of approval. If the department LOTO administrator can demonstrate to the Safety Coordinator that, in a particular situation, the utilization of a tagout system ensures full employee protection, then a tagout will be permitted.

Documentation of Tagout Alone will be required. One copy shall be placed in the "Site Specific" section of

the departmental LOTO Manual (or otherwise directed by the department administrator), and a second copy in the Safety Coordinator's C.F. LOTO Manual.

When a tagout device is used on an energy-isolating device that is not capable of being locked out, the tagout device will be attached at the same location that the lockout device would have been attached. In these cases a "Danger, Do Not Operate" tag shall be used.

Equipment Classification

Machinery and equipment shall be assessed and classified into one of three categories for determining LOTO procedures to be followed. Category procedures must be followed.

Categories of Procedures:

Specific procedural steps for shutting down, isolating, blocking and securing machines or equipment to control hazardous energy

Specific procedural steps for the placement, removal and transfer of lockout devices or tagout devices and the responsibility for them

Specific requirements for testing a machine or equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures

EXCEPTION: Site specific procedures need not be in place if all of the following criteria are met:

Machinery or equipment has no other potential for stored or residual energy or re-accumulation of stored energy that after being shut down, could endanger employees.

Isolating and locking out of the energy source completely de-energizes and
de-activates the machine or equipment.

Machinery or equipment requires only one lockout device to achieve a locked-out condition.

Machinery or equipment is isolated from its energy source and locked out during servicing or maintenance.

Servicing or maintenance will not create a hazard for other employees.

Accidents involving the machinery or equipment's unexpected activation have not occurred in past servicing.

NOTE: If all of the above criteria are met, a lockout device shall be applied to the energy-isolation device in accordance with LOTO Procedure Part IV by the authorized person doing the maintenance.

Cord and Plug

Equipment powered by an electrical cord and plug may be serviced as long as the equipment is unplugged and under the control of the employee during the work activity. "Control of the Plug" means in possession: in the hand or pocket, within reach, or in line of sight or having a "plug boot" device on the plug.

Single Energy Source

An equipment specific lockout/tagout procedure is not required for the equipment if ALL of the following

criteria are met:

- It has a single energy source that will completely de-energize and deactivate it
- It has no other potential for stored energy
- It requires only one lock to achieve lockout/tagout
- It will not create a hazard for other employees
- No accidents involving its unexpected activation have occurred in past servicing

If all of the above criteria are met, a lockout device shall be applied to the energy isolation device by the authorized person doing the maintenance activity.

Multiple Energy Sources

Specific procedures for equipment with multiple energy sources are found in LOTO Procedure Part V, "Equipment Specific Procedures." If no procedure exists, a procedure must be established and documented prior to the commencement of maintenance activity.

Establish procedure (Form 1, Appendix C may be used for this task)

Document and retain a copy in the Departmental LOTO Procedures.

Forward a copy to the C.F. Safety Coordinator.

Requirements for LOTO Devices

Devices -- locks, tags, chains, wedges, key blocks, adapter pins, and self-locking fasteners -- shall be:

Durable, capable of withstanding the environment to which they are exposed for the maximum period of time.

Singularly identified as LOTO devices

The only devices used for controlling energy.

Shall be standardized within Campus Facilities Departments in the following criteria:

- Color, shape, and size
- Print and print Format

Shall be identifiable, that is, indicating the identity of the employee applying the device

Shall be substantial enough to prevent removal without the use of excessive force or unusual techniques - (bolt cutters etc.)

Shall be constructed and printed to withstand weathering

Shall be able to withstand corrosive environments

Shall have an attachment means of a non-reusable type, attachable by hand, self-locking and non-releasable with a minimum unlocking strength of no less than 50 lbs.

Periodic Inspections

Periodic inspections, conducted to identify and correct deficiencies or deviations, are performed by an authorized employee not involved in the energy-control procedure being inspected.

Where lockout is used, the inspecting employee must review the responsibilities of each "authorized" employee's (group review meetings are acceptable).

Where tagout is used, the inspecting employee must review the responsibilities of "affected" and "authorized" employees' responsibilities with those employees for which the energy-control procedure being inspected, and ensure each employee understands the requirements and limitations of a tagout procedure (as identified in paragraph i.)

Additional Training Responsibilities:

Tags are essentially warning devices affixed to energy isolating devices, and do not provide the physical restraint on those devices that is provided by a lock.

Department LOTO Administrators shall ensure that an evaluation of energy-control procedures is conducted at least once a year in their departments. A copy of the evaluation will be sent to the C.F. Safety Coordinator and a copy will remain in the department's LOTO Procedures Manual. The certification of evaluation shall contain:

- The machine on which the procedure was used
- Date of Inspection
- Employees included in the inspection
- Person/Persons conducting the inspection

Use of Tagout alone

When equipment is physically incapable of accepting a lock, tagout shall be used. **A "Danger-- Do Not Operate" tag** *shall be used (See Appendix B). The tags:*

Do not provide the same protection as a lock – they are only warning devices. They must not be bypassed or ignored.

Shall be placed at the same location that would hold the lockout device.

Are attached to devices which, if operated or changed, might result in danger to employees or damage to equipment.

Shall be of a standardized design to aid in recognition.

Shall contain, at a minimum:

- Name of authorized employee
- Department Name or Supervisor Name
- Department Phone Number or Supervisor Phone Number
- Date attached

When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.

Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.

Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.

Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.

Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

Can only be removed by the authorized employee who placed it or through the emergency lockout/tagout removal procedure, Form 2 – Appendix B; and on CF Safety website.

Shall always be used in conjunction with lockout/tagout procedures

Additional safety measures to be followed:

Remove and isolate a circuit element.

Block a control switch.

Open extra disconnects.

Remove a valve handle.

“DANGER” and ”DO NOT OPERATE” tags with employee’s name may not be reused beyond the scope of work or date of the tags.

SEQUENCE OF LOCKOUT

To ensure that the lockout/tagout procedures protect employees, as designed, follow the six steps below (a – e) in order. Specific Procedures for equipment may be found in “Lockout/Tagout Equipment Specific Procedures” .(Appendix B)

Prepare for Shutdown

Before the authorized or affected employee turns off the machine, the authorized employee shall:

- Identify the type and magnitude of the energy that the machine or equipment utilizes.
- Understand the hazards of the energy.
- Know the methods available to control the energy.
- Verbally notify all affected employees that servicing or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked out. (For example, notify building coordinator, work order desk, etc.)

Shutdown

If the machine or equipment is operating, shut it down by the normal stopping procedure.

Depress the stop button etc. NOTE: Shutting down the machine must not create any additional hazards

from equipment stoppage.

Isolate Equipment

Ensure that no personnel are exposed.

De-activate the energy isolating device(s) so that the machine or equipment is isolated from the energy source(s).

Ensure that the equipment is disconnected from the energy source(s).

Switches, circuit breakers, valves etc. must be physically located and disconnected by the authorized employee.

Applying lockout/tagout devices

The authorized employee shall:

- Apply LOTO Devices to each energy-isolating device. LOTO Devices must hold the switches, valves, etc., in the “safe” or “off” position.
- Use assigned lock.
- Fill out “Danger”, “Do Not Operate” LOTO tag with appropriate information. (See Appendix A) Attach tags to each energy-isolating device.
- The tag must clearly show that moving the energy-isolating device from the “safe” or “off” position is not allowed.

NOTE: Many machines have more than one power source, make sure all of them are deactivated and secured.

Releasing stored energy

Residual energy can be extremely harmful. Stored or residual energy such as (capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) must be dissipated or restrained from the machine or equipment. Potentially hazardous stored or residual energy, from all sources and components, must be released, relieved, disconnected, or restrained.

<u>The Authorized employee shall:</u>

- Ground
- Reposition
- Bleed off pressure.
- Block elevated parts in place
- Drain lines.
- Let equipment cool.
- Discharge capacitors
- Use other methods available.

Verification (Ensuring Zero Energy State)

To ensure that the Lockout/Tagout procedure has successfully isolated the machine/equipment, the authorized employee shall:

Operate the machine's control to verify that the equipment is isolated by operating the push button or other normal operating control. Read pressure gauges or other similar devices.

Verify isolation - Test with other means such, as volt/amp/meter etc. to make certain the equipment is inoperative.

Return operating control to "neutral" or "off" position after verifying isolation of equipment.

The machine or equipment is now locked out.

Restoring Equipment to Service

When servicing / maintenance has been completed and the machine or equipment is ready to return to normal operating condition, take the following steps:

Check the Machine

- Verify that tools and equipment used during maintenance have been removed. Guards or other protective devices are replaced.
- Machine components are operationally intact and ready to start.

Check for Employees:

- Check to ensure that employees are safely positioned or removed. Verify that operating controls are in the "neutral" or "off" position.
- Remove the lockout devices. This is to be done only by the authorized employee who put them on. If appropriate, re-energize the equipment and test it for proper operation.
- Notify affected employees that the servicing or maintenance is complete and that the machine is again in service.

NON-ROUTINE PROCEDURES

Testing or Positioning of Equipment

In situations where Lockout/tagout devices must be temporarily removed from the energy-isolating device and the machine or equipment energized to test or position the machine, the following sequence of actions shall be followed:

- Clear the machine or equipment of tools and materials. Inform affected employees.
- Remove the lockout or tagout device.
- Energize and proceed with testing or positioning.
- When testing or positioning is completed, de-energize all systems and re-apply energy control measures.

Group Lockout or Tag-out

When servicing and/or maintenance is performed by a crew, craft, department or other group, the follow procedure shall be followed:

An authorized employee places all keys in the group lock box.

The program administrator, designated supervisor, or authorized employee shall determine the exposure status of the group members with regard to the lockout or tagout of the machine or equipment.

Each authorized employee shall affix his or her personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when the work begins.

The authorized employees shall remove those devices when they stop working on the machine or equipment being serviced or maintained.

Shift or Personnel Changes

To ensure continuity of lockout tagout protection during shift or personnel changes, the following procedure shall be used:

- Affected personnel on the new shift shall be notified that equipment is being repaired utilizing lockout/tagout procedures.

- If anticipated that the equipment being worked on will be returned to service after a shift change, the following shall take place.

- The authorized employee coming on, who is replacing the present authorized employee, shall affix his/her lock before the present authorized employee removes his/her lock.

- Special situations exist within Campus Facilities Maintenance Department for which specific rules obtain governing shift-change procedures. This information can be obtained from the Departmental Administrator or the C.F. Safety Department.

Absent Employee

Should an employee neglect to remove his/her lock from a lockout/tagout system and all servicing/maintenance work is complete, two lockout/tagout administrative persons, after completing Form 2, *Emergency Lockout/Tagout Removal*, have the authority to remove the absent employee's lock. The procedure for such a removal is as follows (See also Appendix C):

- The authorized employee shall notify his/her supervisor.
- The supervisor shall attempt to contact the absent employee, his or her supervisor, and the unit LOTO Administrator.
- The supervisor shall verify that the authorized employee is not available.
- The supervisor, LOTO Administrator (or designee) shall, with the authorized employee, remove the lock. The employee whose lock was removed shall be notified as soon as feasible.
- The removal of a lock requires the signature of two authorized employees.
- Upon the return to work by the absent employee, the signature of the absent employee is required. The absent employee's locking device may then be returned to the employee.
- Copies of the incident will be forwarded to the LOTO Administrator, Absent Worker and the CF Safety
- Coordinator for review. Copies of the forms will be retained for not less than 2 years.

Outside Contractor

Whenever outside personnel are to be engaged in servicing activities covered by the scope and application of this standard, employees of Campus Facilities shall perform and/or supervise all lockout/tagout functions prior to work by the outside contractor.

While ultimate control of lockout functions remains with Campus Facilities, the contractor shall be encouraged to place his own lock/tag on the isolating device to effectively include them in the lockout cycle. In such cases, the contractor shall be properly trained in Campus Facilities LOTO procedures. Training shall be conducted on an as needed basis by the LOTO Administrator of the area where the work will occur, or by the C.F. Safety Coordinator.

Outside Contractors Responsibilities
Comply with Campus Facilities' LOTO program when work involves CF employees
Inform Campus Facilities personnel of contractor LOTO program
Ensure that contractor personnel understand CF LOTO procedures.

Ensure that C.F. employees understand and comply with the contractor's LOTO program.

TRAINING PROGRAM
Overview

All employees shall be instructed in the safety significance of the LOTO procedure by a Competent Person as defined by OSHA. Training shall be performed before the employee is permitted to use or be affected by any LOTO procedure.

Each "authorized" employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy, and the methods and means necessary for energy isolation and control.

All "affected" employees shall be instructed in the purpose and use of the energy control procedures and in recognition and purpose of LOTO devices.

All "other" employees whose work operations are in areas where energy control procedures may be utilized, shall understand the intent of this program, use of locks and tags and associated dangers and hazards.

Additional Training shall be given when:

- LOTO procedures are modified.
- Equipment or machinery is added or modified. Change of job assignment
- Periodic inspections show a deficiency in the understanding of the procedures.
- The Safety Department, Departmental LOTO Administrator, Supervisor, or employees of any Campus Facilities unit deem it necessary to ensure continued effectiveness of the program.

Application of LOTO
Upon completion of training, employees "authorized" to perform LOTO shall be able to demonstrate the following:

- Preparation for Shutdown -Identify Energy Sources
- Equipment Shutdown

- Equipment Isolation - Release of stored energy Apply the correct and proper LOTO device Verify isolation
- Test circuits
- Try to re-start machine
- Open valve

Release from Lockout or Tagout and Restore Equipment to Service

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

- The work area shall be inspected to ensure that nonessential items have been removed and to ensure that machine or equipment components are operationally intact.
- The work area shall be checked to ensure that all employees have been safely positioned or removed. After lockout or tagout devices have been removed and before a machine or equipment is started, affected employees shall be notified that the lockout or tagout device(s) have been removed.
- Each lockout or tagout device shall be removed from each energy isolating device by the employee who applied the device.

Appendix A

To be used WITH Pad Locks and Locking Devices

FRONT

BACK

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Form 1A
Equipment Specific Procedure
Equipment: _____
Location: _____CF EQUIP. LOTO CODE_____
Work Scope: _____ Contact Person: _____

Energy/Flow to Be Controlled (circle all that apply)
Steam Natural Gas Moving Parts Chemicals Electric Power Water Compressed Air Control Power Pneumatic Hydraulic
Lockout Points

Hazard	Action Required	Lock #	Name of Person Applying Device	Department	Supervisor	Phone #	Date Lock On	Date Lock Off

Form 1B
Equipment Specific Procedure
Equipment: _____Location:_____
Work Scope: _____
Contact Person: _____
Energy flow to be controlled
Steam Natural Gas Moving Parts Chemicals Electric Power
Water Compressed Air Control Power Pneumatic Hydraulic
Lockout Points

Hazard	Action Required	Lock #	Name of Person Applying Device	Date Lock On	Date Lock Off

Form 2

EMERGENCY LOCKOUT / TAGOUT REMOVAL

Date: _____ Time: _____

Equipment to Be Unlocked: _____

Person Requesting Lock Removal: _____ Unit: _____

Reason for Removing Lock:

The following actions have been taken:
1. Verified that Authorized Employee is not available.
2. Verified that the equipment is safe before removing the lockout/tagout device.
3. Made all reasonable attempts to inform the Authorized Employee that the Lockout has been removed.

Required Signatures:

_____Time: _____Date: _____
*Authorized Employee who removed lock.

_____Time: _____Date: _____
*Authorized Departmental Administrator or designee

_____Time: _____Date: _____

_____Time: _____Date: _____
Authorized Employee whose lock was removed

_____Time:_____Date: _____
Campus Facilities Program Administrator

Note: Emergency removal of lockout/tagout devices requires two signatures.
*Signatures required before removal of LOTO device.

ANNUAL EVALUATION REPORT
Form 3
Location: _____Date:

_____
Identification of the machine to which an inspection is being done.

_____
Authorized and Affected Employees interviewed.

_____
Name (print)
Signature _____ SNN _____

Primary and Stored Energy Sources	Magnitude:	Deficiencies noted:

Other Comments:

Upon completion of this form, it shall be forwarded to the safety manager for filing.
Completed forms shall be maintained for a minimum of 5 years.

Appendix C Training Plan

Only Competent persons, as defined by OSHA, shall conduct the training. A Train-the-Trainer class shall be offered to those departments requiring an on-site competent person.

Lockout - Tagout Training Outline

I. Objectives

To understand the need for lockout/tagout procedures and to demonstrate and teach the procedures to prevent accidents and injuries.

II. Training Materials

Locks
Tags
Electrical Locking Devices
Valve Locking Devices
Training Handouts
Equipment Safety Video
Test

III. Introduction

Keeping you safe is the purpose of LOTO
Several types of energy that can harm you
LOTO is used to isolate you from an energy source

IV. LOTO Prevents

exposure to energy
accidental starting of equipment
using damaged equipment

V. Injury can result when LOTO not used in the following examples

Maintenance & Repair
Cleaning equipment
Machine Guards removed
Adjustments to machinery

VI. Types of Energy and Hazards

Electricity - Electrical Shock
Chemical - Chemical Exposure & Burns
Moving Machinery - Amputation, crushing from moving machinery
High Temperature - Burns
Hydraulic Pressure - Exposure to hot or dangerous fluids
Stored Energy - can be chemical, thermal, hydraulic or gravitational

VII. Lockout Steps

Before you lock & tag know the equipment and types of energy associated with it and the maintenance you will be doing.
Shutdown the Equipment. Use the normal shutdown procedures to prepare the machinery for Locking and Tagging. All controls should be in the OFF or Neutral position.
Isolate the energy to the machine. Turn off main power switches. Shut all fluid isolation valves.
Lock & Tag the Energy Sources. Put a Lock and Tag on all energy isolation devices. Unless specifically designed for Lockout purposes on-off switches cannot be used to isolate electricity - use the main breaker for that piece of equipment.

Release all Stored Energy. Block, vent and drain all fluid lines. Discharge all capacitors. Block all pieces that would be a hazard if they moved. Disconnect pneumatic lines.
Test to ensure LOTO is effective. Check voltage on all circuits. Check pressure gages on fluid lines.
Attempt to start the equipment in the normal manner.
Return all control devices to the OFF or NEUTRAL position.

VIII. Types of Lockout Devices

A. Show and discuss purpose of proper use of each device. Include discussion on the limitations of each device

a. Locks
b. Hasps
c. Tags
d. Breaker clips
e. Chains
f. Pancake or blind flanges
g. Valve hand-wheel covers

IX. Discussion Questions

When is LOTO required?
Who must place the Lock and Tag?
Where must the Lock and Tag be placed?
What is the purpose of LOTO?
What are the LOTO steps?
What are the different Types of Energy?
How to properly release equipment following LOTO?

Authorized Employee

LOCKOUT - TAGOUT (LOTO)
Training Certificate

Name _____ **Department** _____

I understand the training I have received on the Mandatory Lockout - Tagout Program. The training consisted of:

Location of Equipment, Control Operation & Energy Isolation Points
How to safely turn on and off equipment
Types & Hazards of energy sources
Type and Magnitude of the energy
Methods & Means necessary for energy isolation

I understand the hazards of electricity, hydraulic force and machines in motion. I understand that I have been trained to protect myself by not reaching into (breaking the plane) on any machinery until I have personally Locked and Tagged all sources of energy and ensured that the machinery controls have been disabled.

I understand that if I chose to Isolate a machine energy source by unplugging the power cord I must be in control of the plug at all time and that I may not leave the area until the machine is in a condition that would allow the machine to be safely plugged into a receptacle.

I understand that diagnostic evaluation of certain equipment requires some equipment to be energized, or running before or during LOTO procedures. In such cases, I understand that my supervisor and I will assess hazards and agree to proceed in a safe manner.

I acknowledge receipt of necessary locks, hasps, tags, etc., required for effective isolation of electrical power to a single piece of equipment and that I have available (from Supervisors) material needed for isolating hydraulic fluid flow to hydraulic motors. I understand that if I need additional LOTO material, I am accountable for requesting it from a supervisor in my department.

I understand that VIOLATING THE LOCKOUT-TAGOUT PROCEDURE may result in disciplinary action up to and including termination of employment.

Employee _____
Trainer Signature _____ Date _____

Spanish Translation of LOTO Training Certificate

La Traducción Español

Yo comprendo el entrenar Yo he recibido sobre el cierre patronal mandatario y Tagout de programa.
La Capacitación consistió de:
La ubicación de equipo, controla puntos de aislamiento de energía y operación.
Como sin riesgo encender y fuera quipment.
Escribe y peligros de de fuentes de energía.
El tipo y la magnitud de la energía usada por el equipo
El método y significa necesario para el aislamiento de energía.
para el equipo (o equipo el grupo) enumeró sobre la frente de esta forma

Yo Comprendo los peligros de electricidad, máquinas y fuerza hidráulica en el movimiento. Yo comprendo que Yo se he entrenado para proteger me por no alcanzando en (quebrando el avión) sobre ninguna maquinaria hasta que Yo tener Cerré personalmente y Etiqueté todas las fuentes de energía y aseguré que los controles de maquinaria han estado incapacitado .

Yo Comprendo que si Yo elegí para Aislar una fuente de energía de máquina por desenchufar el cable eléctrico Yo debo estar en el control del enchufe a todo el tiempo y que Yo no puedo salir el área hasta que la máquina esté en una condición que permitiría la máquina ser sin riesgo enchufó en un receptáculo.

Yo acuso recibo de cerraduras necesarias, broches, etiqueta, el etc. requirió que el aislamiento efectivo de poder eléctrico al pedazo único de equipo y que Yo haber disponible (desde Supervisores) material necesitado de la corriente aislante de fluído hidráulico motores hidráulicos. Yo comprendo que si Yo necesito QUE LOTO adicional material, Yo ser responsable de pedido lo desde un Supervisor en mi Departamento.

Yo Comprendo que VIOLANDO EL CIERRE PATRONAL y TAGOUT DE PROCEDIMIENTO resultará en acción disciplinaria hasta e incluyendo LA TERMINACION DEL EMPLEO.

LOTO Administration Program Administrator:

C.F. Associate Director of Personnel and Training _____

C.F. Safety Coordinator _____

4.6 Respiratory Protection

4.6.1 Purpose

This respiratory protection program lays out standard operating procedures to ensure the protection of all Campus Facilities employees from respiratory hazards through proper selection and use of respirators. Respirators are to be used only where engineering control of respirator hazards is not feasible, or while engineering controls are being installed.

Asbestos abatement activities are exempt from this policy because they are covered by The University of Missouri-Columbia E H & S Department in a separate policy.

4.6.2 Responsibilities

Management

It is management's responsibility to determine what specific jobs or tasks may require the use of respiratory protective equipment. Management must also provide proper respiratory protective equipment to meet the needs of each specific application. Employees must be provided with adequate training and instructions on all equipment.

Supervisors

Supervisors of each area are responsible for ensuring that all personnel under their control are completely knowledgeable of the respiratory protection requirements for the areas in which they work. They are also responsible for ensuring that their subordinates comply with all facets of this respiratory protection program, including respirator inspection and maintenance. They are responsible for coaching, counseling, scheduling retraining if necessary and implementing disciplinary procedures for employees who do not comply with respiratory protection requirements.

Employees

It is the responsibility of the employees to have an awareness of the respiratory protection requirements for their work areas (as explained by management). Employees are also responsible for wearing the appropriate respiratory protective equipment according to proper instructions and for maintaining the equipment in a clean and operable condition.

Program Administrator

It is the responsibility of the Program Administrator to evaluate hazards, select appropriate respirators, facilitate training for respiratory protection and modify this policy to remain in compliance with OSHA standards and guidelines. The Program Administrator for Campus Facilities is the Safety Training and Development Coordinator.

4.6.3 Definitions

Air purifying respirator means a respirator with an air purifying filter, cartridge or canister that removes specific air contaminants by passing ambient air through the air purifying element.

Atmosphere supplying respirator means a respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere and includes supplied air respirators (SARS).

Canister or cartridge means a container with a filter, sorbent, or catalyst or combination of these items, which removes specific contaminants from the air passed through the container.

Emergency situation means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

Employee exposure means exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

Filter or air purifying element means a component used in respirators to remove solid or liquid aerosols from the inspired air.

Filtering face piece (dust mask) means a negative pressure particulate respirator with a filter as an integral part of the face piece or with the entire face piece composed of the filtering medium.

Fit factor means a quantitative estimate of the fit of a particular respirator to a specific individual and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

Fit test means the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.

High efficiency particulate air filter (HEPA) means a filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. Equivalent NIOSH particulate filters are N100, R100 and P100.

Immediately dangerous to life or health (IDLH) means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects or would impair an individual's ability to escape from a dangerous atmosphere. Campus Facilities does not work in IDLH environments.

Negative pressure respirator (tight fitting) means a respirator in which the air pressure inside the face piece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Oxygen deficient atmosphere means an atmosphere with an oxygen content below 19.5% by volume.

Physician or other licensed health care professional (PLHCP) means an individual whose legally permitted scope of practice (i.e., license, registration or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the health care services required by this standard.

Positive pressure respirator means a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Pressure demand respirator means a positive pressure atmosphere-supplying respirator that admits breathing air to the face piece when the positive pressure is reduced inside the face piece by inhalation.

Qualitative fit test (QLFT) means a pass/fail fit test to assess the adequacy of respirator fit that relied on the individual's response to the test agent.

Quantitative fit test (QNFT)means an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Tight fitting face piece means a respiratory inlet covering that forms a complete seal with the face.

User seal check means an action conducted by the respirator user to determine if the respirator is properly seated to the face.

4.6.4 Work Area Evaluation

Work area evaluations will be performed on a periodic basis to provide for a continuing healthful environment for employees and to aid in proper respiratory protection selection. In order to determine the potential exposure level regarding use of hazardous materials; a work area evaluation based on similar processes, the Material Safety Data Sheet (MSDS), professional judgment of the CF Safety Training and Development Coordinator and Supervision and air monitoring may be used. Results of these evaluations will determine the need for respiratory protection. Periodically thereafter as required by substance specific standards or every twelve months, a review of the work area evaluation will be made to determine if respiratory protection continues to be required. Records of all work area evaluations will be on file at the CF Safety office for access by employees. The CF Job Hazard Analysis using the MSDS and any air monitoring assessments will be our records.

4.6.5 Respirator Selection

Respirators are selected on the basis of respiratory hazards to which the worker is exposed and workplace and user factors that affect respirator performance and reliability. All selections must be approved by the Program Administrator using the OSHA guidelines.

Outside consultation, manufacturer's assistance, and other recognized authorities will be consulted if there is any doubt regarding proper selection.

1. Respirator Types and Uses

The following types of respirators are in use in this facility:

Types:
For identified required use: Half mask and full face air purifying, supplied air, Powered air purifying respirator (PAPR),
Comfort voluntary use: Filtering face piece (Paper disposable type)

Examples of use:
Asbestos (see E H & S Policy), Abrasive blasting, Painting, Dust, Use of solvents, thinners, degreasers, Pesticides, herbicides

Only NIOSH-certified respirators are selected and used. Where practicable, the respirators will be assigned to individual workers for their exclusive use.

2. When approving any respirator in general:

Select and provide respirators based on respiratory hazard(s) to which a worker is exposed as well as workplace and user factors that affect respirator performance and reliability.
Select a NIOSH-certified respirator. (NIOSH stands for the National Institute for Occupational Safety and Health)

Identify and evaluate the respiratory hazard(s) in the workplace, including a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form. Consider the atmosphere to be immediately dangerous to life or health (IDLH) if a reasonable estimate of employee exposure cannot be identified.
Select respirators from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

3. When selecting respirators for atmospheres that are not IDLH:

Provide a respirator that is adequate to protect the health of the employee and ensure compliance with all other OSHA statutory and regulatory requirements, under routine and reasonably foreseeable emergency situations.

<u>Select respirators appropriate for the chemical state and physical form of the contaminant.</u>

For protection against gases and vapors, provide:

1. An atmosphere-supplying respirator, or
2. An air-purifying respirator provided that:

(1) The respirator is equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant; or

(2) If there is no ESLI appropriate for conditions in our workplace, implement a change schedule for canisters and cartridges that is based on objective information or data that will ensure that canisters and cartridges are changed before the end of their service life. Describe in the respirator program the information and data relied upon and the basis for the canister and cartridge change schedule and the basis for reliance on the data.

For protection against particulates, provide:

1. An atmosphere-supplying respirator; or
2. An air-purifying respirator equipped with a filter certified by NIOSH under 30 CFR part 11 as a high efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for particulates by NIOSH under 42 CFR 84; or for contaminants consisting primarily of particles with mass median aerodynamic diameters (MMAD) of at least 2 micrometers, an air-purifying respirator equipped with any filter certified for particulates by NIOSH.

4.6.6 Medical Evaluations

1. Initial Examination

At the University of Missouri – Columbia, Campus Facilities, persons will not be assigned to tasks requiring use of respirators nor fit tested unless it has been determined that they are physically able to perform the work and use the respirator.

The Occupational Medicine Program, Division of Pulmonary and Critical Care in the School of Medicine will perform medical evaluations using a medical questionnaire found in Sections 1 and 2, Part A of Appendix C of 29 CFR 1910.134.

All medical questionnaires and examinations are confidential and handled during the employee's normal working hours or at a time and place convenient to the employee. The medical questionnaire is administered so that the employee understands its content. All employees are provided an opportunity to discuss the questionnaire and examination results with the physician or other licensed health care professional.

Before any initial examination or questionnaire is given, Campus Facilities will supply the physician or other licensed health professional with the following information so that he/she can make the best recommendation concerning an employee's ability to use a respirator:

a. Type and weight of the respirator to be used by the employee;
b. Duration and frequency of respirator use (including use for rescue and escape);
c. Expected physical work effort;
d. Additional protective clothing and equipment to be worn;
e. Temperature and humidity extremes that may be encountered.

Once the physician or other licensed health care professional determines whether the employee has the ability to use or not use a respirator, he/she provides a written recommendation containing only the following information:

Limitations on respirator use related to the medical condition of the employee, or relating to the workplace conditions in which the respirator will be used, including whether or not the employee is medically able to use the respirator;
The need, if any, for follow-up medical evaluations; and
A statement that the physician or other licensed health care professional has provided the employee with a copy of the written recommendation.

2. Follow-up medical examination:

A follow-up medical examination will be provided if a positive response is given to any question among questions 1 through 8 in Section 2, Part A of Appendix C of 29 CFR 1910.134 or if an employee's initial medical examination demonstrates the need for a follow-up medical examination. The follow-up medical examination includes tests, consultations, or diagnostic procedures that the physician or other licensed health care professional deems necessary to make a final determination.

If the physician or other licensed health care professional finds a medical condition that may place the employee's health at increased risk if the respirator is used, a powered air-purifying

respirator (PAPR), if medically authorized, will be provided until such time as a negative pressure respirator is medically authorized.

3. Additional medical examinations:

Campus Facilities will provide additional medical evaluations for any of the following:

- An employee reports medical signs or symptoms that are related to ability to use a respirator;
- A physician or other licensed health care professional, supervisor, or the Program Administrator
- informs Campus Facilities that an employee needs to be reevaluated;
- Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or
- A change occurs in workplace conditions (e.g., physical work effort, protective clothing, and temperature) that may result in a substantial increase in the physiological burden placed on an employee.

Employees may contact the Occupational Medicine Program, Division of Pulmonary and Critical Care in the School of Medicine for a copy of their confidential medical evaluation or questionnaire.

4.6.7 Fit Testing Procedures

Fit testing will be done by following the fit test procedures listed in the Fit Test Appendix of OSHA 1910.134

Employees who use tight fitting respirators will be properly fitted and tested for a face seal prior to use of the respirator in a contaminated area. Quantitative or qualitative fit testing will be performed at least every 12 months or sooner as prescribed by policy, procedure, industry standards, or governmental regulations.

Quantitative fit testing will be performed for fit testing of full face piece respirators used in the negative pressure mode for protection greater than 10 times the exposure limit but not to exceed 50 times the exposure limit.

Campus Facilities employees are fit tested at the following times with the same make, model, style, and size of respirator that will be used:

- Before any of our employees are required to use any respirator with a negative or positive pressure tight-fitting face piece;
- Whenever a different respirator face piece (size, style, model, or make) is used;
- At least annually;
    - Whenever the employee reports, or the, physician or other licensed health care professional, CF supervisor, or CF Program Administrator makes visual observations of changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring,

dental changes, cosmetic surgery, or an obvious change in body weight; and

when the employee, subsequently after passing a QLFT or QNFT, notifies their CF Supervisor, CF Program Administrator, or physician or other licensed healthcare professional that the fit of the respirator is unacceptable. The employee will be retested with a different respirator face piece.

Employees with facial hair that comes between the sealing surfaces of the face piece or interferes with the valve function or employees with any other condition that interferes with the face-to-face piece seal or valve function will not be fit tested or permitted to wear tight fitting respirators. Also, the following is applicable to fit testing of respirators:

If an employee wears corrective glasses or goggles or other personal protective equipment, ensure that such equipment is worn in a manner that does not interfere with the seal of the face piece to the face of the user.

4.6.8 Proper Use Procedures

Once the respirator has been properly selected and fitted, its protection efficiency must be maintained. Campus Facilities ensures with written procedures that respirators are used properly in the workplace.

1. Face piece Seal Protection

Do not permit respirators with tight-fitting face pieces to be worn by employees who have:

Facial hair that comes between the sealing surface of the face piece and the face or that interferes with valve function; or
Any condition that interferes with the face-to-face piece seal or valve function.

If an employee wears corrective glasses or goggles or other personal protective equipment, ensure that such equipment is worn in a manner that does not interfere with the seal of the face piece to the face of the user. Prescription glass inserts may be provided by Campus Facilities for employees who are required to wear a full face respirator.

For all tight-fitting respirators, employees shall ensure that a user seal check is performed each time they put on the respirator using the procedures as follows:

Positive pressure check: close off exhalation valve and exhale gently into the face piece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the face piece without any evidence of outward leakage of air at the seal.

Negative pressure check: close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hands or by replacing the filter seals. Inhale gently so that the face piece collapses slightly and hold the breath for ten seconds. If the face piece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness is considered satisfactory.

2. Continuing Respirator Effectiveness

Appropriate surveillance must be maintained of work area conditions

and degree of employee exposure or stress. When there is a change in work area conditions or degree of employee exposure or stress that may affect respirator effectiveness, reevaluate the continued effectiveness of the respirator.

Employees must leave the respirator use area immediately to prevent exposure:

1. To wash their faces and respirator face pieces as necessary to prevent eye or skin irritation associated with respirator use; or

2. If they detect vapor or gas breakthrough, changes in breathing resistance, or leakage of the face piece; or

3. To replace the respirator or the filter, cartridge, or canister elements.

If an employee must remove clothing or rinse off any contaminants they must keep the respirator on until decontamination is complete to avoid inhalation exposure.

3. Maintenance and Care Procedures

Campus Facilities provides each respirator user with a respirator that is clean, sanitary, and in good working order. The respirator user must clean and disinfect the respirator using the procedures recommended by the respirator manufacturer or equivalent procedures.

The respirators are cleaned and disinfected at the following intervals:

Respirator type:	Are cleaned and disinfected at the following interval:
Issued for the exclusive use of an employee	as often as necessary to be maintained in a sanitary condition
Issued to more than one employee	before being worn by different individuals
Used in fit testing and training	after each use

4. Storage

Storage of respirators must be done properly and in accordance with manufacturer's instructions to ensure that the equipment is protected and not subject to environmental conditions such as contamination, dust, sunlight, excessive moisture, chemicals, etc. that may cause deterioration.

5. Inspection

In order to assure the continued reliability of respirator equipment, it must be inspected by the responsible employee on a regular basis. The frequency of inspection is related to the frequency of use. CF recommends the following:

Respirator type:	Inspected at the following frequencies:
All types used in routine situations	Before each use and during cleaning

All respirator inspections include inspection for the following:

a. Respirator function, tightness of connections, and the condition of the various parts including, but not limited to, the face piece, head straps, valves, connecting tube, and cartridges, canisters or filters; and
b. Of elastomeric parts for pliability and signs of deterioration.

6. Repairs

Respirators that fail an inspection or are otherwise found to be defective are removed from service, and are discarded or repaired or adjusted in accordance with the following procedures:

a. Repairs or adjustments to respirators are to be made only by persons appropriately trained to perform such operations and only with the respirator manufacturer's NIOSH-approved parts designed for the respirator;
b. Repairs must be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed.
c. Reducing and admission valves, regulators, and alarms must be adjusted or repaired only by a person properly trained.

7. Discarding of respirators

Respirators that fail an inspection and are otherwise defective or not fit for use and cannot be repaired must be discarded. The following discarding procedure is used: cutting up the respirator and placing into general trash.

8. Information for employees using respirators when not required under the standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If Campus Facilities provides respirators for voluntary use, certain precautions should be taken to be sure that the respirator itself does not present a hazard.

Employees should do the following:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging.
3. Do not wear the respirator into atmospheres containing contaminants for which it is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors or very small solid particles of fumes or smoke.
4. Keep track of the respirator so that it is not mistakenly used by someone else.

4.6.9 Air Quality Procedures

When atmosphere-supplying respirators are being used to protect employees it is essential to ensure that the air being breathed is of sufficiently high quality. Campus Facilities procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators include coverage of the following OSHA requirements:

1. Compressed Air, Compressed Oxygen, Liquid Air, and Liquid Oxygen Used for Respirators:

Compressed and liquid oxygen must meet the United States Pharmacopoeia requirements for medical or breathing oxygen. Compressed breathing air must meet at least the requirements for Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:

1. Oxygen content (v/v) of 19.5-23.5%;
2. Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;
3. Carbon monoxide (CO) content of 10 parts per million (ppm) or less;
4. Carbon dioxide content of 1,000 ppm or less; and
5. Lack of a noticeable odor.

Ensure that compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air. Ensure that oxygen concentrations greater than 23.5% are used only in equipment designed for oxygen service or distribution.

2. Compressors:

Ensure that compressors used to supply breathing air to respirators are constructed and situated so as to:

1. Prevent entry of contaminated air into the air-supply system;
2. Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56 deg. C) below the ambient temperature;
3. Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality. Sorbent beds and filters must be maintained and replaced or refurbished periodically following the manufacturer's instructions; and

4. Have a tag containing the most recent change date and the signature of the person authorized by our company to perform the change. The tag must be maintained at the compressor.

For compressors that are not oil-lubricated, ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm. For oil-lubricated compressors, use a high-temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels. If only high-temperature alarms are used; the air supply must be monitored at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

3. Breathing Air Couplings:

Ensure that breathing air couplings are incompatible with outlets for non-respirable worksite air or other gas systems. No asphyxiating substance must be introduced into breathing air lines.

4. Filters, Cartridges, and Canisters:

Ensure that all filters, cartridges and canisters used in the workplace are labeled and color-coded with the NIOSH approval label and that the label is not removed and remains legible.

4.6.10 Training

1. General

Employees who use respirators in the workplace shall receive respiratory training prior to initial use and at least annually thereafter.

Training shall include the following:

- Explanation of Campus Facilities Respiratory Protection Program, the OSHA regulations and NIOSH Respirator Standard;
- The name of the Campus Facilities and EH&S Program Administrators and their duties and responsibilities;
- Why respirators are necessary, and how improper fit, usage, and maintenance can compromise the protection ability of the respirator and give a false sense of security;
- Respiratory Hazards that may be encountered such as fumes, mists, dusts, etc.
- Hazard Assessments and Hazard Controls, Air Sampling
- Material Safety Data Sheets (MSDS); Threshold Limit Value (TLV), Permissible
- Exposure Limit (PEL's), Short Term Exposure Limit (STEL's) etc.
- The capabilities and limitations of the respirator;

- Proper selection process, types of respirators and fit factors, additional PPE requirements;
- How to wear, remove, use, inspect for repairs or replacement and perform a seal check on the respirator;
- Effective use in emergency situations, including respirator malfunction;

  Maintenance procedures and proper storage of the respirator;
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators;
- Fit test procedures
- All employees trained must be able to demonstrate their knowledge of the respiratory training that they have received.
- Records of the training given each individual will be found on file at Campus Facilities Safety.

2. Retraining

Employees are to be retrained annually and when the following situations occur:

- Changes in the workplace or the type of respirator render previous training obsolete.
- Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or
- Any other situation arises in which retraining appears necessary to ensure safe respirator use.
- For special situations prescribed by policy or procedure, industry standards, or governmental regulations, more frequent retraining shall be required.
- Employees may request retraining on any or all information at any time, if they feel the need for review.

4.6.11 Program Evaluation

At the Campus Facilities Department; the program evaluation, performed annually by the Program Administrator, involves the following:

Conducting evaluations of the workplace as necessary to ensure that the provisions of the current written program are being effectively implemented and that it continues to be effective.

Regularly consulting employees required to use respirators to assess
their views on program effectiveness and to identify any problems. Any problems that are identified during this assessment must be corrected.

Factors to assess include, but are not limited to:

- Respirator fit (including the ability to use the respirator without interfering with effective workplace performance)
- Appropriate respirator selection for the hazards to which the employee is exposed
- Proper respirator use under the workplace conditions the employee encounters
- Proper respirator maintenance

References

The following documents are helpful references:

* 29 CFR 1910.134, Respiratory Protection, and Appendices,
* 42 CFR 84, Approval of Respiratory Protective Devices,
* ANSI Z88.2, Respiratory Protection,
* NIOSH Guide to Industrial Respiratory Protection-1987 (however, this may be out of date),
* NIOSH Guide to the Selection and Use of Particulate Respirators Certified Under 42 CFR 84 (4/23/96).
* 49 CFR 173 and 178

Attachments

1 Campus Facilities Respirator Fit Test Request Form
2 OSHA 1910.134 Appendix C – OSHA Respirator Medical Evaluation Questionnaire

Revised: March 4, 2004
Revised: March 11, 2004
Revised: March 17, 2004
Revised: May 20, 2004
Revised: June 2, 2004
Revised: June 3, 2004
Revised: June 8, 2004
Revised: June 15, 2004
Revised: July 21, 2004
Attachment 1

Campus Facilities Respirator Fit Test Request

http://www.cf.missouri.edu/safety/forms/respirator_fit_test_request.docx

To: UMC E H & S Department

From: Campus Facilities

Instructions for CF Department: Fill out this form and e-mail it to E H & S at *EHS@missouri.edu* prior to contacting EH&S at 882-7018 to arrange an appointment.

Attention E H & S: Please provide a respirator fit test and respirator components as follows:

Name of Employee: _____

Employee I.D. _____

Respirator Medical exam completed: _____(date completed)

Current Respirator Type: _____Half mask _____Full Face _____PAPR

Respirator Type Needed: _____Half mask _____Full Face _____PAPR

Respirator Components Needed: _____Organic Vapors _____Acid Gas

_____HEPA _____Other (describe)

Eyeglasses worn (Yes/No) _____

Protective suits/coveralls worn (Tyvek, flame resistant, etc.) _____

Describe type work to be performed and hazards involved: _____

_____.

_____

Signature of CF Safety or CF Supervisor | Date | CF Department | Phone #

Dept. Mocode #:_____

Peoplesoft account #_____

Information for employees prior to their scheduled fit test:

If this is your **First Fit Testing** you must have a supervisor verify a copy of a physician's written opinion prior to the fit test.

If this is a **Re-fit** (you have had a fit test previously at MU Environmental Health & Safety) you are not required to have a supervisor verify a copy of a physician's written opinion prior to the fit test.

EXCEPTION (1): Asbestos workers are required to undergo fit testing and medical monitoring annually and must have a supervisor verify a copy of a physician's written opinion that you may wear a respirator prior to each annual testing.

EXCEPTION (2): Any employee who has experienced a significant change in their health status since their last medical examination must be re-evaluated before using a respirator or receiving an annual fit test.

EXCEPTION (3): A physician or other licensed health care professional, supervisor, or the Program Administrator informs Campus Facilities that an employee needs to be reevaluated.

EXCEPTION (4): Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation.

EXCEPTION (5): A change occurs in workplace conditions (e.g., physical work effort, protective clothing, and temperature) that may result in a substantial increase in the physiological burden placed on an employee.

If you already have a respirator, you must bring your equipment with you to the fit test for inspection and repair, if needed.

Bring your Employee ID number with you. Your Employee ID number is on your paystub. The number is 8-digits being with a "0" or a "1". We will use the ID number to enter your information into our system.

You must have **NO** facial hair that interferes with the mask. When in doubt, remove facial hair.

You **MUST NOT** smoke for at least 30 minutes before the scheduled fit test.

You must provide 24 hours notice if the fit test is to be cancelled or rescheduled.

Fit tests are administered by EHS Industrial Hygiene staff in Room 21 of the Research Park Development Building.

Please contact Environmental Health & Safety if you have any other questions at 573-882-7018.

Attachment 2

Appendix C to §1910.134: OSHA Respirator Medical Evaluation Questionnaire (Mandatory)

To the employer: Answers to questions in Section 1, and to question 9 in Section 2 of Part A, do not require a medical examination.

To the employee: Can you read (circle one): Yes/No

Your employer must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisor must not look at or review your answers, and your employer must tell you how to deliver or send this questionnaire to the health care professional who will review it.

Part A. Section 1. (Mandatory) The following information must be provided by every employee who has been selected to use any type of respirator (please print).

1. Today's date:
2. Your name:
3. Your age (to nearest year):
4. Sex (circle one): Male/Female
5. Your height: ft. in.
6. Your weight: lbs.
7. Your job title
8. A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code):
9. The best time to phone you at this number:
10. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one): Yes/No
11. Check the type of respirator you will use (you can check more than one category):
a. _____N, R, or P disposable respirator (filter-mask, non-cartridge type only).
b. _____Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained breathing apparatus).
12. Have you worn a respirator (circle one): Yes/No
If "yes," what type(s):

Part A. Section 2. (Mandatory) Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "yes" or "no").
1. Do you *currently* smoke tobacco, or have you smoked tobacco in the last month: Yes/No

2. Have you *ever had* any of the following conditions?
a. Seizures (fits): Yes/No
b. Diabetes (sugar disease): Yes/No
c. Allergic reactions that interfere with your breathing: Yes/No
d. Claustrophobia (fear of closed-in places): Yes/No

e. Trouble smelling odors: Yes/No

3. Have you *ever had* any of the following pulmonary or lung problems?
a. Asbestosis: Yes/No
b. Asthma: Yes/No
c. Chronic bronchitis: Yes/No
d. Emphysema: Yes/No
e. Pneumonia: Yes/No
f. Tuberculosis: Yes/No
g. Silicosis: Yes/No
h. Pneumothorax (collapsed lung): Yes/No
i. Lung cancer: Yes/No
j. Broken ribs: Yes/No
k. Any chest injuries or surgeries: Yes/No
l. Any other lung problem that you've been told about: Yes/No

4. Do you *currently* have any of the following symptoms of pulmonary or lung illness?
a. Shortness of breath: Yes/No
b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No
c. Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No d. Have to stop for breath when walking at your own pace on level ground: Yes/No
e. Shortness of breath when washing or dressing yourself: Yes/No
f. Shortness of breath that interferes with your job: Yes/No
g. Coughing that produces phlegm (thick sputum): Yes/No
h. Coughing that wakes you early in the morning: Yes/No
i. Coughing that occurs mostly when you are lying down: Yes/No
j. Coughing up blood in the last month: Yes/No
k. Wheezing: Yes/No
l. Wheezing that interferes with your job: Yes/No
m. Chest pain when you breathe deeply: Yes/No
n. Any other symptoms that you think may be related to lung problems: Yes/No

5. Have you *ever had* any of the following cardiovascular or heart problems?
a. Heart attack: Yes/No
b. Stroke: Yes/No
c. Angina: Yes/No
d. Heart failure: Yes/No
e. Swelling in your legs or feet (not caused by walking): Yes/No
f. Heart arrhythmia (heart beating irregularly): Yes/No
g. High blood pressure: Yes/No
h. Any other heart problem that you've been told about: Yes/No

6. Have you *ever had* any of the following cardiovascular or heart symptoms?
a. Frequent pain or tightness in your chest: Yes/No
b. Pain or tightness in your chest during physical activity: Yes/No
c. Pain or tightness in your chest that interferes with your job: Yes/No
d. In the past two years, have you noticed your heart skipping or missing a beat: Yes/No
e. Heartburn or indigestion that is not related to eating: Yes/ No

f. Any other symptoms that you think may be related to heart or circulation problems: Yes/No

7. Do you *currently* take medication for any of the following problems?
a. Breathing or lung problems: Yes/No
b. Heart trouble: Yes/No
c. Blood pressure: Yes/No
d. Seizures (fits): Yes/No

8. If you've used a respirator, have you *ever had* any of the following problems? (If you've never used a respirator, check the following space and go to question 9☺
a. Eye irritation: Yes/No
b. Skin allergies or rashes: Yes/No
c. Anxiety: Yes/No
d. General weakness or fatigue: Yes/No
e. Any other problem that interferes with your use of a respirator: Yes/No

9. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire: Yes/No
Questions 10 to 15 below must be answered by every employee who has been selected to use either a full-facepiece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary.

10. Have you *ever lost* vision in either eye (temporarily or permanently): Yes/No

11. Do you *currently* have any of the following vision problems?
a. Wear contact lenses: Yes/No
b. Wear glasses: Yes/No
c. Color blind: Yes/No
d. Any other eye or vision problem: Yes/No

12. Have you *ever had* an injury to your ears, including a broken ear drum: Yes/No

13. Do you *currently* have any of the following hearing problems?
a. Difficulty hearing: Yes/No
b. Wear a hearing aid: Yes/No
c. Any other hearing or ear problem: Yes/No

14. Have you *ever had* a back injury: Yes/No

15. Do you *currently* have any of the following musculoskeletal problems?
a. Weakness in any of your arms, hands, legs, or feet: Yes/No
b. Back pain: Yes/No
c. Difficulty fully moving your arms and legs: Yes/No
d. Pain or stiffness when you lean forward or backward at the waist: Yes/No
e. Difficulty fully moving your head up or down: Yes/No
f. Difficulty fully moving your head side to side: Yes/No
g. Difficulty bending at your knees: Yes/No
h. Difficulty squatting to the ground: Yes/No

i. Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No
j. Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

Part B. Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the health care professional who will review the questionnaire.
1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No

If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions: Yes/No
2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals: Yes/No

If "yes," name the chemicals if you know them:

3. Have you ever worked with any of the materials, or under any of the conditions, listed below:
a. Asbestos: Yes/No
b. Silica (e.g., in sandblasting): Yes/No
c. Tungsten/cobalt (e.g., grinding or welding this material): Yes/No
d. Beryllium: Yes/No
e. Aluminum: Yes/No
f. Coal (for example, mining): Yes/No
g. Iron: Yes/No
h. Tin: Yes/No
i. Dusty environments: Yes/No
j. Any other hazardous exposures: Yes/No
If "yes," describe these exposures:

4. List any second jobs or side businesses you have:

5. List your previous occupations:

6. List your current and previous hobbies:

7. Have you been in the military services? Yes/No
If "yes," were you exposed to biological or chemical agents (either in training or combat): Yes/No

8. Have you ever worked on a HAZMAT team? Yes/No

9. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-the-counter medications): Yes/No
If "yes," name the medications if you know them:

10. Will you be using any of the following items with your respirator(s)?

a. HEPA Filters: Yes/No
b. Canisters (for example, gas masks): Yes/No
c. Cartridges: Yes/No

11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you)?:
a. Escape only (no rescue): Yes/No
b. Emergency rescue only: Yes/No
c. Less than 5 hours *per week*: Yes/No
d. Less than 2 hours *per day*: Yes/No
e. 2 to 4 hours *per day*: Yes/No
f. Over 4 hours *per day*: Yes/No

12. During the period you are using the respirator(s), is your work effort:
a. *Light* (less than 200 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift:_____hrs._____mins.

Examples of a light work effort are *sitting* while writing, typing, drafting, or performing light assembly work; or *standing* while operating a drill press (1-3 lbs.) or controlling machines.
b. *Moderate* (200 to 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift:_____hrs._____mins.
Examples of moderate work effort are *sitting* while nailing or filing; *driving* a truck or bus in urban traffic; *standing* while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; *walking* on a level surface about 2 mph or down a 5-degree grade about 3 mph; or *pushing* a wheelbarrow with a heavy load (about 100 lbs.) on a level surface.
c. *Heavy* (above 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift:_____hrs._____mins.
Examples of heavy work are *lifting* a heavy load (about 50 lbs.) from the floor to your waist or shoulder; *working* on a loading dock; *shoveling; standing* while bricklaying or chipping castings; *walking* up an 8-degree grade about 2 mph; *climbing* stairs with a heavy load (about 50 lbs.).

13. Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator: Yes/No
If "yes," describe this protective clothing and/or equipment:

14. Will you be working under hot conditions (temperature exceeding 77ºF): Yes/No

15. Will you be working under humid conditions: Yes/No

16. Describe the work you'll be doing while you're using your respirator(s): ?

17. Describe any special or hazardous conditions you might encounter when you're using your respirator(s) (for example, confined spaces, life-threatening gases):

18. Provide the following information, if you know it, for each toxic substance that you'll be exposed to when you're using your respirator(s):
Name of the first toxic substance:
Estimated maximum exposure level per shift:
Duration of exposure per shift:
Name of the second toxic substance:
Estimated maximum exposure level per shift:
Duration of exposure per shift:
Name of the third toxic substance:
Estimated maximum exposure level per shift:
Duration of exposure per shift:
The name of any other toxic substances that you'll be exposed to while using your respirator:

19. Describe any special responsibilities you'll have while using your respirator(s) that may affect the safety and well-being of others (for example, rescue, security):

[63 FR 20099, April 23, 1998]

4.7 Powered Industrial Trucks

4.7.1 Purpose

To familiarize employees with the hazards and safety concerns involved in the movement of products and materials with powered industrial trucks (PTIs), hoists and lifting gear. Material handling is a significant safety concern. There are numerous opportunities for personal injury and property damage if proper procedures and caution are not followed. Information in this section shall be used to train prospective PTI operators and for refresher courses as needed. The OSHA reference for Powered Industrial Trucks is 1910.178.

4.7.2 Pre-Qualifications for Powered Industrial Truck (PIT) Operators

PIT operator candidates must meet the following basic requirements prior to starting initial or annual training:
Must have no vision problems that cannot be corrected by glasses or contacts
No hearing loss that cannot be corrected with hearing aids
No physical impairments that would affect safe operation of the PIT No neurological disorders affecting balance or consciousness
Taking no medication that affects perception, vision or physical abilities

4.7.3 Training

PIT Operator Training shall be conducted under the close supervision of an experienced operator, selected by management. Such training and evaluation must be completed before an operator is permitted to independently operate a Powered Industrial Truck (forklift, etc.). Training consists of a combination of formal instruction, practical training (demonstrations performed by the trainer and practical exercises performed by the trainee), and evaluation of the operator's performance in the workplace.

Truck-related training topics:

- Operating instructions, warnings, and precautions for the types of truck the trainee will be qualified to operate
- Differences between the truck and the automobile
- Truck controls and instrumentation: where located, what they do, and how they work
- Engine or motor operation
- Steering and maneuvering
- Visibility (including restrictions due to loading)
- Fork and attachment adaptation, operation, and use limitations
- Vehicle capacity
- Vehicle stability
- Vehicle inspection and maintenance the operator will be required to perform
- Refueling and/or charging and recharging of batteries
- Operating limitations

Any other operating instructions, warnings or precautions listed in the operator's manual for the types of vehicle that the employee is being trained to operate.

Workplace-related topics:

- Surface conditions where the vehicle will be operated
- Composition of loads to be carried and load stability
- Load manipulation, stacking, and unstacking
- Pedestrian traffic
- Narrow aisles and other restricted places
- Hazardous (classified) locations
- Ramps and other sloped surfaces that could affect the vehicle's stability
- Closed environments and other areas where insufficient ventilation or poor vehicle maintenance could cause a buildup of carbon monoxide or diesel exhaust
- Other unique or potentially hazardous environmental conditions in the workplace that could affect safe operation
- Refresher training and evaluation. Refresher training, including an evaluation of previous training, shall be conducted to ensure that the operator has the knowledge and skills to safely operate a PIT. Refresher operator training shall be provided when the operator:

    - has been observed or evaluated to be operating the PIT in an unsafe manner
    - has been involved in an accident or near-miss incident
    - is assigned a different type of truck
        - may be affected by changed driving conditions in the workplace.

An evaluation and/or refresher training of the PIT operator will be conducted at least once every three years.

4.7.4 PIT Operators: Safe Operating Procedures & Rules

1. Trained and authorized personnel only will operate PITs.
2. PITs will be equipped with a headache rack, fire extinguisher, revolving beacon, back-up alarm and seat belts, which shall be worn when operating the vehicle.
3. Operator will perform daily pre- and post-trip inspections.
4. PITs shall be taken out of service until safety defects, such as hydraulic fluid leaks; defective brakes, steering, lights, or horn; and/or missing fire extinguisher, lights, seat belt, or back-up alarms are corrected.
5. Operators will follow recharging or refueling safety procedures.
6. Loads will be tilted back on the forks and carried no higher than 6 inches from the ground.
7. Transport loads that restrict vision by driving in reverse.
8. Drive no faster than 5 mph – a normal walking pace.
9. Wear hard hats in high-lift areas.
10. Sound horn and use extreme caution when meeting pedestrians, making turns and cornering.
11. Affix a “NO PASSENGERS” decal to each PIT. Passengers are not allowed on the vehicle.
12. Use an appropriate lift platform (cage with standard rails and toe-boards) when lifting persons.

13. Maintain aisles free of obstructions, marked, and wide enough (six foot minimum) for vehicle operation.
14. Mark PITs with their lift capacity. Operators shall ensure that loads do not exceed weight capacity.
15. Lower forks to the ground, apply parking brake and turn off the PIT when leaving it unattended.
16. All PITs (with exception of pallet jacks) will be equipped with a multi-purpose, dry chemical fire extinguisher. (Minimum rating; 2A:10B:C)
17. Report all accidents to management so the accident may be investigated.
18. Use dock plates that are in good condition when loading rail cars and trailers. Store the plates on edge when not in use.
19. Park rail cars and trailers square to the loading area, chock the wheels and follow established Docking/Un-Docking Procedures.
20. Changing and Charging Storage Batteries
21. Battery-charging sites shall be located in designated areas. .
22. Facilities shall be provided for flushing and neutralizing spilled electrolyte; for fire protection; for protecting charging apparatus from damage by trucks; and for adequate ventilation for dispersal of fumes from gassing batteries.
23. A conveyor, overhead hoist, or equivalent material-handling equipment shall be provided for handling batteries.
24. Reinstalled batteries shall be properly positioned and secured in the truck.
25. A carboy tilter or siphon shall be provided for handling electrolyte.
26. When charging batteries, pour acid into water; NEVER water into acid.
27. Trucks shall be properly positioned and brakes applied before attempting to change or charge batteries.
28. Care shall be taken to assure that vent caps are functioning. The battery (or compartment) cover(s) shall be open to dissipate heat.
29. Smoking is prohibited in the charging area.
30. Precautions shall be taken to prevent open flames, sparks, or electric arcs in battery charging areas.
31. Tools and other metallic objects shall be kept away from the top of uncovered batteries.

Trucks and Railroad cars

- The flooring of trucks, trailers, and railroad cars shall be checked for breaks and weakness before driving the PIT into either.
- The brakes of highway trucks shall be set and wheel chocks placed under the rear wheels to prevent the trucks from rolling while they are boarded with PITs.
- Wheel stops or other recognized positive protection shall be provided to prevent railroad cars from moving during loading or unloading operations.
- Fixed jacks may be necessary to support a semi-trailer and prevent upending during the loading or unloading when the trailer is not coupled to a tractor.
- Positive protection shall be provided to prevent railroad cars from being moved while dock boards or bridge plates are in position.

Operations

- Any time a PIT is found to be in need of repair, defective, or in any way unsafe, the truck shall be taken out of service until the problem is fixed.
- Trucks shall not be driven up to anyone standing in front of a bench or other fixed object.
- No person shall be allowed to stand or pass under the elevated portion of any truck, whether

loaded or empty.

- Unauthorized personnel shall not be permitted to ride on PITs. .
- Arms and legs shall not be placed between the uprights of the mast or outside the running lines of the truck.
- When a PIT is left unattended, load engaging means shall be fully lowered, controls shall be neutralized, power shall be shut off, and brakes set. Wheels shall be blocked if the truck is parked on an incline.
- Maintain a safe distance from the edge of ramps, platforms, elevated docks and freight cars. Do not use the PIT to open or close freight doors.
- Be knowledgeable of headroom beneath overhead installations, lights, pipes, sprinkler system, etc.
- An overhead guard shall be used as protection against falling objects. Such guard offers protection from the impact of small packages, boxes, bagged material, etc., but is not designed to withstand the impact of a falling capacity load.
- A load backrest extension shall be used whenever necessary to minimize the possibility of material falling to the rear.
- Do not park a PIT where it blocks fire aisles, access to stairways or fire equipment.

Traveling

- Observe all traffic regulations, including speed limits. Maintain a safe distance of approximately three truck lengths from the truck ahead. Keep the PIT under control at all times.
- Yield the right-of-way to ambulances, fire trucks, or other emergency vehicles.
- Do not pass other PITs at intersections, blind spots, or other dangerous locations.
- Slow down and sound the horn at cross aisles and other locations where vision is obstructed. Travel in reverse if the load obstructs the view forward.
- Diagonally cross railroad tracks wherever possible. Do not park a PIT closer than 8 feet from the center of railroad tracks.
- Always look in the direction of travel.
- Slowly ascend and descend grades. When ascending or descending grades in excess of 10 percent, loaded trucks shall be driven with the load upgrade. On all grades the load and load engaging means shall be tilted back if applicable, and raised only as far as necessary to clear the road surface.
- Under all travel conditions the truck shall be operated at a speed that will permit it to be brought to a stop in a safe manner.
- Stunt driving and horseplay shall not be permitted.
- Drive slowly over wet and slippery floors.
- Secure dockboards or bridgeplates driving carefully over either. Do not exceed their rated capacity.
- Avoid driving over loose objects.
- Reduce speed when negotiating turns by turning the hand steering wheel in a smooth, sweeping motion. The hand steering wheel shall be turned at a moderate, even rate, except when maneuvering at very low speed.

Loading

- Transport only safe, stable loads. Exercise caution when transporting off-center loads that cannot be centered.
- Handle only loads within the rated capacity of the truck.

- Adjust long or high (including multiple-tiered) loads that may affect capacity. .
- When not handling a load, operate trucks equipped with attachments as partially loaded.
- Place a load-engaging means under the load as far as possible and carefully tilt the mast backward to stabilize the load.
- Use extreme care when tilting loads forward or backward, particularly when high-tiering.
- Tilting forward with load-engaging means elevated is prohibited except to pick up a load. An elevated load shall not be tilted forward over a rack or stack when the load is in a deposit position. When stacking or tiering, tilt backward only enough to stabilize the load.

Fueling Safety

- Refuel with the engine OFF. Avoid spilling fuel.
- Wash away completely, allow all spilled oil or fuel to evaporate, and replace the fuel tank cap before restarting engine.
- Correct all fuel leaks. Do not operate a truck with a leak in the fuel system.
- Do not use an open flame to check electrolyte levels in storage batteries or gasoline levels in fuel tanks.

Maintenance of Powered Industrial Trucks

- Remove from service any unsafe power-operated industrial truck. All repairs shall be made by authorized personnel.
- Repairs to fuel and ignition systems involving potential fire hazards shall be made in locations designated for such repairs.
- Disconnect the battery when making repairs to the electrical system.
- Replace defective equipment with parts meeting original specifications.
- Industrial trucks shall not be altered from their original design. Fork trucks shall not be counterweighted unless approved by the truck manufacturer.
- Perform daily, pre-shift inspections on industrial trucks. Report and correct all defects. Sideline until repaired, any truck with a safety defect.
- Remove from service and repair any vehicle that is overheating.
- Keep the vehicle clean. Use noncombustible, high flash-point (at or above 100 degrees Fahrenheit) agents for cleaning surfaces of oil and grease.

Safe Operation Procedure for Charging LPG Tank

1. No Smoking.
2. Move LPG PIT outside for refueling.
3. Turn off PIT.
4. LPG tanks will be removed in the following order:
   - -shut off service valve
   - -disconnect tank from hose
   - -unbuckle and remove tank from bracket
5. LPG tanks will be replaced in to following order:
   - -place tank in bracket and re-buckle
   - -reconnect hose to tank and tighten firmly
   - -open valve slowly and assure proper seal

NOTE: Federal Law Prohibits dispensing an improper fuel type into any vehicle or into a non- approved fuel container.

In Case of LPG Leaks or Tank Rupture

1. DO NOT start or move the PIT.
2. If fuel hose is leaking, Close valve immediately and designate PIT "Out of Service" until repaired.
3. If tank ruptures, warn others, immediately leave the area (at least 50 feet). and notify management. Do not re-enter the area until cleared by management.

Powered Industrial Truck Pre-Use Checklist

A check of the following items (as applicable) is to be conducted by the operator prior to use each shift.

- Lights
- Horn Brakes Leaks
- Warning Beacon
- Backup Warning Alarm
- Fire Extinguisher

If deficiencies are noted, the unit is to be placed OUT OF SERVICE and the problem corrected.
The operator is responsible for notifying his supervisor and filling out a maintenance request.

4.8 Compressed Gas Safety Program

4.8.1 Purpose

To ensure that employees handling compressed gases are knowledgeable about, and adequately trained in, the inherent hazards of compressed-gas cylinders and their contents, as well as the proper handling, storage, and use of same according to OSHA requirements.

4.8.2 Policy

This section of the safety manual covers requirements that must be followed in the use of all compressed gases. In addition to the standard required work practices for inert gases, hazardous gases may require additional controls and work practices including, but not limited to: the use of gas cabinets; gas monitors; emergency shutoffs; proper equipment design; leak testing procedures; and the use of air-supplying respirators for certain highly toxic gases.

4.8.3 Hazards

Compressed gas cylinders can present a variety of physical and health hazards due to pressure and /or contents, including explosion, poisoning, and impact by containers, fire, asphyxiation and exposure-related illnesses. Compressed gases shall be received, handled and stored in a manner consistent with procedures herein. Compressed air shall not be used for cleaning or blow-down activities unless air pressure is regulated to below 30 psig and areas to be cleaned are free of others.

Hazard Control

Engineering Controls. Depending on types of potential hazard, engineered controls must be in place for certain applications of compressed gas.

Examples of engineering controls are:

- Flow Restrictors
- Fume hoods

- Gas Cabinets
- Gas cylinder storage areas
- Leak Monitors
- Scrubbers
- Smoke detectors
- Sprinkler systems
- Ventilation systems

Administrative Controls

- Employee training
- Identification of authorized employees
- Inspections and audits
- PPE, assignment and use
- Procedures for receipt, use and storage
- Segregation of gas containers
- Signs

Applications

Prior to use of any compressed gas, a review of the applicable requirement in the Engineering Controls and Safe Work Procedures section must be conducted.

- Class 1 Application - Use of Inert Gases - Gases which are non-flammable and non- toxic, but which may cause asphyxiation due to displacement of oxygen in poorly ventilated spaces.
- Class 2 Application - Use of Flammable, Low Toxicity - Gases which are flammable (at a concentration in air of 13% by volume or have a flammable range wider than 13% by volume), but act as non-toxic, simple asphyxiants (e.g. hydrogen, methane).
- Class 3 Application - Use of Pyrophoric Gases and Liquids - Gases or liquids that ignite spontaneously on contact with air at a temperature of 130 F or below.
- Class 4 Application - Use of Corrosive, Toxic, and Highly Toxic Gases - Gases that, at relatively low air-borne concentrations, may cause acute or chronic health effects.
- Class 5 Application - Use of Compressed Gases in Fume Hoods.

Gas Use Requirements - Engineering Applicability

Required Controls	Class 1	Class 2	Class 3	Class 4	Class 5
Gas Cabinet	--	X[1]	X	X	--
Interlocks	X[2]	X[2]	X[2]	X[2]	X[2]
Emergency Off Button			X	X	
Equipment Enclosed and Ventilated	--	X[1]	X	X	X
Smoke Detection	--	X[2]	X[2]	X[2]	X[2]
Sprinkler Protection	--	X[3]	X[3]	X[3]	X[3]
Emergency Power to Exhaust Ventilation	--	--	X[4]	X[4]	X[4]
Pneumatic Shutoff Valve	--	X[5]	X	X	X
Scrubber	--	--	--	X[2]	X[2]
Vacuum Pump Purge and Interlock	--	--	X	--	--
Flow Restricting Orifice	--	X	X	X	X
Ventilation Alarms	--	--	X	X	X
Eyewash and Showers	--	--	--	X[6]	X[6]
Purge Panel	--	--	X	X	X
Gas Monitor	--	--	X[8]	X[8]	X[8]
Piping and Fittings	X	X	X	X	X
Hardware	X	X	X	X	X

Notes
X[1] Not required if flow-restricting orifice is installed in a cylinder valve. May be required for semiconductor applications
X[2] Based on the outcome of hazard review
X[3] Required in lab and inside gas cabinet for new installations
X[4] For new installations
X[5] Typically not required, may be required for semiconductor applications
X[6] For corrosive gases
X[7] See Fume Hood Use
X[8] See Gas Monitoring for details
X[9] See Hazard Review
X[10] See Cryogenic Liquid

Gas Use Requirements - Administrative & Procedural Applicability

Controls	Class 1	Class 2	Class 3	Class 4	Class 5
Hardware Review	--	X[9]	X	X	X[9]
Training	X	X	X	X	X
Hardware Information	X	X	X	X	X
Ordering Cylinders	X	X	X	X	X
Cylinder Receiving Procedures	X	X	X	X	X
Cylinder Leak Testing	--	--	X	X	--
Cylinder Storage Procedure	X	X	X	X	X
Cylinder Transport Procedures	X	X	X	X	X
Cylinder Shipping Procedures	X	X	X	X	X
Cylinder Changing Procedures	--	--	X	X	--
Pump Oil Change Procedures	--	--	--	X	--
Equipment Maintenance Procedures	X	X	X	X	X
Liquid Transfer Procedures	X[10]	--	--	--	--
General Work Practices	X	X	X	X	X
Emergency Procedures	X	X	X	X	X

4.8.4 Engineering Controls / Design Considerations

The following list includes typical engineering controls referenced in the above "Gas Use Requirements" matrix. In some cases, Building Codes may require additional controls. Additional controls or deviations from the controls listed below may also be appropriate for the application, such as those required by the OSHA Process Safety Management Program or EPA's Risk Management Program. Appropriate applicable controls should be identified through the hazard review process.

Gas Cabinets - With the exception of cylinders containing a non-toxic, flammable gas, and cylinders used in fume hood applications, hazardous gas cylinders must be housed in gas cylinder cabinets. These cabinets must be equipped with sprinkler protection, and must be constructed and ventilated according to State code requirements, which include but are not limited to, the need to provide 200 fpm airflow at the cabinet window.

Interlocks - In addition to automatic shutoff of gas flow due to loss of power or ventilation (described below), it is often appropriate for an automatic shutdown of gas flow due to conditions such as high system pressure, high gas delivery pressure, loss of vacuum, loss of cooling, or other conditions identified through the hazard review process.

Emergency Off - Where gases are used in gas cabinets, the emergency off buttons should be located at the lab doorway. Activation of this button will cause pneumatic valves to shut, stopping gas flow. Typically, this button should kill electrical power to hazardous lab equipment as well.

Equipment Enclosures and Ventilation - Experimental apparatus using hazardous gases should be contained in an enclosed and exhausted tool enclosure. These enclosures must be connected to the exhaust ventilation system. Ventilation rates must be sized to allow for 100 fpm of air flow through the largest open enclosure door. Mass flow controllers carrying hazardous gases must be housed in a separate ventilated enclosure (or in an enclosed compartment of a larger tool enclosure) so that 100 fpm exhaust flow is available at the largest open door to the enclosure. All components should be readily accessible for maintenance.

Smoke Detection - All areas using hazardous gases will have a smoke detector that is connected to the building alarm system. In certain cases, it may be necessary to interlock smoke detector activation with the shutdown of hazardous gas flow.

Sprinkler Protection - Where hazardous gases are contained in gas cabinets, sprinkler protection should be provided to the interior of the gas cabinet. In some cases, this protection is required by code. Sprinkler protection is recommended in all areas using hazardous materials.

Emergency Power - Emergency power is recommended for powering exhaust fans connected to hazardous gas enclosures. In certain cases, this protection is required.

Pneumatic Shutoff Valves - All corrosive, toxic, flammable, and pyrophoric gases will contain normally a closed pneumatic shutoff valve, rated for at least full cylinder pressure, and located immediately downstream of the cylinder valve. This valve will shut in the event of power failure, remote actuation of an emergency off button (see this topic), or other appropriate conditions such as hazardous gas alarm activation.

Scrubbers - When hazardous waste gases are generated, it is often advisable to treat/react these gases prior to exhaust from the building. This may involve the use of bubblers in a fume hood or sophisticated units for larger scale hazardous gas processes. Note: In some cases (e.g. minimal volumes of hazardous gases produced), scrubbers may be not necessary or even

advisable. Where scrubbers are used, they must be carefully reviewed as part of the hazard review. Maintenance requirements and procedures need to be understood clearly and followed.

Vacuum Pumps - Vacuum pumps used for hazardous gases need to be carefully selected. Depending on the gases being pumped, special precautions may be necessary. For processes where pyrophoric gases are used, pumps need to be continuously purged with nitrogen, with loss of nitrogen flow causing the pyrophoric gas supply valves to close. Pumps used for oxygen service will need to be prepared for this service, which includes the elimination of hydrocarbon oils for use due to flammability concerns. In some cases, such as the use of highly toxic gases, vacuum pumps will need to be housed in a ventilated enclosure.

Flow Restrictors - A means to limit hazardous gas flow rates to just over maximum flow needed must be installed immediately downstream of each hazardous gas cylinder. For small scale experiments, such as fume hood use, a needle valve is sufficient. For large cylinders a flow restricting orifice, installed by the gas supplier in the cylinder valve or installed in the gas purge panel is required.

Ventilation Alarms - All ducts connected to enclosures used to exhaust hazardous compressed gas cylinders or gas-carrying components must be connected to a ventilation alarm. Typically, activation of this alarm will cause pneumatic gas supply shutoff valves to close.

Eyewash and Showers - A safety shower or eyewash with a wand is required in areas where corrosive gases are used or stored.

Purge Panels - Where corrosive, pyrophoric, or toxic gases are in use, the gas installation must include means to adequately purge the area between the cylinder valve and the regulator with an inert gas prior to breaking these connections for maintenance or cylinder change. Inert gases used for this purpose must be used solely for this purpose and not connected to other apparatus. Failure to adequately purge cylinders can result in lack of ability to close the cylinder valve or “regulator creep” which allows full cylinder pressure to be transferred to the low-pressure side of the regulator.

Piping and Fittings - All gas piping must be compatible with the gases used and capable of withstanding full cylinder pressure. For example, tygon tubing should never be used with hazardous gases or low hazard gases unless one end is open to atmosphere. Fittings should be selected based on the service needs. Face seal or welding fittings should be used for hazardous gas service wherever possible. All gauges and components subject to leakages that carry hazardous gases must be contained in an exhausted enclosure.

Hardware - Never lubricate, modify, force, or tamper with a cylinder valve. Use the appropriate regulator on each gas cylinder. Adaptors or homemade modifications can be dangerous. Assure that all components of the experimental apparatus can handle full cylinder pressure or are otherwise protected. Oil or grease on the high-pressure side of oxygen, chlorine, or other cylinder of an oxidizing agent can lead to an explosion. Whenever the back-siphoning of chemicals into the cylinder might be a problem, use multiple traps or check valves.

4.8.5 Safety Operating Procedures

Hazard Review - A hazard assessment is required for the following:

a. New or relocated equipment using a toxic, corrosive, or pyrophoric gas .

b. New or relocated equipment using a flammable gas in a non-standard application Analytical equipment fuel gases, welding, cutting, brazing, and small scale use in fume hoods are considered standard applications.

c. Existing gas installations should be self-inspected by the work area supervisor against the requirements listed in this section.

d. Existing installations using hazardous gases that pose a significant risk or show design deficiencies will have a hazard review conducted.

Compressed Gas Cylinders

The in-plant handling, utilization and storage of all compressed gases in cylinders, portable tanks, rail tank cars, or motor vehicle cargo tanks shall be in accordance with Compressed Gas Association Pamphlet P-1-1965.

Safety relief devices for compressed gas containers. Compressed gas cylinders, portable tanks, and cargo tanks shall have pressure relief devices installed and maintained in accordance with Compressed Gas Association Pamphlets S-1.1-1963 and 1965 addenda and S-1.2-1963.

Training - All persons handling or using cylinders must have basic training. Reviews of information contained in this section, additional information in the written safety plan for all work areas, and hands-on assistance by an experienced gas user meet this requirement. Additional compressed gas safety training can be obtained through the Safety Department.

Hazard Information - Gas users must be thoroughly familiar with the properties of each gas used. A review of a quality MSDS is necessary.

Ordering - All gas cylinders must be leak-tested during the receipt process building. Supervisors shall, to the extent that visual inspection will allow, determine that compressed gas cylinders under their control are in a safe condition. Visual and other inspections shall be conducted as prescribed in the Hazardous Materials Regulations of the Department of Transportation (49 CFR parts 171-179 and 14 CFR part 103). Where those regulations are not applicable, visual and other inspections shall be conducted in accordance with Compressed Gas Association Pamphlets C-6-1968 and C-8-1962, which are incorporated by reference as specified in Sec. 1910.6. Be sure the cylinder tag (do not rely on stenciling or color coding) indicates the proper gas. Hazardous gases (flammable, pyrophoric, toxic, corrosive) must arrive directly from the shipper. Staging hazardous gases is prohibited. Low hazard gases (e.g. inert gases, oxygen, freon) may be stored temporarily in designated locations that provide means for securing cylinders with chains or straps.

Receipt of Cylinder

- Inspect bottle for defects and proper marking/labels
- Ensure stamped date on bottle has not expired
- Inspect valve assembly and adapter-thread area
- Ensure that MSDS is on file or with shipment
- Follow MSDS requirements for storage

Leak Testing - Toxic, corrosive, and pyrophoric gases must be leak-tested at the following intervals; receiving, installation, disconnect/shipping. Highly toxic gases must be leak-tested by the distributor before delivery. The end-user is responsible for subsequent leak-tests. It is imperative that toxic gases be leak-tested prior to removal from their exhausted enclosures and

subsequent transport.

Storage - For short-term use of hazardous gases, always select the smallest returnable cylinder available. Non-returnable cylinders are strongly discouraged. If non-returnable cylinders must be used, you must be able to treat the remaining contents of the cylinder so that the cylinder valve can be removed prior to disposal. In cases where the gas will be used over an extended period of time (several months to more than one year), order only a quantity of gas that will last for three to six months. Corrosive gases should be returned to the gas supplier within one year to avoid regulator and cylinder valve problems due to corrosion. In storage, restrain cylinders of all sizes by straps, chains, or a suitable stand to prevent them from falling. Segregate full cylinders of low-hazard gases from "empty" cylinders awaiting return to the vendor. Assure that hazardous gas cylinders are stored constantly in a suitable exhausted enclosure as described in Engineering Controls. Do not expose cylinders to temperatures higher than about 50 C. Some small cylinders, such as lecture bottles and cylinders of highly toxic gases, are not fitted with rupture devices and may explode if exposed to high temperatures. Never place cylinders where they may become part of an electric circuit. Avoid areas that are damp or subject to other corrosive materials. Do not store flammables and oxidizers together. Keeps cylinders in storage upright, secure, and interlocked into a compact group. Protect cylinders stored outside from standing water by providing proper drainage. Where outdoor storage is necessary, an overhead cover is necessary to keep sunlight and rain off the cylinder. Keep cylinder cap secure when not in use. Mark cylinder with contents, and if empty/full. Store cylinders no closer than 50 feet to exposed electrical components or combustible materials. Protect cylinders from accidental rupture. Maintain a distance of at least 50 feet between cylinders of chemically reactive gases.

Using the Cylinder

- Inspect valve adapter threads.
- Inspect all fasteners, hoses and regulators prior to hooking up to cylinder.
- Use only for approved purposes.
- Use in up-right position.
- Fasten cylinder to structure or cart.
- Regulators must be of same rated pressure as cylinder
- Keep cylinder valve shut when not in use; do not depend on regulators

Transporting Cylinders - Hazardous gas cylinders must be transported directly from the gas supplier to the end-user storage location, unless an exhausted and approved "staging" area has been constructed. Cylinders must never be transported without valve protection caps in place. Never move a cylinder with a regulator attached! Cylinders larger than lecture bottle size should be chained or strapped to a wheeled cart during transport to ensure stability. Transportation of cylinders must be done only by trained personnel using approved trucks. Handle cylinders of compressed gases with the respect that high-energy sources require.

Shipping - Promptly remove regulators from empty cylinders, leak-test hazardous gases, and replace the protective caps at once. Mark the cylinder "MT". Never bleed a cylinder completely empty. Leave a slight pressure to keep contaminants out. Toxic, corrosive, and pyrophoric gases must remain in their exhausted enclosures until shipped back to the supplier.

Changing Cylinders - Special procedures are required for changing toxic, corrosive, and pyrophoric gases and liquids. A proper cylinder purge panel is needed for high hazard gases, along with an adequate purge procedure. Persons changing gas cylinders requiring SCBA must work with a partner who is identically equipped.

Changing Pump Oil - Hazardous gases may be absorbed into vacuum pump oils. Personnel performing vacuum pump oil changes on pumps used with highly toxic gases must use SCBA

for pump oil change. Hot pump oil should be allowed to cool prior to changing.

Other Equipment Maintenance Considerations - Consider maintenance needs in advance. Consider reaction byproducts (e.g. use proper skin and eye protection when cleaning process chambers or vacuum pumps). "Low hazard" gases such as freons will generate chlorine and fluorine decomposition products. Be sure to LOCK OUT upstream gas lines leading to equipment prepared for maintenance. Compressed gases are a hazardous energy source requiring lockout procedure. Be sure to adequately purge lines following lockout procedures and before beginning maintenance.

General Work Practices - Never use a cylinder that cannot be positively identified. Do not use compressed gas or compressed air to blow away dust or dirt (unless specifically equipped with a 30 psi or less diffuser, as used in machine shops, for this application). Flying dust and debris, as well as high pressure air itself, can cause significant injury. Close cylinder valves when not in use, close cylinder valves. The main cylinder valve should be tightly closed, but needle valves should only be finger tight to avoid ruining the valve and/or valve stem.

Emergency Procedures - Leaking cylinders should be kept in exhausted enclosures. Actuate remote emergency gas shutoff valve/button, if present. (If properly installed, highly toxic gases will have flow limiting devices and/or automatic cylinder shutoff valves in place to limit and shutoff the gas supply.) If hazardous gases are contained in their enclosure, and it is clearly safe to approach, close the main cylinder valve if a leak is stopped or slow. Do not extinguish a flame involving a highly combustible gas until the source of gas has been shut off, otherwise – the flame can reignite and cause an explosion. Cylinder valve leaks should be reported to Public Safety, but as a "nonemergency" if the cylinder and gas are contained in an exhausted enclosure. If a hazardous gas is released into an unexhausted enclosure and the gas supply cannot be promptly cut off, actuate the emergency evacuation procedure in your area and contact Public Safety. This procedure will also be initiated automatically if gas monitors trigger the building evacuation alarm. The Superfund Amendments and Re-authorization Act of 1986 (SARA Title III) states that releases of extremely hazardous substances must be reported to EPA. Accidental discharges of cylinders are to be promptly reported to the Safety Department and area supervisor. Cylinders found to be leaking upon delivery should not be accepted.

Gases for Welding and Cutting

OSHA requirements for oxygen-fuel gas welding and cutting are found in 29 CFR 1910 .253. Cylinder handling precautions, materials of construction, and additional requirements are also listed. Persons who will be using acetylene, oxygen, and other fuel gases, or those who are designing facilities and equipment for this purpose, should review this information. Please see the Personal Protective Equipment section of this manual for information on eye protection during welding and cutting operations. Be sure that, after each use, all fuel gases are shut off at the cylinder valve.

Cryogenic Liquids

Cryogenic liquids should be used with caution due to the potential for skin or eye damage from low temperature and hazards associated with pressure buildups in the containers or enclosed piping. Portable containers should be used only where there is sufficient ventilation. Do not place containers in a closet or other enclosed space where there is no ventilation. The buildup of inert gas in such settings may generate an oxygen deficient atmosphere.

A full-face shield, loose fitting cryogenic handling gloves, apron, and cuffless slacks are the recommended equipment for transferring cryogenic fluids. Special vacuum jacket containers with loose fitting lids should be used to handle small quantities. Vacuum jacketed containers provided by the gas supplier will have overpressure relief devices in place. When plumbing

cryogenic liquids, it is very important to include a pressure relief valve between any two-shutoff valves. In addition, overpressure relief devices must protect any space where cryogenic fluids may accumulate, (consider leakage into enclosed equipment as well). Tremendous pressures can be obtained in enclosed spaces as the liquid converts to gas. For example, one cubic centimeter of liquid nitrogen will expand to 700 times this volume as it converts (warms) to its gaseous state. Lines carrying liquid should be well insulated. Containers to be filled with cryogenic liquids should be filled slowly to avoid splashing. Cryogenic containers showing evidence of loss of vacuum in their outer jacket (ice buildup on the outside of the container) should not be accepted from the gas supplier. Contact with air (or gases with a higher boiling point) can cause an ice plug in a cryogenic container. Should ice plugs be noted, contact the Safety department for assistance.

Compressed Air Systems & Usage

Use compressed air as a cleaning method only when absolutely necessary. This procedure involves serious hazards.

Authorized uses include:

- Paint spraying pneumatic controls
- Pneumatic tools
- Siphons

Compressed Air Usage

Compressed air may be used to clean machinery that can be cleaned no other way. Never, however, use compressed air to clean equipment or parts contaminated with toxic materials.

Use a hand-held nozzle or similar device with a nozzle-pressure of less than 30 psig when cleaning machinery or shop area. This requirement may be achieved with the use of a pressure-reducing valve in the airline or by using air guns designed to reduce or relieve nozzle airline pressure to less than 30 psig.

When using compressed air for cleanup, wear eye protection and ensure that nearby workers are shielded from the air blast and airborne debris.

Air Receivers and Compressors

All air receivers or tanks (this does not include compressed gas cylinders, which must not be employed as air receivers) used for the storage of l cubic foot or more of compressed air at a pressure in excess of 50 psig., must be constructed in accordance with the American Society of Mechanical Engineers (ASME) Boilers and Pressure Code.

All safety valves must be installed and maintained in accordance with the ASME code.

Air receivers and tanks are to be installed so that all drains handholds and personnel access openings are easily accessible. Receivers and tanks should also be supported to allow a complete external inspection.

Each air compressor system must be provided with a connection of the appropriate size for attaching an inspector’s test gauge when the system is in service.

Nothing must obstruct the connection of the inspector’s test gauge.

Provisions must be made for the removal of oil and water from the tanks. Drain valves must be located at the lowest point possible and a draining schedule established to prevent the accumulation of excessive amounts of liquid in the receiver.

Readily visible pressure gauges must be installed. Spring loaded safety devices with a total relieving capacity sufficient to prevent a rise in pressure of more than l0 percent above the maximum allowable working pressure of the receiver must also be installed.

At least one safety valve in each system must be set to operate at or below the maximum allowable working pressure.

Install no valves between the air receiver and any of its safety valves. Daily testing of controlling and safety valves is required.

All safety appliances such as safety valves, indicating devices, and controlling devices must be constructed, located, and installed so that they cannot readily be made inoperative by any means, including weathering.

Hoses and lines used in any compressed air system must be rated to meet the maximum operating pressure (both static and transient) of the equipment or apparatus.

Hoses and lines should be properly assembled; incorrect fittings should be avoided.

A system should be designed with the least number of bends and the largest diameter feasible.

Hoses and lines should be protected from external damage, e.g., heat, abrasion and corrosion. To this end, they should be located where they are free from being trod on, tripped over or driven over.

Vent pressure relief valves and rupture discs to a safe area, such as a wall, where personnel will not be affected.

4.9 Fall Protection

4.9.1 General

Campus Facilities of the University of Missouri—Columbia complies fully with the OSHA Fall Protection Standard (CFR 1926, Subpart M, Fall Protection) in seeking to eliminate, prevent and control risks of injury due to falls.

Employees exposed to fall hazards shall be trained to minimize the danger of falling. Fall-protection equipment will be provided and its use required by all employees. Supervisors are responsible for implementing a fall-protection plan for their jobsite.

4.9.2 Hazard Identification

The supervisor and crew on each jobsite are responsible for identifying jobsite fall-hazards. A trained employee will evaluate each situation or work procedure where individuals are exposed to falls of 6 feet or more. A plan shall be developed to, if possible, eliminate the exposure, or to protect against falls via an approved fall-protection system and/or equipment.

4.9.3 Fall Protection Required

The following situations require fall-protection. This listing is by no means complete. There are many other situations where a fall of 6 feet or more is possible. It should be noted that ladders and scaffolding are not included in this list. They are covered by other OSHA standards and other requirements of Campus Facilities' safety program.

Wall Openings
Employee working on, at, above, or near wall openings (including those with chutes attached) where the outside bottom edge of the wall opening is 6 feet or more above lower levels and the inside bottom edge of the wall opening is less than 39 inches above the walking/working surface, must be protected from falling by a guardrail system, a safety net system, or a personal fall-arrest system.

Holes
Personal fall-arrest systems, covers, or guardrail systems shall be erected around holes (including skylights) that are more than 6 feet above lower levels.

Leading Edges
Employees constructing a leading edge 6 feet or more above lower levels shall be protected by guardrail systems, safety net systems, or personal fall-arrest systems.

Excavations
Employees working near the edge of an excavation 6 feet or more deep shall be protected by guardrail systems, fences, barricades, or covers. Guardrails are also required on walkways crossing over excavations of 6 feet or more in depth.

Formwork and Reinforcing Steel
Fall protection is not required when employees are moving vertically and/or

horizontally over fixed rebar assemblies. OSHA considers that multiple hand holds and foot holds on rebar assemblies provide protection similar to that of a fixed ladder. Fall protection is thus unnecessary for heights below 24 feet while moving point to point. Employees, however, must be fall-protected when climbing or otherwise moving at heights greater than 24 feet -- the same as for fixed ladders.

Hoist Areas
Employees in a hoist area shall be protected from falling 6 feet or more by a guardrail systems or a personal fall-arrest system. If guardrail systems (or chain gate or guardrail) or portions thereof must be removed to facilitate hoisting operations, as during the landing of materials, and a worker must lean through the access opening or out over the edge of the access opening to receive or guide equipment and materials, that employee must be protected by a personal fall-arrest system.

Overhand Bricklaying and Related Work
Employees performing overhand bricklaying and related work 6 feet or more above lower levels shall be protected by a guardrail system, safety net system, or personal fall arrest system, or shall work in a controlled access zone. Such fall protection is also required for employees reaching more than 10 inches below the level of a walking/working surface on which they are working.

Pre-cast Concrete Erection and Residential Construction
Employees 6 feet or more above lower levels and erecting pre-cast concrete members and related operations such as grouting of pre-cast concrete members, and employees engaged in residential construction, shall be protected by guardrail systems, safety net systems, or personal fall-arrest systems.

Ramps, Runways, and Other Walkways
Employees using ramps, runways, and other walkways shall be protected from falling 6 feet or more by guardrail systems.

Low-slope Roofs
Employees engaged in roofing activities on low-slope roofs with unprotected sides and edges 6 feet or more above lower levels shall be protected from falling by guardrail systems, safety net systems, personal fall-arrest systems or a combination of a warning line system and guardrail system, warning line system and safety net 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 without a warning line system is permitted.

Steep Roofs
Employees on a steep roof with unprotected sides and edges 6 feet or more above lower levels shall be protected by guardrail systems with toe-boards, safety net systems, or personal fall- arrest systems.

4.9.4 Controlled Access Zones

A Controlled access zone is a work area designated and clearly marked in which certain types of work (such as overhand bricklaying) may take place without the use of

conventional fall-protection systems, guardrail, personal arrest or safety net to protect the employees working in the zone.

Controlled access zones are used to keep out workers other than those authorized to enter work areas from which guardrails have been removed. Where there are no guardrails, masons are the only workers allowed in controlled access zones.

Controlled access zones, when created to limit entrance to areas where leading edge work and other operations are taking place, must be defined by a control line or by any other means that restrict access. Control lines shall consist of ropes, wires, tapes or equivalent materials, and supporting stanchions, and each must be:

- Flagged or otherwise clearly marked at not more than 6-foot intervals with high-visibility material.
- Rigged and supported in such a way that the lowest point (including sag) is not less than 39 inches from the walking/working surface and the highest point is not more than 45 inches, nor more than 50 inches when overhand bricklaying operations are being performed from the walking/working surface.
- Strong enough to sustain stress of at least 200 pounds. Control lines shall extend along the entire length of the unprotected or leading edge and shall be approximately parallel to the unprotected or leading edge. Control lines also must be connected on each side to a guardrail system or wall. When control lines are used, they shall be erected not less than 6 feet nor more than 25 feet from the unprotected or leading edge, except when pre-cast concrete members are being erected. In the latter case, the control line is to be erected not less than 6 feet nor more than 60 feet or half the length of the member being erected, whichever is less, from the leading edge.

When used to determine access to areas where overhand bricklaying and related work are taking place controlled access zones are defined by a control line erected not less than 10 feet nor more than 15 feet from the working edge. Additional control lines must be erected at each end to enclose the controlled access zone. Only employees engaged in overhand bricklaying or related works are permitted in the controlled access zones.

On floors and roofs where guardrail systems are not in place prior to the beginning of overhand bricklaying operations, controlled access zones will be enlarged as necessary to enclose all points of access, material handling areas, and storage areas.

On floors and roofs where guardrail systems are in place, but need to be removed to allow overhand bricklaying work or leading edge work to take place, only that portion of the guardrail necessary to accomplish that day's work shall be removed.

4.9.5 Fall Protection Systems

When there is a potential fall of 6 feet or more, one or more of the following means of providing protection shall be employed:

Guardrail Systems

Top-rails and mid-rails of guardrail systems must be at least one-quarter inch nominal diameter or thickness to prevent cuts and lacerations. If wire rope is used for top-rails, it must be flagged at not more 6 feet intervals with high-visibility material. Steel and plastic banding cannot be used as top-rails or mid-rails. Manila, plastic, or synthetic rope used for top-rails or mid-rails must be inspected as frequently as necessary to ensure strength and stability.

The top edge height of top-rails or (equivalent) guardrails must be 42 inches, plus or minus 3 inches, above the walking/working level. The top-edge height of the top rail, or equivalent member, must be increased an amount equal to the height of the stilts for workers on stilts.

Screens, mid-rails, mesh, intermediate vertical members, or equivalent intermediate structural members must be installed between the top edge of the guardrail system and the walking/working surface when there are no walls or parapet walls at least 21 inches. When mid-rails are used, they must be installed a to a height midway between the top edge of the guardrail system and the walking/working level.

When screens and mesh are used, they must extend from the top rail to the walking/working level and along the entire opening between top rail supports. Intermediate members, such as balusters, when used between posts, shall not be more than 19 inches apart.

Other structural members, such as additional mid-rails and architectural panels, shall be installed so that there are no openings in the guardrail system more than 19 inches (48 centimeters).

The guardrail system must be capable of withstanding a force of at least 200 pounds applied within 2 inches of the top edge in any outward or downward direction. When the 200 pound test is applied in a downward direction, the top edge of the guardrail must not deflect to a height less than 39 inches above the walking/working level.

Mid-rails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members shall be capable of withstanding a force of at least 150 pounds applied in any downward or outward direction at any point along the mid-rail or other member.

Guardrail systems shall be surfaced to protect workers from punctures or lacerations and to prevent clothing from snagging.

The ends of top rails and mid-rails must not overhang terminal posts, except where such overhang does not constitute a projection hazard.

When guardrail systems are used at hoisting areas, a chain, gate or removable guardrail section must be placed across the access opening between guardrail sections when hoisting operations are not taking place.

At holes, guardrail systems must be set up on all unprotected sides or edges. When holes are used for the passage of materials, the hole shall have not more than two sides with removable guardrail sections. When not in use, the hole must be covered or provided with

guardrails along all unprotected sides or edges.

If guardrail systems are used around holes that are used as access points (such as ladder-ways), gates must be used or the point of access must be offset to prevent accidental walking into the hole.

If guardrails are used at unprotected sides or edges of ramps and runways, they must be erected on each unprotected side or edge.

Personal Fall-Arrest Systems

Consist of an anchorage, connectors, and a body belt or body harness and may include a deceleration device, lifeline, or suitable combinations. If a personal fall-arrest system is used for fall protection, it must do the following:

- Limit maximum arresting force on an employee to 900 pounds when used with a body belt.
- Limit maximum arresting force on an employee to 1,800 pounds when used with a body harness.
- Be rigged so that an employee can neither free fall more than 6 feet nor contact any lower level.
- Bring an employee to a complete stop and limit the deceleration distance an employee travels to 3.5 feet.
- Have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet, or the free-fall distance permitted by the system, whichever is less.

The use of body belts for fall-arrest is prohibited. A full body harness is required. Personal fall arrest systems must be inspected prior to each use for wear damage, and other deterioration. Defective components must be removed from service.

Positioning Device Systems

Body belt or body harness systems are to be set up so that a worker can free-fall no farther than 2 feet. They shall be secured to an anchorage capable of supporting a least twice the potential impact load of an employee's fall, or 3,000 pounds, whichever is greater.

Safety Monitoring Systems

When no other alternative fall protection has been implemented, the employer shall implement a safety monitoring system. Employers must appoint a competent person to monitor the safety of workers and the employer shall ensure that the safety monitor:

- Is competent in the recognition of fall hazards.

- Is capable of warning workers of fall-hazard dangers and in detecting unsafe work practices.
- Is operating on the same walking/working surfaces of the workers and can see them.
- Is close enough to work operations to communicate orally with workers and has no other duties to distract from the monitoring function.

Mechanical equipment shall not be used or stored in areas where safety monitoring systems are being used to monitor roofing operations on low-sloped roofs.

No worker, other than one engaged in roofing work (on low-sloped roofs) or one covered by a fall protection plan, shall be allowed in an area where an employee is being protected by a safety monitoring system.

All workers in a controlled access zone shall be instructed to promptly comply with fall hazard warnings issued by safety monitors.

Safety Net Systems

Safety nets must be installed as close as practicable under the walking/working surface on which employees are working and never more than 30 feet below such levels. Defective nets shall not be used. Safety nets shall be inspected at least once a week for wear, damage, and other deterioration. Safety nets shall be installed with sufficient clearance underneath to prevent contact with the surface or structure below.

Items that have fallen into safety nets including, but not restricted to, materials, scrap, equipment, and tools, must be removed as soon as possible and at least before the next work shift.

Warning Line Systems

Warning line systems consist of ropes, wires, chains and supporting stanchions and are set up as follows:

- Flagged at not more than 6-foot intervals with high-visibility material.
- Rigged and supported so that the lowest point, including sag, is no less than 34 inches from the walking/working surface and its highest point is no more than 39 inches from the walking/working surface.
- After being rigged with warning lines, stanchions, shall be capable of resisting, without tipping over, a force of at least 16 pounds applied horizontally against the stanchion, 30 inches above the walking/working surface, perpendicular to the warning line and in the direction of the floor, roof, or platform edge.
- The rope, wire, or chain shall have a minimum tensile strength of 500 pounds and, after being attached to the stanchions, must support without breaking the load applied to the stanchions as prescribed above.
- Shall be attached to each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in the adjacent section before the stanchion tips over.

Warning lines shall be erected around all sides of roof-work areas. When mechanical equipment is used, the warning line shall be erected not less than 6 feet from the roof edge parallel to the direction of mechanical equipment operation, and not less than 10 feet from the roof edge perpendicular to the direction of mechanical equipment operation.

When mechanical equipment is not being used, the warning line must be erected not less than 6 feet from the roof edge.

Covers

Covers located in roadways and vehicular aisles must be able to support at least twice the maximum axle load of the largest vehicle to which the cover might be subjected. All other covers must be able to support at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time. To prevent accidental displacement resulting from wind, equipment, or workers' activities, all covers must be secured. Temporary covers shall be color-coded or bear the markings "HOLE" or "COVER."

Protection From Falling Objects

When guardrail systems are used to prevent materials from falling from one level to another, any openings must be small enough to prevent passage of potential falling objects. No materials or equipment except masonry and mortar shall be stored within 4 feet of working edges. Excess mortar, broken or scattered masonry units, and all other materials and debris shall be kept clear of the working area by removal at regular intervals.

During roofing work, materials and equipment shall not be stored within 6 feet of a roof edge unless guardrails are erected at the edge. Materials piled, grouped, or stacked near a roof edge must be stable and self-supporting.

4.9.6 Training

Employees will be trained in the following areas:

- the nature of fall hazards in the work area
- the correct procedures for erecting, maintaining, disassembling, and inspecting fall-protection systems
- the use and operation of controlled access zones and guardrail, personal fall-arrest, safety net, warning line, and safety monitoring systems
- the role of each employee in the safety monitoring system when the system is in use
- the limitations of mechanical equipment used during roofing work on low-sloped roofs
- the correct procedures for equipment and materials handling and storage, and the erection of overhead protection
- employees' role in fall-protection plans.

4.9.7 Glossary

Anchorage—A secure point to which lifelines, lanyards or deceleration devices are attached.

Body belt—A strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

Body harness —-Straps that may be secured about the person in a manner that distributes the fall-arrest forces over at least the thighs, pelvis, waist, chest, and shoulders with a means for attaching the harness to other components of a personal fall-arrest system.

Connector—A device that is used to couple (connect) parts of a personal fall arrest system or positioning device system together.

Controlled access zone—A work area designated and clearly marked in which certain types of work (such as overhand bricklaying) may take place without the use of conventional fall protection systems—guardrail, personal arrest or safety net—to protect employees working in the zone.

Deceleration device—Any mechanism—such as rope, grab, rip stitch lanyard, specially-woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines/lanyards—that serves to dissipate a substantial amount of energy during a fall-arrest, or otherwise limits the energy imposed on an employee during fall-arrest.

Deceleration distance—The additional vertical distance a falling person travels, excluding lifeline elongation and free-fall distance, before stopping, from the point at which a deceleration device begins to operate.

Guardrail system—A barrier erected to prevent employees from falling to lower levels.

Hole—A void or gap 2 inches or more in the least dimension in a floor, roof, or other walking/working surface.

Lanyard—A flexible line of rope, wire rope, or strap with, generally, a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage.

Leading edge—The edge of a floor, roof, or formwork for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or formwork sections are placed, formed or constructed.

Lifeline—A component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline) and that serves as a means for connecting other components of a personal fall-arrest system to the anchorage.

Low-slope roof—A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

Opening—A gap or void 30 inches or more high and 18 inches or more wide, in a wall or partition, through which employees can fall to a lower level.

Personal fall-arrest system—A system including but not limited to an anchorage, connectors, and a body belt or body harness used to arrest an employee in a fall from a working level. ***The use of a body belt for fall arrest is now prohibited*.**

Positioning device system—A body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning backwards.

Rope-grab—A deceleration device that travels on a lifeline and, by friction, automatically engages and locks the lifeline to arrest a fall.

Safety-monitoring system—A safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

Self-retracting lifeline/lanyard—A deceleration device containing a drum-wound line that can be extracted slowly from, or retracted onto, the drum under minimal tension during normal employee movement and which, after onset of a fall, automatically locks the drum and arrests the fall.

Snaphook—A connector consisting of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object.

Steep roof—A roof having a slope greater than 4 in 12 (vertical to horizontal).

Toeboard—A low protective barrier that prevents material and equipment from falling to lower levels and which protects personnel from falling.

Unprotected sides and edges—Any side or edge (except at entrances to points of access) of a walking/working surface (e.g. floor, roof, ramp, or runway) where there is no wall or guardrail system at least 39 inches high.

Walking/working surface—Any surface, horizontal or vertical, on which an employee walks or works, including but not limited to floors, roofs, ramps, bridges, runways, formwork, and concrete reinforcing steel. Does not include ladders, vehicles, or trailers on which employees must be located to perform their work duties.

Warning line system—A barrier erected on a roof to warn employees 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, body belt, or safety net systems to protect employees in the area.

4.10 Fire Protection and Prevention Policy

4.10.1 Definitions

"Approved" means equipment that has been listed or approved by a nationally recognized testing laboratory such as Factory Mutual Engineering Corp., or Underwriters' Laboratories, Inc., or Federal agencies such as Bureau of Mines, or U.S. Coast Guard, which issue approvals for such equipment.

"**Closed container"** means a container so sealed by means of a lid or other device that neither liquid nor vapor will escape from it at ordinary temperatures.

"**Combustible liquid"** means any liquid having a flash point at or above 140 deg. F (60 deg. C), and below 200 deg. F (93.4 deg. C).

"**Combustion"** means any chemical process that involves oxidation sufficient to produce light or heat.

"**Fire brigade"** means an organized group of employees that are knowledgeable, trained, and skilled in the safe evacuation of employees during emergency situations and in assisting in firefighting operations.

"**Fire resistance"** means so resistant to fire that, for specified time and under conditions of a standard heat intensity, it will not fail structurally and will not permit the side away from the fire to become hotter than a specified temperature. For purposes of this part, fire resistance shall be determined by the ***Standard Methods of Fire Tests of Building Construction and Materials***, NFPA 251-1969.

"Flammable" means capable of being easily ignited, burning intensely, or having a rapid rate of flame spread.

"**Flammable liquid"** means any liquid having a flash point below 140 deg. F and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100 deg. F.

"**Flash point"** of the liquid means the temperature at which it gives off vapor sufficient to form an ignitable mixture with the air near the surface of the liquid or within the vessel used as determined by appropriate test procedure and apparatus as specified below.

The flash point of liquids having a viscosity less than 45 Saybolt Universal Second(s) at 100 deg. F (37.8 deg. C) and a flash point below 175 deg. F (79.4 deg. C) shall be determined in accordance with the ***Standard Method of Test for Flash Point by the Tag Closed Tester***, ASTM D-56-69.

The flash point of liquids having a viscosity of 45 Saybolt Universal Second(s) or more at 175 deg. F. (79.4 deg. C) or higher shall be determined in accordance with the ***Standard Method of Test for Flash Point by the Pensky Martens Closed Tester***, ASTM D-93-69.

"**Liquefied petroleum gases," "LPG" and "LP Gas"** mean and include any material which is composed predominantly of any of the following hydrocarbons, or mixtures of them, such as propane, propylene, butane (normal butane or iso-butane), and butylenes.

"**Portable tank"** means a closed container having a liquid capacity more than 60 U.S. gallons, and not intended for fixed installation.

"**Safety can"** means an approved closed container, of not more than 5 gallons capacity, having a flash-arresting screen, spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure.

"**Vapor pressure"** means the pressure, measured in pounds per square inch (absolute), exerted by a volatile liquid as determined by the ***Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method),*** ASTM D-323-58.

4.10.2 FIRE PROTECTION, General Requirements - 1926.150

Management shall be responsible for:

- The development of a fire protection program to be followed throughout all phases of construction, maintenance, and demolition work, and shall provide for the firefighting equipment as specified in policy. As fire hazards occur, there shall be no delay in providing the necessary equipment.
- Assure access to all available firefighting equipment be maintained at all times.
- Assure that all firefighting equipment, provided by Campus Facilities, shall be conspicuously located.
- Assure that firefighting equipment shall be periodically inspected and maintained in operating condition. Defective equipment shall be immediately replaced.
- Shall, as warranted by the project, provide a trained and equipped firefighting organization (Fire Brigade) to assure adequate protection to life.
- Assuring that yearly training is completed by their employees.

All employees shall be responsible for:

- Having fire protection at the worksite when the potential for fire exists.
- Knowing the closet location of firefighting equipment.
- Participating in annual fire training.
- Removing from service any damaged equipment.
- Notifying their supervisor when un-inspected or damaged equipment if found.

Water Supply

- A temporary or permanent water supply, of sufficient volume, duration, and pressure, required to properly operate the firefighting equipment shall be made available as soon as combustible materials accumulate.
- Where underground water mains are to be provided, they shall be installed, completed, and made available for use as soon as practicable.

Portable Firefighting Equipment

Fire Extinguishers and Small Hose Lines

- A fire extinguisher, rated not less than 2A, shall be provided for each 3,000 square feet of the protected building area, or major fraction thereof.
- Travel distance from any point of the protected area to the nearest fire extinguisher shall not exceed 100 feet in office spaces and 25 feet in shop areas.
- One 55-gallon open drum of water with two fire pails may be substituted for a fire extinguisher having a 2A rating.

- A ½-inch diameter garden-type hose line, not to exceed 100 feet in length (office) 25 feet (shop) and equipped with a nozzle, may be substituted for a 2A-rated fire extinguisher, providing it is capable of discharging a minimum of 5 gallons per minute with a minimum hose stream range of 30 feet horizontally. The garden-type hose lines shall be mounted on conventional racks or reels. The number and location of hose racks or reels shall be such that at least one hose stream can be applied to all points in the area.
- One or more fire extinguishers, rated not less than 2A, shall be provided on each floor. In multistory buildings, at least one fire extinguisher shall be located adjacent to stairway.
- Extinguishers and water drums, subject to freezing, shall be protected from freezing.
- A fire extinguisher, rated not less than 10B, shall be provided within 50 feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the jobsite. This requirement does not apply to the integral fuel tanks of motor vehicles.
- Carbon tetrachloride and other toxic vaporizing liquid fire extinguishers are prohibited.
- Portable fire extinguishers shall be inspected periodically and maintained in accordance with ***Maintenance and Use of Portable Fire Extinguishers***, NFPA No. 10A-1970. Fire extinguishers which have been listed or approved by a nationally recognized testing laboratory shall be used to meet the requirements of this subpart.

NOTE: Table F-1 in §1926.150©(1)(x) may be used as a guide for selecting the appropriate portable fire extinguishers.

Fire Hose and Connections

- One hundred feet, or less, of 1½-inch hose, with a nozzle capable of discharging water at 25 gallons or more per minute, may be substituted for a fire extinguisher rated not more than 2A in the designated area provided that the hose line can reach all points in the area.
- If fire hose connections are not compatible with local firefighting equipment, departments shall provide adapters, or equivalent, to permit connections.
- During demolition involving combustible materials, charged hose lines, supplied by hydrants, water tank trucks with pumps, or equivalent, shall be made available.

Fixed Firefighting Equipment

Sprinkler Protection

- When a facility is being constructed, which includes the installation of automatic sprinkler protection; the installation shall closely follow the construction and be placed in service as soon as applicable laws permit following completion of each story.
- During demolition or alterations, existing automatic sprinkler installations shall be retained in service as long as reasonable. The operation of sprinkler control valves shall be permitted only by properly authorized persons. Modification of sprinkler systems to permit alterations or additional demolition should be expedited so that the automatic protection may be returned to service as quickly as possible. Sprinkler control valves shall be checked daily at close of work to ascertain that the protection is in service.

Standpipes

- In all structures in which standpipes are required, or where standpipes exist in structures being altered, they shall be brought up as soon as applicable laws permit, and shall be maintained as construction progresses in such a manner that they are always ready for fire protection use. The standpipes shall be provided with Siamese fire department connections

on the outside of the structure, at the street level, which shall be conspicuously marked. There shall be at least one standard hose outlet at each floor.

Fire Alarm Devices

- An alarm system, e.g., telephone system, siren, etc., shall be established whereby employees on the site and the local fire department can be alerted for an emergency. The alarm code and reporting instructions shall be conspicuously posted at phones and at employee entrances.

Fire Cutoffs

- Fire walls and exit stairways, required for the completed buildings, shall be given construction priority. Fire doors, with automatic closing devices, shall be hung on openings as soon as practicable.
- Fire cutoffs shall be retained in buildings undergoing alterations or demolition until operations necessitate their removal.

4.10.3 FIRE PREVENTION - 1926.151

Ignition Hazards

- Electrical wiring and equipment for light, heat, or power purposes shall be installed in compliance with the requirements of Subpart K, ***Electrical***.
- Internal combustion engine powered equipment shall be so located that the exhausts are well away from combustible materials. When the exhausts are piped to outside the building under construction, a clearance of at least 6 inches shall be maintained between such piping and combustible material.
- Smoking shall be prohibited at or in the vicinity of operations which constitute a fire hazard, and shall be conspicuously posted: “No Smoking or Open Flame.”
- Portable battery powered lighting equipment, used in connection with the storage, handling, or use of flammable gases or liquids, shall be of the type approved for the hazardous locations.
- The nozzle of air, inert gas, and steam lines or hoses, when used in the cleaning or ventilation of tanks and vessels that contain hazardous concentrations of flammable gases or vapors, shall be bonded to the tank or vessel shell. Bonding devices shall not be attached or detached in hazardous concentrations of flammable gases or vapors.

Temporary Buildings

- No temporary building shall be erected where it will adversely affect any means of exit.
- Temporary buildings, when located within another building or structure, shall be of either noncombustible construction or of combustible construction having a fire resistance of not less than 1 hour.
- Temporary buildings, located other than inside another building and not used for the storage, handling, or use of flammable or combustible liquids, flammable gases, explosives, or blasting agents, or similar hazardous occupancies, shall be located at a distance of not less than 10 feet from another building or structure. Groups of temporary buildings, not exceeding 2,000 square feet in aggregate, shall, for the purposes of this part, be considered a single temporary building.

Open Yard Storage

- Combustible materials shall be piled with due regard to the stability of piles and in no case higher than 20 feet.
- Driveways between and around combustible storage piles shall be at least 15 feet wide and maintained free from accumulation of rubbish, equipment, or other articles or materials. Driveways shall be so spaced that a maximum grid system unit of 50 feet by 150 feet is produced.
- The entire storage site shall be kept free from accumulation of unnecessary combustible materials. Weeds and grass shall be kept down and a regular procedure provided for the periodic cleanup of the entire area. When there is a danger of an underground fire, that land shall not be used for combustible or flammable storage.
- Method of piling shall be solid wherever possible and in orderly and regular piles. No combustible material shall be stored outdoors within 10 feet of a building or structure.
- Portable fire extinguishing equipment, suitable for the fire hazard involved, shall be provided at convenient, conspicuously accessible locations in the yard area. Portable fire extinguishers, rated not less than 2A, shall be placed so that maximum travel distance to the nearest unit shall not exceed 100 feet.

Indoor Storage

- Storage shall not obstruct, or adversely affect, means of exit. All materials shall be stored, handled, and piled with due regard to their fire characteristics.
- Non-compatible materials, which may create a fire hazard, shall be segregated by a barrier having a fire resistance of at least 1 hour.
- Material shall be piled to minimize the spread of fire internally and to permit convenient access for firefighting. Stable piling shall be maintained at all times. Aisle space shall be maintained to safely accommodate the widest vehicle that may be used within the building for firefighting purposes.
- Clearance of at least 36 inches shall be maintained between the top level of the stored material and the sprinkler deflectors.
- Clearance shall be maintained around lights and heating units to prevent ignition of combustible materials.
- A clearance of 24 inches shall be maintained around the path of travel of fire doors unless a barricade is provided, in which case no clearance is needed. Material shall not be stored within 36 inches of a fire door opening.

4.10.4 FLAMMABLE AND COMBUSTIBLE LIQUIDS - 1926.152

General Requirements

- Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids.
- Approved metal safety cans shall be used for the handling and use of flammable liquids in quantities greater than one gallon, except that this shall not apply to those flammable liquid materials which are highly viscid (extremely hard to pour), which may be used and handled in original shipping containers. For quantities of one gallon or less, only the original container or approved metal safety cans shall be used for storage, use, and handling of flammable liquids.
- Flammable or combustible liquids shall not be stored in areas used for exits, stairways, or normally used for the safe passage of people.

Indoor Storage of Flammable and Combustible Liquids

- No more than 25 gallons of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet. For storage of liquefied petroleum gas, see 1926.153.
    - Quantities of flammable and combustible liquid in excess of 25 gallons shall be stored in an acceptable or approved cabinet meeting the following requirements:
- Acceptable wooden storage cabinets shall be constructed in the following manner, or equivalent: The bottom, sides, and top shall be constructed of an exterior grade of plywood at least 1 inch in thickness, which shall not break down or delaminate under standard fire test conditions.
- All joints shall be rabbeted and shall be fastened in two directions with flathead wood screws. When more than one door is used, there shall be a rabbeted overlap of not less than 1 inch. Steel hinges shall be mounted in such a manner as to not lose their holding capacity due to loosening or burning out of the screws when subjected to fire.
- Such cabinets shall be painted inside and out with fire retardant paint.
- Approved metal storage cabinets will be acceptable.
- Cabinets shall be labeled in conspicuous lettering, “Flammable-Keep Fire Away.”
- Not more than 60 gallons of flammable or 120 gallons of combustible liquids shall be stored
- in any one storage cabinet.
- Not more than three such cabinets may be located in a single storage area. Quantities in excess of this shall be stored in an inside storage room.
- Inside storage rooms shall be constructed to meet the required fire-resistive rating for their use. Such construction shall comply with the test specifications set forth in ***Standard Methods of Fire Test of Building Construction and Material***, NFPA 251-1969.
- Where an automatic extinguishing system is provided, the system shall be designed and installed in an approved manner. Openings to other rooms or buildings shall be provided with noncombustible liquid-tight raised sills or ramps at least 4 inches in height, or the floor in the storage area shall be at least 4 inches below the surrounding floor. Openings shall be provided with approved self-closing fire doors. The room shall be liquid-tight where the walls join the floor. A permissible alternate to the sill or ramp is an open-grated trench, inside of the room, which drains to a safe location. Where other portions of the building or other buildings are exposed, windows shall be protected as set forth in the ***Standard for Fire Doors and Windows***, NFPA No. 80-1970, for Class E or F openings. Wood of at least 1- inch nominal thickness may be used for shelving, racks, dunnage, scuffboards, floor overlay, and similar installations.
- Materials which will react with water and create a fire hazard shall not be stored in the same room with flammable or combustible liquids.
- Storage in inside storage rooms shall comply with Table F-2:

TABLE F-2

Fire Protection Provided	**Yes**	**No**	**Yes**	**No**
Fire Resistance	**2 hrs.**	**2 hrs.**	**1 hr.**	**1 hr.**
Maximum Size	**500 sq. ft.**	**500 sq. ft.**	**150 sq. ft.**	**150 sq. ft.**
Total Allowable Quantities (gal./sq. ft. floor area)	**10**	**4**	**5**	**2**

NOTE: Fire protection system shall be sprinkler, water spray, carbon dioxide or other system approved by a nationally recognized testing laboratory for this purpose.

- Electrical wiring and equipment located in inside storage rooms shall be approved for Class I, Division 1, Hazardous Locations. For definition of Class I, Division 1, Hazardous Locations, see 1926.449.
- Every inside storage room shall be provided with either a gravity or a mechanical exhausting system. Such system shall commence not more than 12 inches above the floor and be designed to provide for a complete change of air within the room at least 6 times per hour.
- If a mechanical exhausting system is used, it shall be controlled by a switch located outside of the door. The ventilating equipment and any lighting fixtures shall be operated by the same switch.
- An electric pilot light shall be installed adjacent to the switch if flammable liquids are dispensed within the room. Where gravity ventilation is provided, the fresh air intake, as well as the exhausting outlet from the room, shall be on the exterior of the building in which the room is located.
- In every inside storage room there shall be maintained one clear aisle at least 3 feet wide. Containers over 30 gallons capacity shall not be stacked one upon the other.
- Flammable and combustible liquids in excess of that permitted in inside storage rooms shall be stored outside of buildings in accordance with paragraph “Storage Outside Buildings” of this section.
- The quantity of flammable or combustible liquids kept in the vicinity of spraying operations shall be the minimum required for operations and should ordinarily not exceed a supply for 1 day or one shift.
- Bulk storage of portable containers of flammable or combustible liquids shall be in a separate, constructed building detached from other important buildings or cut off in a standard manner.

Storage Outside Buildings

- Storage of containers (not more than 60 gallons each) shall not exceed 1,100 gallons in any one pile or area. Piles or groups of containers shall be separated by a 5-foot clearance. Piles or groups of containers shall not be nearer than 20 feet to a building.
- Within 200 feet of each pile of containers, there shall be a 12-foot-wide access way to permit approach of fire control apparatus.
- The storage area shall be graded in a manner to divert possible spills away from buildings or other exposures, or shall be surrounded by a curb or earth dike at least 12 inches high. When curbs or dikes are used, provisions shall be made for draining off accumulations of ground or rain water, or spills of flammable or combustible liquids. Drains shall terminate at a safe location and shall be accessible to operation under fire conditions.
- Outdoor portable tank storage:
  - Portable tanks shall not be nearer than 20 feet from any building.
  - Two or more portable tanks, grouped together, having a combined capacity in excess of 2,200 gallons, shall be separated by a 5-foot-clear area.
  - Individual portable tanks exceeding 1,100 gallons shall be separated by a 5-foot-clear area.
  - Within 200 feet of each portable tank, there shall be a 12-foot-wide access way to permit approach of fire control apparatus.
  - Storage areas shall be kept free of weeds, debris, and other combustible material not necessary to the storage.

Portable tanks, not exceeding 660 gallons, shall be provided with emergency venting and other devices, as required by chapters III and IV of NFPA 30-1969, ***The Flammable and Combustible Liquids Code***.

- Portable tanks, in excess of 660 gallons, shall have emergency venting and other devices, as required by chapters II and III of ***The Flammable and Combustible Liquids Code***, NFPA 30-1969.

Fire Control for Flammable or Combustible Liquid Storage

- At least one portable fire extinguisher, having a rating of not less than 20-B units, shall be located outside of, but not more than 10 feet from, the door opening into any room used for storage of more than 60 gallons of flammable or combustible liquids.
- At least one portable fire extinguisher having a rating of not less than 20-B units shall be located not less than 25 feet, nor more than 75 feet, from any flammable liquid storage area located outside.
- When sprinklers are provided, they shall be installed in accordance with the ***Standard for the Installation of Sprinkler Systems***, NFPA 13-1969.
- At least one portable fire extinguisher having a rating of not less than 20-B:C units shall be provided on all tank trucks or other vehicles used for transporting and/or dispensing flammable or combustible liquids.

Dispensing Liquids

- Areas in which flammable or combustible liquids are transferred at one time, in quantities greater than 5 gallons from one tank or container to another tank or container, shall be separated from other operations by 25-feet distance or by construction having a fire resistance of at least 1 hour.
- Drainage or other means shall be provided to control spills. Adequate natural or mechanical ventilation shall be provided to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit.
- Transfer of flammable liquids from one container to another shall be done only when containers are electrically interconnected (bonded).
- Flammable or combustible liquids shall be drawn from or transferred into vessels, containers, or tanks within a building or outside only through a closed piping system, from safety cans, by means of a device drawing through the top, or from a container, or portable tanks, by gravity or pump, through an approved self-closing valve.
- Transferring by means of air pressure on the container or portable tanks is prohibited.
- The dispensing units shall be protected against collision damage. Dispensing devices and nozzles for flammable liquids shall be of an approved type.

Handling Liquids at Point of Final Use

- Flammable liquids shall be kept in closed containers when not actually in use.
- Leakage or spillage of flammable or combustible liquids shall be disposed of promptly and safely.
- Flammable liquids may be used only where there are no open flames or other sources of ignition within 50 feet of the operation, unless conditions warrant greater clearance.

Service and Refueling Areas

- Flammable or combustible liquids shall be stored in approved closed containers, in tanks located underground, or in aboveground portable tanks.
- The tank trucks shall comply with the requirements covered in the ***Standard for Tank Vehicles for Flammable and Combustible Liquids***, NFPA No. 385-1966.

- The dispensing hose shall be an approved type, and the dispensing nozzle shall be an approved automatic-closing type without a latch-open device.
- Underground tanks shall not be abandoned.
- Clearly identified and easily accessible switch(es) shall be provided at a location remote from dispensing devices to shut off the power to all dispensing devices in the event of an emergency.
- Heating equipment of an approved type may be installed in the lubrication or service area where there is no dispensing or transferring of flammable liquids, provided the bottom of the heating unit is at least 18 inches above the floor and is protected from physical damage.
- Heating equipment installed in lubrication or service areas, where flammable liquids are dispensed, shall be of an approved type for garages, and shall be installed at least 8 feet above the floor.
- There shall be no smoking or open flames in the areas used for fueling, servicing fuel systems for internal combustion engines, receiving or dispensing of flammable or combustible liquids. Conspicuous and legible signs prohibiting smoking shall be posted.
- The motors of all equipment being fueled shall be shut off during the fueling operation.
- Each service or fueling area shall be provided with at least one fire extinguisher having a rating of not less than 20-B:C located so that an extinguisher will be within 75 feet of each pump, dispenser, underground fill pipe opening, and lubrication or service area.

Scope
- This section applies to the handling, storage, and use of flammable and combustible liquids with a flashpoint below 200 deg. F (93.33 deg. C). This section does not apply to: (1) Bulk transportation of flammable and combustible liquids; and (2) Storage, handling, and use of fuel oil tanks and containers connected with oil burning equipment.

Tank Storage
- Refer to 1926.152(i) for design, construction, and installation requirements for flammable or combustible liquid storage tanks.

Piping, Valves, and Fittings
- Refer to 1926.152(j) for design, fabrication, assembly, test, and inspection requirements for piping systems containing flammable or combustible liquids.

4.10.5 LIQUEFIED PETROLEUM GAS (LP-GAS) - 1926.153

Approval of Equipment and Systems
- Each system shall have containers, valves, connectors, manifold valve assemblies, and regulators of an approved type.
- All cylinders shall meet the Department of Transportation specification identification requirements published in 49 CFR Part 178, ***Shipping Container Specifications***.
- As used in this section, “Containers” are defined as all vessels, such as tanks, cylinders, or drums, used for transportation or storing liquefied petroleum gases.

Welding on LP-Gas Containers
- Welding is prohibited on containers.

Container Valves and Container Accessories

- Valves, fittings, and accessories connected directly to the container, including primary shut off valves, shall have a rated working pressure of at least 250 p.s.i.g. and shall be of material and design suitable for LP-Gas service.

- Connections to containers, except safety relief connections, liquid level gauging devices, and plugged openings, shall have shutoff valves located as close to the container as practicable.

Safety Devices

- Every container and every vaporizer shall be provided with one or more approved safety relief valves or devices. These valves shall be arranged to afford free vent to the outer air with discharge not less than 5 feet horizontally away from any opening into a building which is below such discharge.
- Shutoff valves shall not be installed between the safety relief device and the container, or the equipment or piping to which the safety relief device is connected, except that a shutoff valve may be used where the arrangement of this valve is such that full required capacity flow through the safety relief device is always afforded.
- Container safety relief devices and regulator relief vents shall be located not less than 5 feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

Dispensing

- Filling of fuel containers for trucks or motor vehicles from bulk storage containers shall be performed not less than 10 feet from the nearest masonry-walled building, or not less than 25 feet from the nearest building or other construction and, in any event, not less than 25 feet from any building opening.
- Filling of portable containers or containers mounted on skids from storage containers shall be performed not less than 50 feet from the nearest building.

Requirements for Appliances

- Any appliance that was originally manufactured for operation with a gaseous fuel other than LP-Gas, and is in good condition, may be used with LP-Gas only after it is properly converted, adapted, and tested for performance with LP-Gas before the appliance is placed in use.
- Containers shall be upright upon firm foundations or otherwise firmly secured. The possible effect on the outlet piping of settling shall be guarded against by a flexible connection or special fitting.

Containers and Equipment Used Inside of Buildings or Structures

- When operational requirements make portable use of containers necessary, and their location outside of buildings or structures is impracticable, containers and equipment shall be permitted to be used inside of buildings or structures in accordance with paragraphs (h)(2) through (11) of this section.

"Containers in use" means connected for use.

- Systems utilizing containers having a water capacity greater than 2½ pounds (nominal 1 pound LP-Gas capacity) shall be equipped with excess flow valves. Such excess flow valves shall be either integral with the container valves or in the connections to the container valve outlets.

- Regulators shall be either directly connected to the container valves or to manifolds connected to the container valves. The regulator shall be suitable for use with LP-Gas.
- Manifolds and fittings connecting containers to pressure regulator inlets shall be designed for at least 250 p.s.i.g. service pressure.
- Valves on containers having water capacity greater than 50 pounds (nominal 20 pounds LP-Gas capacity) shall be protected from damage while in use or storage.
- Aluminum piping or tubing shall not be used.
- Hose shall be designed for a working pressure of at least 250 p.s.i.g. Design, construction, and performance of hose, and hose connections shall have their suitability determined by listing by a nationally recognized testing agency. The hose length shall be as short as practicable. Hoses shall be long enough to permit compliance with spacing provisions of paragraphs (h)(1) through (13) of this section, without kinking or straining, or causing hose to be so close to a burner as to be damaged by heat.
- Portable heaters, including salamanders, shall be equipped with an approved automatic device to shut off the flow of gas to the main burner, and pilot if used, in the event of flame failure. Such heaters, having inputs above 50,000 B.t.u. per hour, shall be equipped with either a pilot, which must be lighted and proved before the main burner can be turned on, or an electrical ignition system. *NOTE: The provisions of this subparagraph do not apply to portable heaters under 7,500 B.t.u. per hour input when used with containers having a maximum water capacity of 2½ pounds.*
- Container valves, connectors, regulators, manifolds, piping, and tubing shall not be used as structural supports for heaters.
- Containers, regulating equipment, manifolds, pipe, tubing, and hose shall be located to minimize exposure to high temperatures or physical damage.
- Containers having a water capacity greater than 2½ pounds (nominal 1 pound LP-Gas capacity) connected for use shall stand on a firm and substantially level surface and, when necessary, shall be secured in an upright position.
- The maximum water capacity of individual containers shall be 245 pounds (nominal 100 pounds LP-Gas capacity).
- For temporary heating, heaters (other than integral heater-container units) shall be located at least 6 feet from any LP-Gas container. This shall not prohibit the use of heaters specifically designed for attachment to the container or to a supporting standard, provided they are designed and installed so as to prevent direct or radiant heat application from the heater onto the containers. Blower and radiant type heaters shall not be directed toward any LP-Gas container within 20 feet.
- If two or more heater-container units, of either the integral or nonintegral type, are located in an unpartitioned area on the same floor, the container or containers of each unit shall be separated from the container or containers of any other unit by at least 20 feet.
- When heaters are connected to containers for use in an unpartitioned area on the same floor, the total water capacity of containers, manifolded together for connection to a heater or heaters, shall not be greater than 735 pounds (nominal 300 pounds LP-Gas capacity). Such manifolds shall be separated by at least 20 feet.
- Storage of containers awaiting use shall be in accordance with paragraphs (j) and (k) of this section.

Multiple Container Systems

- Valves in the assembly of multiple container systems shall be arranged so that replacement of containers can be made without shutting off the flow of gas in the system. This provision is not to be construed as requiring an automatic changeover device.
- Heaters shall be equipped with an approved regulator in the supply line between the fuel cylinder and the heater unit. Cylinder connectors shall be provided with an excess flow valve

to minimize the flow of gas in the event the fuel line becomes ruptured.

- Regulators and low-pressure relief devices shall be rigidly attached to the cylinder valves, cylinders, supporting standards, the building walls, or otherwise rigidly secured, and shall be so installed or protected from the elements.

Storage of LPG Containers

- Storage of LPG within buildings is prohibited.

Storage Outside of Buildings

- Storage outside of buildings, for containers awaiting use, shall be located from the nearest building or group of buildings, in accordance with the following:

- **TABLE F-3**

• **Quantity of LP-Gas Stored**	• **Distance (feet)**
• 500 lbs. or less	• 0
• 501 to 6,000 lbs.	• 10
• 6,001 to 10,000 lbs.	• 20
• Over 10,000 lbs	• 25

- Containers shall be in a suitable ventilated enclosure or otherwise protected against tampering.

Fire Protection

- Storage locations shall be provided with at least one approved portable fire extinguisher having a rating of not less than 20-B:C.

Systems Utilizing Containers Other Than DOT Containers

- This paragraph applies specifically to systems utilizing storage containers other than those constructed in accordance with DOT specifications. Paragraph (b) of this section applies to this paragraph unless otherwise noted in paragraph (b) of this section.
- Storage containers shall be designed and classified in accordance with Table F-31 of 1926.153(m)(2).
- Containers with foundations attached (portable or semiportable containers with suitable steel “runners” or “skids” and popularly known in the industry as “skid tanks”) shall be designed, installed, and used in accordance with these rules subject to the following provisions:
  - If they are to be used at a given general location for a temporary period not to exceed 6 months they need not have fire-resisting foundations or saddles but shall have adequate ferrous metal supports.
  - They shall not be located with the outside bottom of the container shell more than 5 feet (1.52 m) above the surface of the ground unless fire-resisting supports are provided.

- The bottom of the skids shall not be less than 2 inches (5.08 cm) or more than 12 inches (30.48 cm) below the outside bottom of the container shell.
- Flanges, nozzles, valves, fittings, and the like, having communication with the interior of the container, shall be protected against physical damage.
- When not permanently located on fire-resisting foundations, piping connections shall be sufficiently flexible to minimize the possibility of breakage or leakage of connections if the container settles, moves, or is otherwise displaced.
- Skids, or lugs for attachment of skids, shall be secured to the container in accordance with the code or rules under which the container is designed and built (with a minimum factor of safety of four) to withstand loading in any direction equal to four times the weight of the container and attachments when filled to the maximum permissible loaded weight.
- Field welding where necessary shall be made only on saddle plates or brackets which were applied by the manufacturer of the tank.

Marking of Gas Cylinders

- When LP-Gas and one or more other gases are stored or used in the same area, the containers shall be marked to identify their content. Marking shall be in compliance with American National Standard Z48.1-1954, ***Method of Marking Portable Compressed Gas Containers To Identify the Material Contained***.

Damage From Vehicles

- When damage to LP-Gas systems from vehicular traffic is a possibility, precautions against such damage shall be taken.

TEMPORARY HEATING DEVICES **- 1926.154**

Ventilation

- Fresh air shall be supplied in sufficient quantities to maintain the health and safety of workers. Where natural means of fresh air supply is inadequate, mechanical ventilation shall be provided.
- When heaters are used in confined spaces, special care shall be taken to provide sufficient ventilation in order to ensure proper combustion, maintain the health and safety of workers, and limit temperature rise in the area.

Clearance and Mounting

- Temporary heating devices shall be installed to provide clearance to combustible material not less than the amount shown in Table F-4 in §1926.154(b)(1).
- Temporary heating devices, which are listed for installation with lesser clearances than specified in Table F-4, may be installed in accordance with their approval.
- Heaters not suitable for use on wood floors shall not be set directly upon them or other combustible materials. When such heaters are used, they shall rest on suitable heat insulating material or at least 1-inch concrete, or equivalent. The insulating material shall extend beyond the heater 2 feet or more in all directions.
- Heaters used in the vicinity of combustible tarpaulins, canvas, or similar coverings shall be located at least 10 feet from the coverings. The coverings shall be securely fastened to prevent ignition or upsetting of the heater due to wind action on the covering or other material.

Stability

- Heaters, when in use, shall be set horizontally level, unless otherwise permitted by the manufacturer's markings.

Solid Fuel Salamanders

- Solid fuel salamanders are prohibited in buildings and on scaffolds.

Oil-Fired Heaters

- Flammable liquid-fired heaters shall be equipped with a primary safety control to stop the flow of fuel in the event of flame failure. Barometric or gravity oil feed shall not be considered a primary safety control.
- Heaters designed for barometric or gravity oil feed shall be used only with the integral tanks.
- Heaters specifically designed and approved for use with separate supply tanks may be directly connected for gravity feed, or an automatic pump, from a supply tank.

4.11 Fire Safety Program

4.11.1 Purpose

The Fire Safety Program is designed to reduce the risk of fire in the work place by eliminating potential fire risks. The program also works in conjunction with other emergency plans and safety programs, including the review of all new building construction and renovations to ensure compliance with applicable state, local, and national fire and life safety standards.

4.11.2 Responsibilities

Management

- Ensure that fire prevention methods are established and enforced
- Ensure that fire suppression systems such as sprinklers and extinguishers are periodically inspected and maintained
- Train all employees in the use of fire extinguishers
- Train employees on evacuation routes and procedures

Supervisors

- Monitor the use of flammable materials and liquids
- Train assigned employees in the safe storage, use and handling of flammable materials
- Ensure that flammable material storage areas are properly maintained

Employees

- Use, store and transfer flammable materials in accordance with provided training
- Do not mix flammable materials
- Report immediately violations of the Fire Safety Program

4.11.3 Elimination of Ignition Sources

All nonessential ignition sources must be eliminated where flammable liquids are used or stored. The following is a list of some of the more common potential ignition sources:

- Open flames, such as cutting and welding torches, furnaces, matches, and heaters- these sources should be kept away from flammable liquids operations. Cutting or welding on flammable liquids equipment should not be performed unless the equipment has been properly emptied and purged with a neutral gas such as nitrogen.
- Chemical sources of ignition such as d.c. motors, switched, and circuit breakers should be eliminated where flammable liquids are handled or stored. Only approved explosion-proof devices should be used in these areas.
- Mechanical sparks-- Can be produced as a result of friction. Only non-sparking tools should be used in areas where flammable liquids are stored or handled.
- Static sparks-- Can be generated as a result of electron transfer between two contacting surfaces. The electrons can discharge in a small volume, raising the temperature to above the ignition temperature. Every effort should be made to eliminate the possibility of static sparks. Also proper bonding and grounding procedures must be followed when flammable liquids are transferred or transported.

4.11.4 Removal of Incompatibles

Materials that can contribute to a flammable liquid fire should not be stored with flammable liquids. Examples are oxidizers and organic peroxides, which, on decomposition, can generate large amounts of oxygen.

4.11.5 Flammable Gases

Generally, flammable gases pose the same type of fire hazards as flammable liquids and their vapors. Many of the safeguards for flammable liquids also apply to flammable gases, other properties such as toxicity, reactivity, and corrosivity also must be taken into account. Also, a gas that is flammable could produce toxic combustion products.

4.11.6 Fire Extinguishers/Sprinklers/Fire Alarm

A portable fire extinguisher is a "first aid" device and is very effective when used while the fire is small. The use of fire extinguisher that matches the class of fire, by a person who is well trained, can save both lives and property. Portable fire extinguishers must be installed in workplaces regardless of other firefighting measures. The successful performance of a fire extinguisher in a fire situation largely depends on its proper selection, inspection, maintenance, and distribution.

Classification of Fires and Selection of Extinguishers

Fires are classified into four general categories, depending on the type of material or fuel involved. The type of fire determines the type of extinguisher to be used:

- *Class A* fires involve materials such as wood, paper, and cloth which produce glowing embers or char.

- *Class B* fires involve flammable gases, liquids, and greases, including gasoline and most hydrocarbon liquids, which must be vaporized for combustion to occur.

- *Class C* fires involve fires in live electrical equipment or in materials near electrically powered equipment.

- *Class D* fires involve combustible metals, such as magnesium, zirconium, potassium, and sodium.

Extinguishers will be selected according to the potential fire hazard, the construction and occupancy of facilities, hazard to be protected, and other factors pertinent to the situation.

Location and Marking of Extinguishers

Extinguishers will be conspicuously located and readily accessible for immediate use in the event of fire. They will be located along normal paths of travel and egress. Wall recesses and/or flush-mounted cabinets will be used as extinguisher locations whenever possible.

Extinguishers will be clearly visible. In locations where visual obstruction cannot be completely avoided, directional arrows will be provided to indicate the location of extinguishers and the arrows will be marked with the extinguisher classification.

If extinguishers intended for different classes of fire are located together, they will be conspicuously marked to ensure that the proper class extinguisher selection is made at the time of a fire. Extinguisher classification markings will be located on the front of the shell above or below the extinguisher nameplate. Markings will be of a size and form to be legible from a distance of 3 feet.

Condition of Extinguisher

Portable extinguishers will be maintained in a fully charged and operable condition. They will be kept in their designated locations at all times when not being used. When extinguishers are removed for maintenance or testing, a fully charged and operable replacement unit will be provided.

Mounting and Distribution of Extinguishers

Extinguishers will be installed on hangers, brackets, in cabinets, or on shelves. Extinguishers having a gross weight not exceeding 40 pounds will be so installed that the top of the extinguisher is not more than 3-1/2 feet above the floor.

Extinguishers mounted in cabinets or wall recesses or set on shelves will be placed so that the extinguisher operating instructions face outward. The location of such extinguishers will be made conspicuous by marking the cabinet or wall recess in a contrasting color that will distinguish it from the normal decor.

Extinguishers must be distributed in such a way that the amount of time needed to travel to their location and back to the fire does not allow the fire to get out of control. OSHA requires that the travel distance for Class A and Class D extinguishers not exceed 75 feet. The maximum travel distance for Class B extinguishers is 50 feet because flammable liquid fires can get out of control faster that Class A fires. There is no maximum travel distance specified for Class C extinguishers, but they must be distributed on the basis of appropriate patterns for Class A and B hazards.

Inspection and Maintenance

Once an extinguisher is selected, purchased, and installed, it is the responsibility of CF Maintenance/individual departments to oversee the inspection, maintenance, and testing of fire extinguishers to ensure that they are in proper working condition.

Sprinklers

Only Authorized personnel* may disable sprinklers and alarm system.

*Building Maintenance.

4.11.7 Fire Safety Inspections/Housekeeping

First-line supervisors and Safety Committees are responsible for conducting work-site surveys that comply with the Fire Safety Program. Surveys should include observations of work-site safety and housekeeping issues and should specifically address proper storage of chemicals and supplies, unobstructed access to fire extinguishers, and emergency evacuation routes. Surveys should also determine if an emergency evacuation plan is present in work areas and that personnel are familiar with the plan.

Emergency Exit

Every exit will be clearly visible, or the route to it conspicuously identified in such a manner that every occupant of the building will readily know the direction of escape from any point. At no time will exits be blocked.

Any doorway or passageway which is not an exit or access to an exit but which may be mistaken for an exit, will be identified by a sign reading "Not An Exit" or a sign indicating its actual use (e.g. "Storeroom"). A readily visible sign will mark exits and accesses to exits. Each exit sign (other than internally illuminated signs) will be illuminated by a reliable light source providing not less than 5 foot-candles on the illuminated surface.

4.11.8 Persons with Disabilities: Emergency Plan

The first-line supervisor is assigned the responsibility of assisting Persons with Disabilities (PWD) under their supervision. The supervisor will choose an alternate assistant. The role of the two assistants is to report to their assigned person, and to either assist in evacuation or ensure that the PWD is removed from danger.

- Supervisors, alternates, and the person with a disability will be trained on available escape routes and methods.
- A list of persons with disabilities is kept in the Departmental Offices.
- Visitors who have disabilities will be assisted in a manner similar to that of company employees. The Host of the person with disabilities will assist in their evacuation.

4.11.9 Emergencies Involving Fire

Fire Alarms

In the event of a fire emergency, a fire alarm will sound for the building.

Evacuation Routes and Plans

Each facility shall have an emergency evacuation plan. All emergency exits shall conform to NFPA standards.

Should evacuation be necessary, go to the nearest exit or stairway and proceed to an area of refuge outside the building. Most stairways are fire resistant and present barriers to smoke if the doors are kept closed.

Do not use elevators. Should the fire involve the control panel of the elevator or the electrical system of the building, power in the building may be cut and you could be trapped between floors. The elevator shaft can also become a flue, lending itself to the passage and accumulation of hot gases and smoke generated by the fire.

Emergency Coordinators/Supervisors

Emergency Coordinators/Supervisors will be responsible for verifying personnel have evacuated from their assigned areas.

Fire Emergency Procedures

If you discover a fire

1. Activate the nearest fire alarm.
2. Call 911

3. Notify occupants in the area.

Fight the fire ONLY if

1. The fire department has been notified of the fire, AND
2. You have the proper extinguisher, in good working order, AND know how to use it.
3. The fire is small and confined to its area of origin.

If you hear a fire alarm

1. Evacuate the area.
2. Leave the building and move away from exits and out of the way of emergency operations.
3. Assemble in a designated area.
4. Report to the monitor so he/she can determine that all personnel have evacuated your area.
5. Remain outside until competent authority states that it is safe to re-enter.

Evacuation Routes

1. Learn at least two escape routes, and emergency exits from your area.
2. Never use an elevator as part of your escape route.
3. Learn to activate a fire alarm.
4. Learn to recognize alarm sounds.
5. Take an active part in fire evacuation drills.

4.12 Flammables and Combustibles Safe Operating Procedures

4.12.1 Purpose

Proper Storage and use of flammable liquids can significantly reduce the possibility of accidental fires and injury to employees. To minimize risk to life and property, the requirements of NFPA 30 & 321 and OSHA Standard 1910.106 have been implemented. MSDS for flammable liquids are kept in each shop location.

4.12.2 Responsibilities

Management
Provide proper storage for flammable liquids
Ensure that proper training is provided to employees who work with flammable liquids
Ensure containers are properly labeled

Supervisors
Provide adequate training in the use and storage of flammable liquids
Monitor for liquids for proper use and storage Keep
only the minimum amount required on hand Ensure
that MSDS are current for all flammable liquids

Employees
Follow all storage and use requirements
Report deficiencies in storage and use to supervisors
Contain and clean spills if possible.
Report spills to supervisors.

4.12.3 Hazard Control

Engineering Controls
Properly designed flammable storage areas
Ventilated Storage areas
Grounding Straps on Drums and dispensing points
Administrative Controls
Designated storage areas
Limiting amount of flammable liquids in use and storage
Employee Training
Limited & controlled access to bulk storage areas
Posted Danger, Warning and Hazard Signs

4.12.4 Definitions

Flammable Liquid - a liquid with a flashpoint below 100^0F
Class IA - flashpoint below 73^0F and boiling point below 100^0F
Class IB - flashpoint below 73^0F and boiling point above 100^0F
Class IC - flash at or above 73^0F and below 100^0F
Combustible Liquids - a liquid having a flash point at or above 100^0 F.
Class II Combustibles - Flashpoint above 100^0F and below 140^0F
Class III Combustibles - Flashpoint at or above 140^0F

Subclass IIIA - flashpoint at or above 140^0F and below 200^0F
Subclass IIIB - flashpoint at or above 200^0F

4.12.5 Substitution

Flammable liquids sometimes may be substituted by relatively safe materials in order to reduce the risk of fires. Any substituted material should be stable and nontoxic and should either be nonflammable or have a high flashpoint.

4.12.6 Storage & Usage of Flammable Liquids

Flammable and combustible liquids require careful handling at all times. The proper storage of flammable liquids within a work area is very important in order to protect personnel from fire and other safety and health hazards.

- Storage of Flammable liquids shall be in NFPA approved flammable storage lockers or in low value structures at least 50 feet from any other structure. Do not store other combustible materials near flammable storage areas or lockers
- Bulk drums of flammable liquids must be grounded and bonded to containers during dispensing
- Portable containers of gasoline or diesel are not to exceed 5 gallons
- Safety cans used for dispensing flammable or combustible liquids shall be kept at a point of use.
- Appropriate fire extinguishers are to be mounted within 75 feet of outside areas containing flammable liquids, and within 10 feet of any inside storage area for such materials.
- Storage rooms for flammable and combustible liquids must have explosion-proof light fixtures
- Bulk storage of gasoline or diesel are kept in above ground tanks. Tank areas are diked to contain accidental spills. Tanks shall be labeled IAW NFPA guidelines. All tank areas shall be designated no smoking - no hot work - no open flame areas.
- No flames, hot work, or smoking is permitted in flammable or combustible liquid storage areas.
- The maximum amount of flammable liquids that may be stored in a building are

  20 gallons of Class IA liquids in containers

  100 gallons of Class IB, IC, II, or III liquids in containers

  500 gallons of Class IB, IC, II, or III liquids in a single portable tank.
- Flammable liquid transfer areas are to be separated from other operations by distance or by construction having proper fire resistance.
- When not in use flammable liquids shall be kept in covered containers.
- Class I liquids may be used only where there are no open flames or other sources of ignition within the possible path of vapor travel.

- Flammable or combustible liquids shall be drawn from or transferred into vessels, containers, or portable tanks within a building only through a closed piping system, from safety cans, by means of a device drawing through the top, or from a container or portable tanks by gravity through an approved self-closing valve. Transferring by means of air pressure on the container or portable tanks shall be prohibited.
- Maintenance and operating practices shall be in accordance with established procedures which will tend to control leakage and prevent the accidental escape of flammable or combustible liquids. Spills shall be cleaned up promptly.
- Combustible waste material and residues in a building or unit operating area shall be kept to a minimum, stored in covered metal receptacles and disposed of daily.
- Rooms in which flammable or combustible liquids are stored or handled by pumps shall have exit facilities arranged to prevent occupants from being trapped in the event of fire.
- Inside areas in which Class I liquids are stored or handled shall be heated only by means not constituting a source of ignition, such as steam, hot water or forces central systems located away from the area.

Cabinets

Not more than 120 gallons of Class I, Class II, and Class IIIA liquids may be stored in a storage cabinet. Of this total, not more than 60 gallons may be Class I and II liquids. Not more than three such cabinets (120 gallons each) may be located in a single fire area except in an industrial area.

Containers

The capacity of flammable and combustible liquid containers will be in accordance with the above table.

Maximum allowable capacity of containers and portable tanks

	Flammable Liquids		**Combustible Liquids**		
Container	**1A**	**1B**	**1C**	**II**	**III**
Glass or approved plastic1	1 pt[2]	1 qt[2]	1 gal	1 gal	1 gal
Metal (Other than DOT drums)	1 gal	5 gal	5 gal	5 gal	5 gal
Safety Cans	2 gal	5 gal	5 gal	5 gal	5 gal
Metal drums (DOT	60 gal	60 gal	60 gal	60 gal	60 gal
Approved portable tanks	660 gal	660 gal	660 gal	660 gal	660 gal

(1) Nearest metric size is also acceptable for the glass and plastic
(2) One gallon or nearest metric equivalent size may be used if metal and labeled with their contents.

Storage Inside Buildings

Where approved storage cabinets or rooms are not provided, inside storage will comply with the following basic conditions:

- The storage of any flammable or combustible liquid shall not physically obstruct a means of egress from the area or building.
- Containers of flammable or combustible liquids will remain tightly sealed except when transferred, poured or applied. Remove only that portion of liquid in the storage container required to accomplish a particular job.
- If a flammable and combustible liquid storage building is used, it will be a one- story building devoted principally to the handling and storing of flammable or combustible liquids. The building will have 2-hour fire-rated exterior walls having no opening within 10 feet of such storage.
- Flammable paints, oils, and varnishes in 1 or 5-gallon containers, used for building maintenance purposes, may be stored temporarily in closed containers outside approved storage cabinets or room if kept at the job site for less than 10 calendar days.

Ventilation

Every inside-storage room will be provided with a continuous mechanical exhaust ventilation system. To prevent the accumulation of vapors, the location of both the makeup and exhaust air openings will be arranged to provide, as far as practical, air movement directly to the exterior of the building and if ducts are used, they will not be used for any other purpose.

Designated Flammable Storage Areas

[to be document

4.13 Hearing Conservation

4.13.1 Introduction

Occupational Safety and Health Administration (OSHA) general industry standard, Occupational Noise Exposure (29 CFR) 1910.95), requires employers to implement a Hearing Conservation program when noise equals or exceeds an 8-hour time-weighted average sound level (TWA) of 85 decibels measured on the A scale (slow response) or, equivalently. Employees whose Time Weighted Average (TWA) noise exposure levels exceed 85 dB (A) must be added to the Hearing Conservation program. The OSHA noise standard is a minimum standard and may be improved upon in numerous areas, as long as employers provide at least as much protection as the standard. Meeting the National Institute for Occupational Safety and Health (NIOSH) recommended Exposure Limits (REL) is the goal of this program.

4.13.2 Purpose

To apply policy and practices to reduce the potential for occupational hearing loss for all employees whose job duties expose them to noise levels above those recommended by OSHA.

4.13.3 Policy

It is the policy of University of Missouri, Campus Facilities to provide its employees with a safe and healthful work environment. This primary objective includes reducing hearing loss due to exposure to hazardous levels of noise. This is accomplished by applying effective engineering and administrative control measure where feasible. When effective engineering and administrative controls are not feasible, or while they are being implemented or evaluated, hearing protection may be required to achieve this goal. Under these conditions employees will be provided and expected to wear hearing protection per manufacturer's recommendations. **Employees shall only wear hearing protectors provided by Campus Facilities**.

4.13.4 Responsibilities

Employer

The University of Missouri, Campus Facilities shall set the policy for the hearing conservation program; see that the policy is properly administered, and assure that it complies with OSHA recommendations. This includes delegation to or contracting with trained personnel to implement the various aspects of the hearing conservation program. In addition, the employer shall provide or contract for necessary noise control devices, noise measuring and audiometric equipment, and hearing protection devices.

Program Administrator

The program administrator shall ensure that noise measurements, audiometric testing, employee training, and the selection and fitting of hearing protections devices be implemented by appropriately trained/certified and knowledgeable individuals. The Program Administrator need not perform all of these functions, but shall ensure that the functions are effectively coordinated. This may include the use of Departmental Administrators.

Program Administrator: CF-Safety Representative
Department: MU Environmental Health and Safety
Departmental Administrators/Managers/supervisor responsible for scheduling audiometric testing, training, and employee compliance with this program.

Management and Supervisory Personnel

Managers and Supervisors of each area are responsible for ensuring that all employees under their supervision are trained and made aware of the hearing conservation requirements for their respective work areas. They are also responsible for ensuring their employees comply with all facets of this program, ensuring hearing protection devices are properly used, inspected and maintained, and for disciplinary procedures for employees who do not comply with the requirements of this program.

Employees

Employees in the Hearing Conservation Program shall be aware of the program requirements and responsible for complying with the all elements of the hearing conservation program, including properly wearing protective hearing devices per manufacturer's recommendations including, proper use and maintenance of these devices. Employees are encouraged to also protect their hearing while not at work, when participating in noisy task or hobbies.

4.13.5 Summary of OSHA's Noise Standard

OSHA standard CFR1910.95, calls for a maximum permissible exposure limit (PEL) of 90 dB(A). This noise limit is a time-weighted average level (TWA) for an eight hour exposure with no hearing protection. The standard also uses a 5 dB exchange rate or trading relationship between noise level and duration, meaning that the exposure level may be increased by 5 dB every time the duration is cut in half.

NIOSH publication #98-126 "Criteria for a recommended standard calls for a recommended exposure level (REL) of 85 dB(A). This limit is a time-weighted average level (TWA) for an eight hour exposure with no hearing protection. This standard also has a 140 dB(A) exposure ceiling. NIOSH uses a 3dB exchange rate or trading relationship between noise level and duration, meaning that the exposure level maybe increased by 3db every time the durations are cut in half. The following table below indicates the NIOSH based hearing protection needed for a given noise exposure level.

Table 1

dB(A) (**slow response**)	**Protection Level**
85- 96	Single Protection Required
97 and above	Double Protection Required

The above chart represents the protection level if employees are working in an area at the listed exposures. Hearing protection is encouraged, but not required for employees and visitors passing through an area at the listed exposures. A list of specific equipment and areas is listed in Appendix A

4.13.6 Noise Exposure Monitoring

Noise levels will be tested to determine the extent of the exposures, to target areas where noise controls may be necessary, and to identify employees who shall be included in other aspects is of the hearing conservation program.

Noise exposure monitoring will be conducted for all employees exposed to a TWA of 85 dB(A) or above.

Area monitoring may be used under some circumstances when recommended by the monitoring entity, but personal monitoring will be used when workers are highly mobile, noise levels vary considerably, or when the noise has a significant impulsive component. All continuous, intermittent, and impulsive sound from 80 dB(A) to 140 dB(A) shall be included in the calculation of noise exposure level or dose. The dosimeter shall be set to a threshold of 80 dB(A) to determine the need to implement a hearing conservation program and permissible exposure limits.

It is understood that noise conditions can be altered when equipment is eliminated, added, or rearrange in the workplace. When noise levels have been altered due to the above changes or when engineering review warrants it, additional testing may be performed.

Noise measurement equipment shall be recalibrated and maintained and used according to manufacturer's recommendations.

4.13.7 Engineering/Administrative Noise Control

When procuring new equipment, the University of Missouri Campus Facilities shall address noise levels in the specifications and selection when feasible. Feasible engineering or administrative controls shall be used to reduce noise levels to at least the PEL TWA or 85 dB(A) or less.

4.13.8 Audiometric Testing

New Campus Facilities employees participating in the CF Hearing Conservation program shall have a baseline audiometric test scheduled within the first six months of first exposure at, or above, the 85 db(A) with the appointed testing group. Baseline and annual audiograms will be preceded by at least 14 hours without exposure to workplace noise. Hearing protectors may be substituted for the 14 hour noise-free period, but this practice is not recommended. The responsibility for this scheduling shall be in accordance with section 4.13.4 of this document. Thereafter, all employees that are routinely exposed to equal or greater than a TWA of 85 dB(A) shall receive an audiometric test annually.

Audiograms will be conducted by a certified technician or by a trainee under the direct supervision of a licensed audiologist. Audiometric testing entities will be selected by Campus Facilities.

Audiograms shall be evaluated to determine whether a standard threshold shift (STS) has occurred, which is defined as a change in hearing threshold from a baseline in either ear of an average of 10dB or more at the audiometric frequencies of 2000, 3,000 and 4,000 Hz. Employees and those who experience an STS shall be notified in writing within 21 days of determination. Notification will also be sent by the testing entity to the Campus Facilities hearing Protection Program Administrator. The departmental administrator, manager, or supervisor will also receive a letter to direct the employee to use hearing protection and have their hearing protectors checked. They may be provided with hearing protectors, which offer greater attenuation if necessary. An annual audiogram may be substituted for the baseline if the reviewing professional determines that an STS is persistent. Employees shall be referred for further evaluation, if additional testing is necessary, or if a medical condition of the ear is thought to cause aggravation by the use of hearing protection.

The testing entity shall maintain accurate records of the measurements of the background sound pressure levels in audiometric test rooms to assure that, at a minimum, they meet the OSHA requirements as set out in Appendix D of standard 1910.95.

Names of employees who display work related hearing shifts of an average of 10 dB or more from the original baseline at 2,000, 3,000 and 4,000 HZ in either ear must be sent to University of Missouri Risk Management.

4.13.9 Hearing Protection

All employees exposed to noise at or above 85 dB(A) shall be provided with hearing protectors and shall wear them in accordance with this policy. All hearing protectors should have a noise reduction rating of 29 dB(A) or greater.

Employees shall be provided with a choice of suitable protectors, which OSHA has interpreted to mean at least one model of ear plugs and one model of ear muffs, more styles are preferred. More are preferred. Protectors will be provided at no cost to the employee.

Hearing protectors shall attenuate exposures to at least 85 dB(A) for an 8-hour TWA. Hearing protectors shall attenuate exposures to at least 85 dB(A) for employees who have experienced an STS. A Noise Reduction Rating of 29 or greater is required for all formable foam hearing protection.

Employers must reassess the adequacy of hearing protector attenuation whenever there is a change in exposure or process that might necessitate a change in attenuation.

4.13.10 Hearing Conservation Training Program

At time of hire and annually thereafter, a training program shall be provided for employees exposed to a TWA of 85 dB(A) or above. This program shall include the following:

1. An explanation of the effects of noise on hearing.

2. The purposes and procedures of audiometric testing.

3. Several aspects of hearing protection:
   *The purposes of hearing protectors.
   *The advantages, disadvantages, and attenuation of various types.
   *Selection, fitting, use, and care of the devices.

It is also advisable to discuss extra-curricular (non-occupational) noise exposures as this noise exposure also affect hearing in the same manner as occupational noise exposures.

The entire training program need not be conducted all at one time. Employees shall be re-trained every 12 months.

4.13.11 Record Keeping

Records shall be kept of noise exposure and audiometric tests, including details about instrumentation and calibration. Noise exposure measurements shall be kept for the duration of employment and audiometric test records shall be kept for the duration of employment by the testing entity It is recommended, however, that both types of records be maintained for substantially longer periods.

For employees that have been tested and determined to have an STS a copy of the STS will be sent to University of Missouri Risk Management.

Reviewed and approved by Campus Facilities Directors April 25, 2016

Appendix A
Single hearing protection required working in areas 85 dbA-96 db(A)
Double hearing protection required working in areas 97 db(A) and over

Equipment/Area	Single Hearing Protection	Double Hearing Protection
Landscape Services		
Back Pack Leaf Blower		Required
Hand Held Leaf Blower	Required	
John Deere 1145		Required
String Trimmer	Required	
Hedge Trimmer	Required	

John Deere 1445	Required	
John Deere 495	Required	
X-Mark Laser	Required	
X-Mark Turf Tracer	Required	
Power Plant Areas		
Boiler 12 Basement feed pumps and fans	Required	
Boiler 10 Basement next to fans	Required	
Gas turbine 1	Required	
Gas Turbine 2	Required	
Turbine deck when turbines are operating	Required	
East and West Ash Silo (Blower Rooms)		Required
Gas Compressor Building		Required
High pressure feed Water Pump		Required
Tools		
Caron Arc Gouging & Hammering		Required
Chop saw		Required
6 Inch Grinder		Required
Masonry Table Saws		Required
Handheld Masonry Saws		Required
Radial		Required
Metal Chop saw		Required
Hammer Drill		Required
Circular Saw	Required	
Disc Grinder	Required	
Band Saw	Required	
Handheld Grinders	Required	
Saber Cut Saw	Required	
Skill Saw	Required	
Pierce and Shear	Required	
Band Saw Lock Former	Required	
Plasma Cutter	Required	
24" Plainer	Required	
Power Mastic Shaper	Required	
36" Belt Sander	Required	
16" Plainer	Required	
Table Saw	Required	
Panel Saw	Required	
Belt Sander	Required	
Router	Required	
Miter Saw	Required	
Impact Driver	Required	

Square Scrub	Required	
Loading Cinder Trucks		Required
Kubota	Required	
Chainsaw		

*For equipment not listed in Appendix A, follow manufacturer's recommendations on hearing protection use. If not available contact Cf Safety Representative or Environmental Health and Safety for testing
*For areas not listed, contact Environmental Health and Safety or Campus Facilities Safety for further noise monitoring.

4.13.12 Hearing Protector Selection Standard Operating Procedure

Selecting the right type of hearing protectors depends on the type of noise and working conditions. Your safety, industrial hygiene, and/or health personnel should be able to find the right one for you.

One of the most important points is the length of time that you use your hearing protectors. The more comfortable and easy they are to use, the longer you will wear them.

Remember the following points when choosing your hearing

protectors: FIT
There must be an effective seal.

EFFICIENCY
Noise must be reduced to safe levels.

COMFORT
As you must use the hearing protectors all the time you are exposed to noise, they should be as light and as comfortable as possible.

EASY TO USE
Practical and simple to use.

COMPATIBLE WITH OTHER FORMS OF PROTECTION
You should be able to use other protective devices like safety glasses, hardhats, goggles, welding helmets or respirators with your hearing protectors.

You are encouraged to take hearing protection home for use in non-occupational noisy activities.

4.13.13 Hearing Protector Fit Test Protocol

Before using any hearing protection devices, always make sure that the device is clean and in good condition.

For all hearing protection devices, refer to the packaging materials for more specific information.

HOW TO FIT FOAM EARPLUGS

1. Wash your hands. Roll the earplug between your fingers to squeeze into as small a diameter as possible.

2. To insert the earplug more easily, straighten the ear canal by reaching over the head with the opposite hand and pulling slightly upward and back on the pinna (outer ear). Insert the earplug into the ear canal.

3. Hold the earplug in this position for several seconds until it has expanded.

HOW TO FIT PREMOLDED EARPLUGS

Premolded earplugs are made from flexible materials which are preformed to fit the ear. Many are sold in two or more sizes and must be individually sized for each ear. If you have difficulty with a premolded earplug, you should check with your fitter to make sure that the size is appropriate.

1. Straighten the ear canal by reaching over the head with the opposite hand and pulling slightly upward and back on the pinna (outer ear).

2. Grasp plug and insert until you feel it sealing.

3. If a good seal cannot be obtained with a slight twisting motion, use a smaller or larger size or try another type of ear protector.

HOW TO FIT CANAL CAPS (SEMI-AURAL DEVICES)

Canal caps have flexible tips connected to a lightweight headband.

1. Hold the large end of the tips and place them in the ear canal openings.

2. Continue to push and wiggle the tips until a firm seal is obtained.

HOW TO FIT EAR MUFFS

1. Align the height of the ear cup so as to completely cover the entire ear. Brush excess hair away from ear cushions as much as possible. Be certain the cushions seal tightly against the head, with no interference from objects such as respirator headbands, glasses, or earrings, in order to obtain the best performance.

2. The ear cups may be slipped up or down to adjust for a firm, comfortable fit on

the ear. Note: Ear muffs may not fit all head sizes and shapes.

4.13.14 Hearing Protection Training and Protocol

1. Explain to the employee the importance of paying attention to all noise exposures, both at work and at home.

2. Explain the difference between disposable and reusable earplugs.
   a. Disposable earplugs are thrown away after a limited number of usings while reusable earplugs may last several months.
   b. Disposable earplugs may be formed or molded to fit in the ear; reusable earplugs are usually pre-molded.

3. Discuss the proper fitting of earplugs
    a. When the first plug is inserted, sounds will be heard as if the ear is stuffed or plugged up. When the second plug is inserted, sounds should appear equal on both sides.
    b. Cup your hands over the ear after the plug is inserted. If sounds appear quieter when the hand is in place, the plug is not sealing properly.
    c. If the plug has a handle, pump it. You should feel a change in pressure.
    d. Make sure that the earplug does not slide out of the ear easily.
    e. To check the fit of foam plugs, insert the plug, allow it to expand fully, and then remove it. There should be a smooth indentation in the plug approximately 1/3 to 1/2 way down the plug and there should be no wrinkles or creases.

4. Explain the proper care and use of hearing protectors

    a. Disposable Earplugs
        1. Always ensure that hands are clean before inserting plugs.
        2. Discard any plug which becomes dirty or loses its flexibility.

    b. Reusable Earplugs
        1. Always ensure that hands are clean before inserting plugs.
        2. Wash daily with mild soap and water, rinse, dry and place in a storage container or plastic bag.
        3. Discard any plugs which are brittle, misshapen, or discolored or which have begun to shrink.
        4. Make sure canal caps, if used, have a tight and springy headband.

    c. Ear Muffs
        1. Wash ear muff seals daily with mild soap and water. Rinse and dry.
        2. Replace muff cushions which have become cracked, dried out or brittle. Replace entire muff when the headband has lost its tension.
        3. Personalize ear muffs with markers or tape labels. DO NOT drill initials into the ear muff caps.
        4. Make sure that the seal is tight by keeping long hair away from the seals, using glasses with small bows/temples, and avoiding large earrings.

5. If the employee has experienced an STS, have the employee demonstrate to the trainer how hearing protection is worn.
    a. Check the condition of the hearing protection device.
    b. Check for fit and reinstruct on insertion or use.
    c. Discuss the importance of using hearing protection for all activities with noise exposure. Discuss the work area, work situation, exposure levels and use of hearing protection devices. Refit with a protector having greater attenuation if appropriate.

6. Complete records:
    a. Have each employee sign a form indicating that training has been received.
    b. Make sure that all training forms are dated and include topics covered, training materials used and name(s) of presenter(s).

4.14 Safety Signs, Tags, and Markers (29CFR 1926.xxx/1910.xxx)

4.14.1 Purpose

The purpose of this section is to familiarize Campus Facilities employees with signs, tags and markers and symbols that warn of physical hazards in the workplace. Hazmat, Hazcom , Hazwoper and Bloodborne Pathogens signage is not included herein nor is Air Contaminants signage, which requires additional standards and may be found in "Confined Space Entry" or "Respiratory Protection Program" documents.

4.14.2 Scope

The following information applies to the design of signs, tags, markers and symbols and their use in designating hazards that could result in accidental injury, illness or property damage. Requirements herein apply to all uses, with the exception of street, highway, railroad, the workplace employee bulletin board, and safety poster signage.

Signs and tags are not intended as substitutes for eliminating hazards.

Preferred methods for dealing with hazards are engineering controls,

administrative/environmental controls, P.P.E, or other safe-work practices.

A sign or tag's ability to warn employees depends upon catching the worker's

attention, even in emergency situations. To ensure a quick, safe response,

signage shall be consistent in color-coding, key words and symbols.

Tags are *temporary* means of warning all concerned of a hazardous condition,

defective equipment, etc.

Tags are not intended as a complete method of protection or warning and

shall be used only until a more positive means of hazard control can be put

in place, e.e., Lock Out /Tag Out (LOTO)

Tags shall not be used in place of, or as a substitute for, signs.

Markers shall be able to withstand the environment where they are used.

Specifications for the Definition, Design and Wording on New and Replacement Signs and Tags

4.14.3 Definitions

- **Sign** - A surface with letters or markings thereon to alert workers and the public to hazards. Excluded are news releases, safety posters and employee bulletins.
- **Tag** - a device usually made of paper, pasteboard, card, plastic or other material used to identify a hazardous condition

  Example: A "Do Not Start" tag placed on a machine on which repairs are to be made. LOTO procedures would then be implemented to lock out, de-energize, or inactivate the machine.

- **Marker** - Smaller than signs, Most often associated with an adhesive-type mounting. Must be able to withstand the environment where it is used.

  Example: A warning of 440 Volts on front of an A.C. Panel.

4.14.4 Design

- All signs must have rounded or blunt corners and be free of sharp edges, burrs, splinters or other sharp projections.
- Fastening devices shall not pose a hazard
- Colors shall be of opaque glossy as specified by ANSI Z535 - 1998

4.14.5 Wording

- Wording on signs shall be accurate, concise, understandable, and contain specifics, such as "HIGH VOLTAGE" or "CLOSE CLEARANCE," explaining its existence.
- Shall be visible at all times during work and shall be removed or covered promptly when the hazard no longer exists

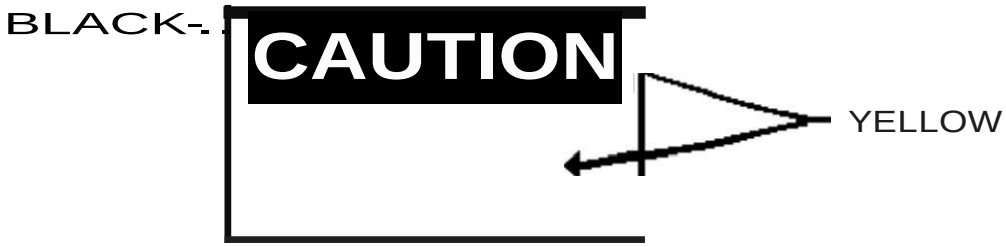
OSHA and ANSI Color -Code Reference

RED	FIRE	To designate the location of protection equipment and apparatus, including fire alarm boxes, fire blankets, fire exit, etc. To Identify safety cans and other
	DANGER	
	STOP	To mark dangerous parts of machines and equipment that may cut, crush, shock
YELLOW	CAUTION	To mark physical hazards which might result in stumbling, falling, tripping, striking against or being caught between.
	SAFETY	To Mark the location of first aid and safety equipment
	WARNING	To warn against starting, using or moving equipment under repair. Also used for designating information
MAGENTA/	RADIATION	To Mark X-Ray, alpha, beta, gamma, neutron and proton radiation
	BOUNDRIES	To designate traffic aisles, housekeeping markings, stairways (risers, direction and boarder limit lines) and directional signs.

Use of Signs- Note: Old Signage shall be upgraded as needed to reflect the new standards

Figure 1 - old signage

Figure 2



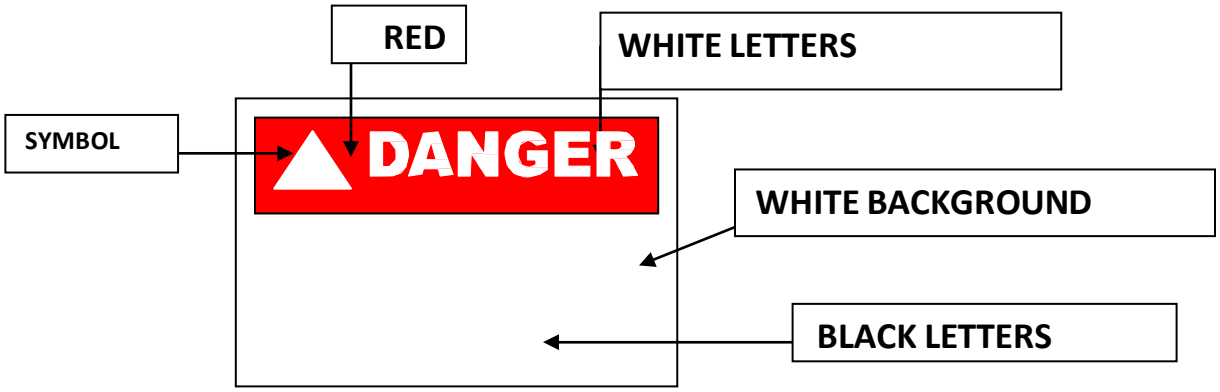
New Signage - ANSI Z535.2 - 1998

A. **"Danger" signs: Used in the most extreme situations, where an immediate hazard may cause death or serious injury.**

- Signs posted to warn of specific dangers, including radiation hazards
- "Danger" signs must have the same type of design
- Used only where an immediate hazard exists
- Employees must be instructed that these signs warn of immediate danger and special precautions are necessary.

SOME EXAMPLES: - Immediate Dangers- Death or Serious Injury

• **Caustics**	• **Do Not Enter - Authorized Personnel Only**
• **Chlorine**	• **Hard Hat Area**
• **Compressed Air**	• **High Voltage**
• **Confined Space**	• **Keep Hands Clear**
• **Crane Overhead**	• **Look out for fork lift**
• **Eye and Face Protection Required**	• **XXX Volts**
• **Hazardous Area**	• **Keep Out**
• **High Pressure Line**	• **Ear Protection Required**

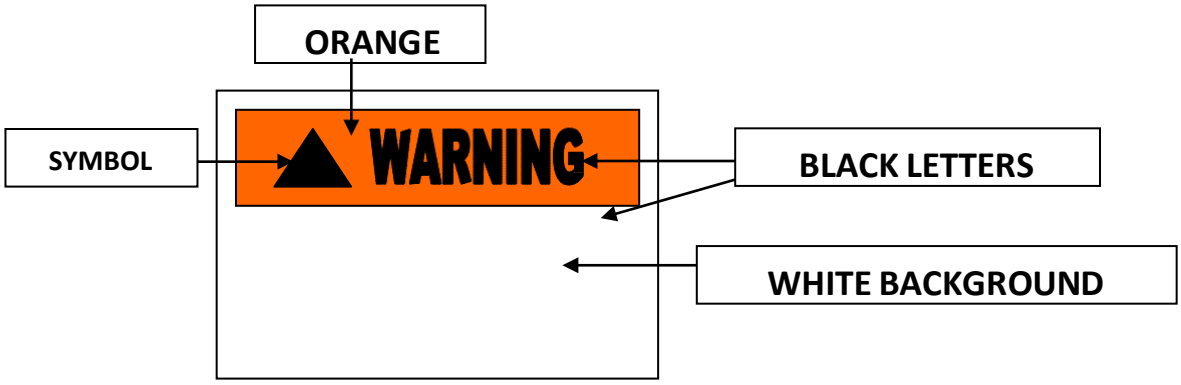


New Signage Cont.

B. WARNING - Potential Hazard (likely to occur), **could cause death or serious injury.**

Some Examples: Potential Dangers - Could cause death or serious injury

• **Do Not Operate Without Guards in Place**	• **High Voltage - Keep Away**
• **Lockout Power Before Working on Equipment**	• **Machine Starts Automatically**
• **Chemical Storage Area**	• **Electric Hazard**
• **Keep Clear of Moving Parts**	• **Emergency Exit - Do Not Block**
• **Noise Area**	• **HOT**
• **Eye Protection Required in this area**	• **No Trespassing**
• **Keep Out**	• **Propane**
• **Noise Area**	• **ACID**



C. CAUTION- Potential hazard (likely to occur), may cause minor to moderate injury

- Use caution signs only to warn against potential hazards (likely to occur).
- Use to caution against unsafe practices
- Instruct employees that a caution sign indicates a possible hazard and to take proper precautions

CAUTION

D. Safety Instruction Signs - Must be white and have a "Safety Blue" with white letters. Any letter on the white background must be black.

- Used where general instructions on safety measures are needed.

E. EXIT - when required, shall be lettered in legible red letters and not less than 6" high on a white field. The main stroke of the letter shall be ¾ " wide.

- Used to indicate a means of egress (escape)

F. Directional - (other than automotive traffic signs) shall be white with a black panel and a white directional symbol. Additional lettering shall be black letters on white background.

- Used to show a path or a direction (i.e. air flow)

G. Traffic Sign

- Shall be posted in work areas at points of hazard
- Shall conform to ANSI D6.1-1971 (Manual of Uniform Traffic Control Devices for Streets and Highways)

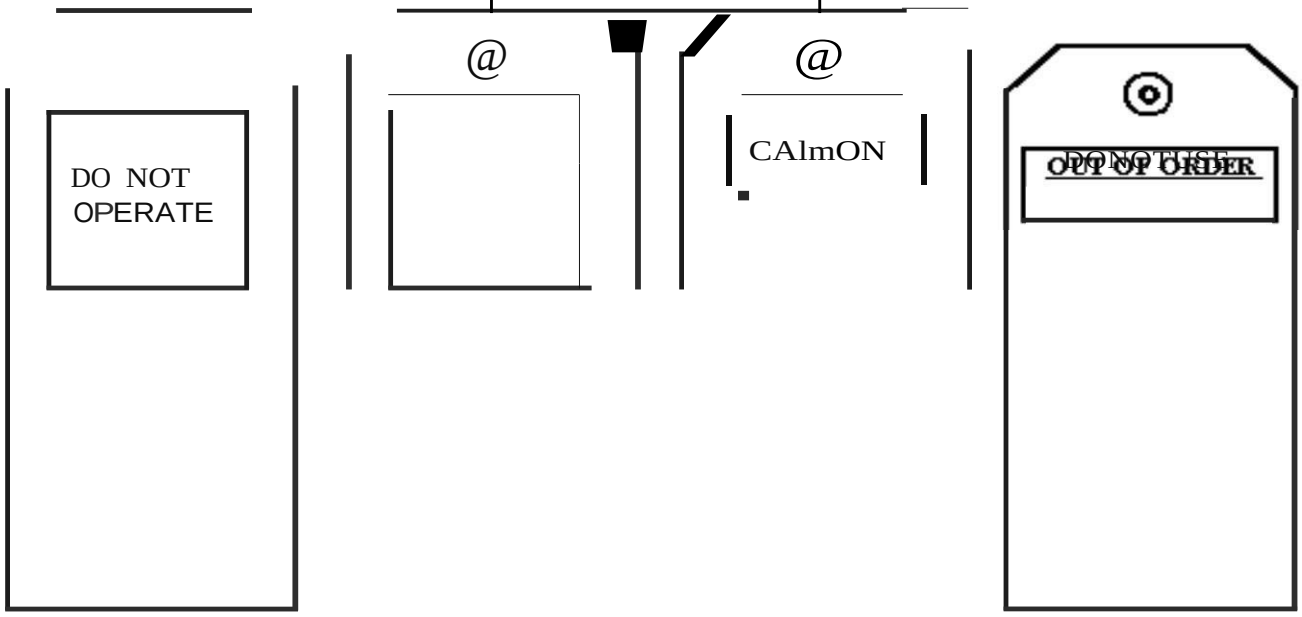
H. Biological Hazard - (Biohazard)

- Used to signify actual or potential presence of a biohazard.
- Used to identify equipment, containers, rooms, material, experimental animals or combinations thereof that contain, or are contaminated with viable (live or active) hazardous agents.
- Biohazard refers only to those infectious agents that are a risk or potential risk to humans.

2. TAGS--- OTHER THAN LOCKOUT/TAG OUT

(OLD OR NEW SIGNAGE ACCEPTABLE)

Figure 3



White tag - White letters on a red square

White tag• White letters on red oval with a black square

Yellow tag• Yellow letters on a black back• ground

White tag• White letters on a black back• ground

Basic Stock (Background)	Safety Colors (Ink)	Copy Specification (Letters)
White	Red	Do Not Operate
White	Black and Red	Danger
Yellow	Black	Caution
White	Black	Out of Order Do Not Use

4.14.6 General Rules for Use of Warning Signs, Tags, And Markers

Voltages and Live Parts

1. Post signs conspicuously to prevent unauthorized personnel from entering rooms or other guarded locations containing exposed live parts.

No Smoking" or "Open Flame" signs around operations that constitute a fire hazard.

2. Post "High Voltage" signs where live parts may be contacted.
3. Mark "High Voltage" permanently, visibly and readily legible on the outside box covers of pull and junction boxes of systems of 600 Volts or greater.
4. Signs or visible markings on the equipment or structure must indicate the operating voltage of exposed live parts of transformer installations.
5. Post and maintain proper signs where an exposed or concealed energized electric power circuit exists.
6. When more than one independent crew must have the same line or equipment de-energized, each crew must prominently tag the line or equipment.
7. When covers of manholes, handholds, or vaults are removed, promptly place appropriate warning signs.

Permit Required Confined Space Entry

8. If the workplace contains permit spaces, exposed employees must be informed by posted danger signs or other equally effective means, of the existence, location and danger posed by the permit space.

Telecommunications

9. Post conspicuous warning signs and /or flags or other traffic control devices in the vicinity of vehicular or pedestrian traffic before work that may endanger employees is begun.
10. Post danger signs if work exposes energized or moving parts that are normally protected.
11. Poles unsafe to climb must be conspicuously tagged.

Ladders, Tools, and Equipment

13. Defective ladders, tools, and equipment, that are withdrawn from service must be immediately tagged "Do Not Use" until such time as the equipment is repaired of disposed.

Welding, Cutting, Brazing

(See Welding, Cutting and Brazing Procedures)

Material, Personnel Hoists and Elevators, Powered Platforms, Gantry Cranes, Overhead Cranes and Conveyors

14. Post hoist- and elevator-operating rules, including signal system and allowable line speed for various loads, along with a "No Riders Allowed" sign at the operator's station and on the car frame or crosshead.

15. Follow appropriate LOTO procedures on conveyors. "Do Not Operate" tags must be used during repair of the equipment and when operation would be hazardous to maintenance personnel.
16. Place warning or "Out of Order" signs on the crane and on the floor beneath (or on the hook so that it is visible from the floor) and then follow appropriate LOTO procedures before adjusting overhead/gantry cranes.
17. When a suspension wire rope is put in place to be used and remain at a specific location: A corrosion-resistant tag that includes the rope's diameter, construction classification, whether non-preformed or preformed, grade of material, manufacturer's name, rated strength, month and year the ropes were installed, and name and company of the installer must be securely attached to one of the wire rope fastenings. The original tag must be stamped with the date of the resocketing, or the tag retained and a supplemental tag provided showing the date, installer, and company. A new tag must be installed at each rope renewal

Concrete and Masonry

18. Signs and barriers must be used to limit employee access to post-tensioning areas during tensioning operations.

Spray Finishing Using Flammable and Combustible Materials

19. Post conspicuous "No Smoking" signs in large letters on a contrasting color background when:
    - spraying areas and paint-storage rooms,
    - powder-coating areas and storage rooms,
    - storing, mixing or applying organic peroxides .

Underground Construction

20. Post "KEEP OUT" signs on unused chutes, manways and other openings.
21. Post warning signs at all entrances to operations involving gas.
22. Prominently post signs at all entrances to an underground jobsite when air-monitoring determines that contaminants may be present in dangerous quantities.
23. Post "NO SMOKING" and "OPEN FLAMES" signs in areas where fire or explosion hazards exist.
24. Post "Buried Line" signs where air lines are buried or hidden by water or debris.

4.15 Stairways and Ladders

4.15.1 Introduction

Stairways and ladders are a major source of injuries and fatalities among construction workers. OSHA estimates that there are 24,882 injuries and as many as 36 fatalities per year due to falls from stairways and ladders used in construction. Nearly half of these injuries are serious enough to require time off the job--11,570 lost workday injuries and 13,312 non-lost workday injuries occur annually due to falls from stairways and ladders used in construction. As these data demonstrate, work on and around ladders and stairways is hazardous.

4.15.2 Scope and application

Information herein applies to all stairways and ladders used in construction, alteration, repair (including painting and decorating), and demolition of worksites. Information does not apply to ladders that are specifically manufactured for scaffold access and egress, but does apply to job-made and manufactured portable ladders intended for general-purpose use and which are then used for scaffold access and egress. Rules for ladders used on or with scaffolds are addressed in Subpart L--*Scaffolds* (29 CFR 1926.451).

4.15.3 General Requirements

- A stairway or ladder must be provided at all worker points of access where there is a break in elevation of 19 inches (48 cm) or more and no ramp, runway, embankment, or personnel hoist is provided.
- When there is only one point of access between levels, it must be kept clear to permit free passage by workers. If' free passage becomes restricted, a second point of access must be provided and used.
- Where there are more than two points of access between levels, at least one point of access must be kept clear.
- All stairway and ladder fall-protection systems required by these rules must be installed and all duties required by stairway and ladder rules herein must be performed before employees begin work that requires their use and that of respective fall-protection systems.

Stairways

The following general requirements apply to all stairways used during the process of construction:

- Stairways that will not be a permanent part of the structure on which construction work is performed must have landings at least 30 inches deep and 22 inches wide at every 12 feet or less of vertical rise.
- Stairways must be installed at least 30 degrees -- and no more than 50 degrees -- from the horizontal.
- Variations in riser height or stair tread depth must not exceed 1/4 inch in any stairway system, including any foundation structure used as one or more treads of the stairs.

- Where doors or gates open directly onto a stairway, a platform must be provided that extends at least 20 inches beyond the swing of the door.
- Metal pan landings and metal pan treads must be secured in place before filling.
- All stairway parts must be free of dangerous projections such as protruding nails.
- Slippery conditions on stairways must be corrected.
- Workers may not use spiral stairways that will not be a permanent part of the structure.

The following requirements apply to stairs in temporary service during construction:

- Except during construction of the actual stairway, stairways with metal pan landings and treads must not be used where the treads and/or landings have not been filled in with concrete or other materials, unless the pans of the stairs and/or landings are temporarily filled in with wood or other materials. All treads and landings must be replaced when worn below the top edge of the pan.
- Except during construction of the actual stairway, skeleton metal frame structures and steps must not be used (where treads and/or landings will be installed later) unless the stairs are fitted with secured temporary treads and landings.
- Temporary treads must be made of wood or other solid material and installed the full width and depth of the stair.

Stair rails and Handrails

The following general requirements apply to all stair rails and handrails:

- Stairways having four or more risers, or rising more than 30 inches in height--whichever is less--must have at least one handrail. A stair rail also must be installed along each unprotected side or edge. When the top edge of a stair rail system also serves as a handrail, the height of the top edge must be no more than 37 inches nor less than 36 inches from the upper surface of the stair rail to the surface of the tread.
- Winding or spiral stairways must have a handrail to prevent using areas where the tread width is less than 6 inches.
- Stair rails installed after Mach 15, 1991, must be not less than 36 inches in height.
- Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members must be provided between the top rail and stairway steps to the stair rail system.
- Midrails, when used, must be located midway between the top of the stair rail system and the stairway steps.
- Screens or mesh, when used, must extend from the top rail to the stairway step and along the opening between top rail supports.
- Intermediate vertical members, such as balusters, when used, must not be more than 19 inches apart.
- Other intermediate structural members, when used, must be installed so that there are no openings of more than 19 inches wide.
- Handrails and the top rails of the stair rail systems must be able to withstand, without failure, at least 200 pounds of weight applied within 2 inches of the top edge in any downward or outward direction, at any point along the top edge.
- The height of handrails must not be more than 37 inches nor less than 30 inches from the upper surface of the handrail to the surface of the tread.
- The height of the top edge of a stair rail system used as a handrail must not be more than 37 inches or less than 36 inches from the upper surface of the stair rail system to

the surface of the tread.

- Stair rail systems and handrails must be surfaced to prevent injuries such as punctures or lacerations and to keep clothing from snagging.
- Handrails must provide an adequate handhold for employees to grasp to prevent falls.
- The ends of stair rail systems and handrails must be built to prevent dangerous projections, such as rails protruding beyond the end posts of the system.
- Temporary handrails must have a minimum clearance of 3 inches between the handrail and walls, stair rail systems, and other objects.
- Unprotected sides and edges of stairway landings must be provided with standard 42-inch guardrail systems.

Ladders

The following general requirements apply to all ladders, including job-made ladders:

- A double-cleated ladder or two or more ladders must be provided when ladders are the only way to enter or exit a work area having 25 or more employees, **or** when a ladder serves simultaneous two-way traffic.
- Ladder rungs, cleats, and steps must be parallel, level, and uniformly spaced when the ladder is in position for use.
- Rungs, cleats, and steps of portable and fixed ladders (except as provided below) must not be spaced less than 10 inches apart, nor more than 14 inches apart, along the ladder's side rails.
- Rungs, cleats, and steps of step stools must not be less than 8 inches apart, nor more than 12 inches apart, between center lines of the rungs, cleats, and steps.
- Rungs, cleats, and steps at the base section of extension trestle ladders must not be less than 8 inches (20 cm) nor more than 18 inches apart, between center lines of the rungs, cleats, and steps. The rung spacing on the extension section must not be less than 6 inches nor more than 12 inches.
- Ladders must not be tied or fastened together to create longer sections unless they are specifically designed for such use.
- A metal spreader or locking device must be provided on each stepladder to hold the front and back sections in an open position when the ladder is being used.
- When splicing side rails, the resulting side rail must be equivalent in strength to a one-piece side rail made of the same material.
- Two or more separate ladders used to reach an elevated work area must be offset with a platform or landing between the ladders, except when portable ladders are used to gain access to fixed ladders.
- Ladder components must be surfaced to prevent injury from punctures or lacerations. and prevent snagging of clothing.
- Wood ladders must not be coated with any opaque covering, except for identification or warning labels which may be placed only on one face of a side rail.

Portable Ladders

- Non-self-supporting and self-supporting portable ladders must support at least four times the maximum intended load; extra heavy-duty type 1A metal or plastic ladders must sustain 3.3 times the maximum intended load. The ability of a self-supporting ladder to sustain loads must be determined by applying the load to the ladder in a downward vertical direction. The ability of a non-self-supporting ladder to sustain loads must be

determined by applying the load in a downward vertical direction when the ladder is placed at a horizontal angle of 75.5 degrees.

- The minimum clear distance between side rails for all portable ladders must be 11.5 inches.
- The rungs and steps of portable metal ladders must be corrugated, knurled, dimpled, coated with skid-resistant material, or treated to minimize slipping.

Fixed Ladders

- A fixed ladder must be able to support at least two loads of 250 pounds each, concentrated between any two consecutive attachments. Fixed ladders also must support added anticipated loads caused by ice buildup, winds, rigging, and impact loads resulting from using ladder safety devices.
- Individual rung/step ladders must extend at least 42 inches above an access level or landing platform either by the continuation of the rung spacing as horizontal grab bars or by providing vertical grab bars that must have the same lateral spacing as the vertical legs of the ladder rails.
- Each step or rung of a fixed ladder must be able to support a load of at least 250 pounds applied in the middle of the step or rung.
- The minimum clear distance between the sides of individual rung/step ladders and between the side rails of other fixed ladders must be 16 inches.
- The rungs of individual rung/step ladders must be shaped to prevent slipping off the end of the rungs.
- The rungs and steps of fixed metal ladders manufactured after March 15, 1991, must be corrugated, knurled, dimpled, coated with skid-resistant material, or treated to minimize slipping.
- The minimum perpendicular clearance between fixed ladder rungs, cleats, steps, and any obstruction behind the ladder must be 7 inches, except that the clearance for an elevator pit ladder must be 4.5 inches.
- The minimum perpendicular clearance between the centerline of fixed ladder rungs, cleats, and steps, and any obstruction on the climbing side of the ladder must be 30 inches. If obstructions are unavoidable, clearance may be reduced to 24 inches, provided a deflection device is installed to guide workers around the obstruction.
- The step-across distance between the center of the steps or rungs of fixed ladders and the nearest edge of a landing area must be no less than 7 inches and no more than 12 inches. A landing platform must be provided if the step-across distance exceeds 12 inches.
- Fixed ladders without cages or wells must have at least a 15-inch clear width to the nearest permanent object on each side of the centerline of the ladder.
- Fixed ladders must be provided with cages, wells, ladder safety devices, or self-retracting lifelines where the length of climb is less than 20 feet but the top of the ladder is at a distance greater than 20 feet above lower levels.
- If the total length of the climb on a fixed ladder equals or exceeds 20 feet, the following requirements must be met: fixed ladders must be equipped with either (a) ladder safety devices; (b) self-retracting lifelines and rest platforms at intervals not to exceed 150 feet; or (c) a cage or well, and multiple ladder sections, each ladder section not to exceed 50 feet in length. These ladder sections must be offset from adjacent sections, and landing platforms must be provided at maximum intervals of 30 feet.
- The side rails of through or side-step fixed ladders must extend 42 inches above the top level or landing platform served by the ladder. Parapet ladders must have an access

level at the roof if the parapet is cut to permit passage through it; if the parapet is continuous, the access level is the top of the parapet.

- Steps or rungs for through-fixed-ladder extensions must be omitted from the extension; and the extension of side rails must be flared to provide between 24 inches and 30 inches clearance between side rails.
- When safety devices are provided, the maximum clearance distance between side rail extensions must not exceed 36 inches.

Cages for Fixed Ladders

- Horizontal bands must be fastened to the side rails of rail ladders or directly to the structure, building, or equipment for individual-rung ladders.
- Vertical bars must be on the inside of the horizontal bands and must be fastened to them.
- **Cages must not extend less than 27 inches, or more than 30 inches from the centerline** of the step or rung, and must not be less than 27 inches wide.
- The inside of the cage must be clear of projections.
- Horizontal bands must be spaced at intervals not more than 4 feet apart measured from centerline to centerline.
- Vertical bars must be spaced at intervals not more than 9.5 inches, measured centerline to centerline.
- The bottom of the cage must be between 7 feet and 8 feet above the point of access to the bottom of the ladder. The bottom of the cage must be flared not less than 4 inches between the bottom horizontal band and the next higher band.
- The top of the cage must be a minimum of 42 inches above the top of the platform or the point of access at the top of the ladder. Provisions must be made for access to the platform or other point of access.

Wells for Fixed Ladders

- Wells must completely encircle the ladder.
- Wells must be free of projections.
- The inside face of the well on the climbing side of the ladder must extend between 27 inches (68 cm) and 30 inches from the centerline of the step or rung.
- The inside width of the well must be at least 30 inches.
- The bottom of the well above the point of access to the bottom of the ladder must be between 7 feet and 8 feet.

Ladder Safety Devices and Related Support Systems for Fixed Ladders

- All safety devices must be able to withstand, without failure, a drop test consisting of a 500-pound weight dropping 18 inches.
- All safety devices must permit the worker to ascend or descend without continually having to hold, push, or pull any part of the device, leaving both hands free for climbing.
- All safety devices must be activated within 2 feet after a fall occurs, and limit the descending velocity of an employee to 7 feet/second or less.
- The connection between the carrier or lifeline and the point of attachment to the body belt or harness must not exceed 9 inches in length.

Mounting Ladder Safety Devices for Fixed Ladders

- Mountings for rigid carriers must be attached at each end of the carrier, with intermediate mountings, spaced along the entire length of the carrier, to provide the necessary strength to stop workers' falls.
- Mountings for flexible carriers must be attached at each end of the carrier. Cable guides for flexible carriers must be installed with a spacing between 25 feet and 40 feet along the entire length of the carrier, to prevent wind damage to the system.
- The design and installation of mountings and cable guides must not reduce the strength of the ladder.
- Side rails and steps or rungs for side-step fixed ladders must be continuous in extension.

4.15.4 Use of All Ladders

- When portable ladders are used for access to an upper landing surface, the side rails must extend at least 3 feet above the upper landing surface. When such an extension is not possible, the ladder must be secured, and a grasping device such as a grab rail must be provided to assist workers in mounting and dismounting the ladder. A ladder extension must not deflect under a load that would cause the ladder to slip off its supports.
- Ladders must be maintained free of oil, grease, and other slipping hazards.
- Ladders must not be loaded beyond the maximum intended load for which they were built or beyond their manufacturer's rated capacity.
- Ladders must be used only for the purpose for which they were designed.
- Non-self-supporting ladders must be used at an angle where the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder. Wood job-made ladders with spliced side rails must be used at an angle where the horizontal distance is one-eighth the working length of the ladder.
- Fixed ladders must be used at a pitch no greater than 90 degrees from the horizontal, measured from the back side of the ladder.
- Ladders must be used only on stable and level surfaces unless secured to prevent accidental movement.
- Ladders must not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental movement. Slip-resistant feet must not be used as a substitute for the care in placing, lashing, or holding a ladder upon slippery surfaces.
- Ladders placed in areas such as passageways, doorways, or driveways, or where they can be displaced by workplace activities or traffic must be secured to prevent accidental movement or a barricade must be used to keep traffic or activities away from the ladder.
- The area around the top and bottom of the ladders must be kept clear.
- The top of a non-self-supporting ladder must be placed with two rails supported equally unless it is equipped with a single support attachment.
- Ladders must not be moved, shifted, or extended while in use.
- Ladders must have nonconductive side rails if they are used where the worker or the ladder could contact exposed energized electrical equipment.
- The top or top step of a stepladder must not be used as a step.
- Cross-bracing on the rear section of stepladders must not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.
- Ladders must be inspected by a competent person for visible defects on a periodic basis and after any incident that could affect their safe use.

- Single-rail ladders must not be used.
- When ascending or descending a ladder, the worker must face the ladder.
- Each worker must use at least one hand to grasp the ladder when climbing.
- A worker on a ladder must not carry any object or load that could cause him/her to lose balance and fall.
- Read and follow the manufacturer's instructions label affixed to the ladder if you are unsure how to use the ladder.
- Do not use ladders that have loose rungs, cracked or split side rails, missing rubber pads, or are otherwise visibly damaged. Inspect ladders before use.
- Keep ladder rungs clean and free of grease; remove buildup of material such as dirt or mud.
- Do not use a metal ladder on rooftops or within reach of tools and equipment to electrical power lines.
- Orchard Ladders are for tree work only (3 point) and shall only be used by qualified employees.
- Specialty ladders shall only be used by qualified trained employees.
- Do not place ladders in a passageway or doorway without posting warning signs or cones that detour pedestrian traffic away from the ladder; secure the doorway that you are blocking with the ladder and post signs that will detour traffic away from your work. Never block a doorway that is a fire exit.
- Do not place a ladder at a blind corner or doorway without diverting foot traffic by blocking or roping off the area.
- Allow only one person on the ladder at a time.
- Face the ladder when climbing up or down it.
- Maintain a three-point contact by keeping both hands and one foot or both feet and one hand on the ladder at all times when climbing up or down the ladder.
- When performing work from a ladder, face the ladder and do not lean backward or sideways from the ladder.
- Do not stand on tables, chairs, boxes or other improvised climbing devices to reach high places; use the ladder or stepstool.
- Do not stand on the top two rungs of any ladder.
- Do not stand on a ladder that wobbles, or that leans to the left or right of center.
- When using a ladder, extend the top of the ladder at least 3 feet above the edge of the landing.
- Secure the non-step ladder in place by having another employee hold it or by roping it off at the ground or the top.
- Do not move a rolling ladder while someone is on it.
- Do not place ladders on barrels, boxes, loose bricks, pails, concrete blocks or other unstable bases.
- Do not carry items in your hands while climbing up or down a ladder.
- Do not try to "walk" a ladder by rocking it. Climb down the ladder, and then move it.
- Do not use a ladder as a horizontal platform.
- Do not lay unattended tools or materials on top of ladders.
- Ladders not in use shall be stored appropriately so that they cannot be climbed by mistake.
- Ladders should be stored in a horizontal position when possible and practical.
- Ladders not in use shall be secured. Never leave a ladder unattended.
- For further information, see your supervisor or safety program manual.

4.15.5 Structural Defects

- Portable ladders with structural defects--such as broken or missing rungs, cleats, or steps, broken or split rails, corroded components, or other faulty or defective components--must immediately be marked defective, or tagged with "Do Not Use," or similar language, and withdrawn from service until repaired.
- Fixed ladders with structural defects--such as broken or missing rungs, cleats, or steps, broken or split rails, or corroded components--must be withdrawn from service until repaired.
- Defective fixed ladders are considered withdrawn from use when they are (a) immediately tagged with "Do Not Use" or similar language; (b) marked in a manner that identifies them as defective; or (c) blocked-such as with a plywood attachment that spans several rungs.
- Ladder repairs must restore the ladder to a condition meeting its original design criteria before the ladder is returned to use.

4.15.6 Training Requirements

Under the provisions of these requirements, employers must provide a training program for each employee using ladders and stairways. The program must enable each employee to recognize hazards related to ladders and stairways and to use proper procedures to minimize these hazards. For example, employers must ensure that each employee is trained by a competent person in the following areas, as applicable:

- the nature of fall hazards in the work area:
- the correct procedures for erecting, maintaining, and disassembling the fall protection systems to be used;
- the proper construction, use, placement, and care in handling of all stairways and ladders; and the maximum intended load-carrying capacities of ladders used.

In addition, employers must, as necessary, retrain each employee to maintain the understanding and knowledge acquired through compliance with these provisions.

4.15.7 Glossary

Cleat - A ladder crosspiece of rectangular cross section placed on edge upon which a person may step while ascending or descending a ladder.

Double-Cleat Ladder - A ladder with a center rail to allow simultaneous two-way traffic for employees ascending or descending.

Failure - Load refusal, breakage, or separation of components.

Fixed Ladder - A ladder that cannot be readily moved or carried because it is an integral part of a building or structure.

Handrail - A rail used to provide employees with a handhold for support.

Job-Made Ladder - A ladder that is fabricated by employees, typically at the construction site; noncommercially manufactured.

Load Refusal - The point where the structural members lose their ability to carry the load.

Point of Access - All areas used by employees for work-related passage from one area or level to another.

Portable Ladder - A ladder that can be readily moved or carried.

Riser Height - The vertical distance from the top of a tread or platform/landing to the top of the next higher tread or platform/landing.

Side-Step Fixed Ladder - A fixed ladder that requires a person getting off at the top to step to the side of the ladder side rails to reach the landing.

Single-Cleat Ladder - A ladder consisting of a pair of side rails connected together by cleats, rungs, or steps.

Stair rail System - A vertical barrier erected along the unprotected sides and edges of a stairway to prevent employees from falling to lower levels.

Temporary Service Stairway - A stairway where permanent treads and/or landings are to be filled in at a later date.

Through Fixed Ladder - A fixed ladder that requires a person getting off at the top to step between the side rails of the ladder to reach the landing.

Tread Depth - The horizontal distance from front to back of a tread, excluding nosing, if any.

4.16 Excavation

4.16.1 Purpose

The purpose of this program is to prevent injuries and accidents from occurring during excavation work Campus Facilities (CF) performs. This policy will set forth the official practices required for excavations made by the employees on property owned by the University Of Missouri (MU).

4.16.2 Scope

The program applies to any and all CF employees who perform excavation type work, or who work around utility construction job sites.

4.16.3 Definitions

Aluminum air shoring - An engineered shoring system comprised of aluminum air cylinders (crossbraces), used in conjunction with vertical rails (uprights) or horizontal rails (walers). Such a system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.
Benching - A method of protecting employees from cave-ins by excavating the sides of an excavation to form 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 working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. All competent persons must complete the trenching and shoring class, and be certified by the department for successful completion of the class. A competent person should have and be able to demonstrate the following:

They have the Training, experience, and knowledge of soil analysis, protective systems, and the requirements of OSHA 29 CFR 1926 Subpart P. A Competent Person must have the authority to exercise prompt corrective measures to eliminate existing and predictable hazards and to stop work when required. They must have the ability to recognize the following:

1. Conditions that could result in cave-ins,
2. Failures in protective systems,
3. Hazardous atmospheres,
4. Other hazards including those associated with working in confined spaces.

Excavation - Any man-made cut, cavity, trench, or depression in the earth's surface formed by earth removal
Registered professional engineer (PE) - A person who is registered as a professional engineer in the state of Missouri

Shield (shield system) - A structure that is able to withstand the forces imposed on it by a

cave-in and has the ability to protect employees within the structure. Shields can be a permanent structure or can be designed to be portable (trench box) and moved along as work progresses.

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

Sloping (sloping system) - A method of protecting employees by sloping away from the sides of a trench or excavation so as to prevent cave-ins. The angle of slope will vary based on factors such as soil type, environmental conditions of exposure, and application of surcharge loads.

Trench (trench excavation) - 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. If forms or other structures are installed or constructed in an excavation as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet or less, the excavation is also considered to be a trench.

4.16.4 Procedures

A competent person shall be assigned to all excavations or trenches 4 feet or greater in depth and excavation shall be appropriately benched, shored, or sloped according to the procedures and requirements set forth in OSHA's Excavation standard, OSHA 29 CFR 1926.650, .651, and .652. Excavations or trenches 20 feet deep or greater must have a protective system designed by a registered professional engineer.

Guidelines

- Underground utilities must be located and marked before excavation begins.
- Employees are not permitted in the excavation while heavy equipment is operated in or near the trench.

Inspections

The competent person shall conduct inspections:

- Daily and before the start of each shift.
- As dictated by the work being performed in the trench.
- After every rain storm.
- After other natural events occur that could increase hazards or change conditions, such as snowstorm, windstorm, thaw, earthquake, dramatic change in weather, etc.
- When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom, or other similar conditions occur.
- When there is a change in the size, location, or placement of the spoil pile.
- When there is any indication of change or movement in adjacent structures or heavy equipment.

For excavations occurring 4 feet or greater in depth, a trench inspection form shall be completed daily. The completed form must be forwarded to the CF Project Supervisor. **(APPENDIX A)**

Soil Classifications

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.
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 stratifications (When soils are configured in layers) - The soil must be classified on the basis of the classification of the weakest 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.

Because most excavations on MU property will be conducted in order to repair / replace existing pipelines or equipment (i.e. the soil has been previously disturbed), excavations shall be made to meet the requirements for Type C soil unless designated otherwise by the competent person.

Spoil and Material Placement

Spoil piles on jobsites will require an erosion and sedimentation control plan if there's a possibility for runoff. Contact Environmental Health and Safety at (573) 882-7018 for assistance

Temporary spoil shall be placed no closer than 2 feet from the surface edge of the excavation, measured from the nearest base of the spoil to the edge of the cut. This distance should not be measured from the crown of the spoil deposit, but from nearest spoil pile edge. This distance requirement ensures that loose rock or soil from the temporary spoil will not fall on employees in the trench or affect the stability of the trench wall.

Permanent spoil should be placed in accordance with the Erosion & Sedimentation Plan for the job 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. Permanent spoil should be placed at least 2 feet from the edge of the excavation.

Job materials shall be placed at a safe distance not less than 2 feet from the trench so as not to create similar types of hazards. Job materials can include pipe, tools, vehicles, equipment, or any other material that will be used in completion of the work.

Surface Crossings

Surface crossings of trenches should not be made unless absolutely necessary. When necessary, they are only permitted under the following conditions:

- **Vehicle crossings** must be designed by and installed under the direction of a registered professional engineer.

- **Walkways or bridges** must:
  - have a minimum clear width of 40 inches,
  - be fitted with standard rails (32 inches high)
  - extend a minimum of 36 inches past each surface edge of the trench.

Trench Egress

- Trenches 4 feet or more in depth shall be provided with a fixed means of egress.
- Spacing between ladders or other means of egress must be such that a worker will not have to travel more than 25 feet laterally to the nearest means of egress.
- Ladders must be secured and extend a minimum of 36 inches above the landing.
- Metal ladders should not be used when electric utilities are present in the trench.

Protection form Vehicular Traffic

- Employees exposed to vehicular traffic shall be provided with and required to wear vests or other suitable garments marked with or made of reflective or high-visibility materials.
- Only personnel who have been trained in Work Zone and Traffic Control procedures shall be permitted to control traffic by use of flags, barricades and other traffic control devices.
- Work occurring in or adjacent to any University street, city street, or state highway shall not commence without an approved Traffic Control Plan. A hard copy of the Traffic Control Plan shall be kept on site and readily available throughout entire duration of the work.
- The Traffic Control Plan for work in or adjacent to University or city streets shall conform to the current standards and requirements as defined and set forth by the City of Columbia. Contact the Community Development Department (573) 874-7474 for further direction.
- The Traffic Control Plan for work in or adjacent to state highways/roadways shall conform to the current standards and requirements as defined and set forth by the Missouri Department of Transportation (MODOT). Contact MODOT for further direction by phone at (866) 275-6636 or on their website http://epg.modot.org/index.php?title=616.23_Traffic_Control_for_Field_Operations
- For work occurring near but not in or directly adjacent to any University street, city street or state highway, a Traffic Control Plan may still be required to ensure implementation of proper signage to warn or inform drivers of the associated construction zone. Consult appropriate authority having jurisdiction as defined above for further direction.

Excavation Safety Requirements

- All employees on an excavation site must wear a hard hat and safety glasses.
- High visibility vests are also required when equipment is being operated on or near an excavation.
- Employees are not permitted to work under loads being lifted or moved by heavy equipment. Employees are required to stand away from equipment that is being loaded or unloaded to avoid being struck by falling materials or spillage.
- Equipment operators or truck drivers may remain in their equipment during loading and unloading if the equipment is properly equipped with a cab shield or adequate canopy.
- Barricades shall be installed where necessary.
- Hand or mechanical signals are to be used as required.
- Trenches left open overnight shall be fenced and barricaded.

- Employees shall not be permitted to work in hazardous and/or toxic atmospheres. Such atmospheres include those with less than 19.5% oxygen, greater than 23.5% oxygen a combustible gas concentration greater than 10% of the lower flammable limit, no greater than 35ppm carbon monoxide (CO), no greater than 20ppm hydrogen sulfide, or concentrations of hazardous substance that exceed those specified in the Threshold Limit Values for airborne contaminants established by the ACGIH or the OSHA Permissible Exposure Limits.
- When the excavation operation approaches the estimated location of underground utility installations, the exact location of the installation shall be determined by safe and acceptable means (such as hand digging).
- When the excavation is open, underground utility installations shall be protected, supported, or removed as necessary to safeguard employees.

Atmospheric Testing

Employees are required to perform atmospheric testing before entering and provide continual monitoring while working in trenches. If employees are required to wear respiratory protection to complete the job, the employee must be trained, fit-tested, and enrolled in the CF Respiratory Protection Program
Some trenches qualify as permit-required confined spaces. When this occurs, compliance with the CF Confined Space Program is required.

Standing Water

Methods for controlling standing water and water accumulation must be provided and should consist of the following if employees must work in the excavation:

- Use of special support or shield systems approved by a registered professional engineer.
- Water removal equipment, such as pumps, must be used and monitored by a qualified person. Equipment with internal combustion engines should be located as far from the trench as possible. If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation**. Reference the University of Missouri's Permissible Storm Sewer Discharge Guidance Document.**
- Trenches are to be carefully inspected by a competent person after each rain and before employees are permitted to re-enter the trench. Employees are not permitted to work in or around the trench during rainstorms.

Excavations around Foundations

- Where the stability of adjoining buildings, walls, or other structures is endangered by excavation under the base of footing, foundation or walls, a support system designed by a PE shall be provided to ensure the stability of such structure for the protection of employees.
- Sidewalks and pavement shall not be undermined unless a support system or another method of protection is provided to protect employees and pedestrians from their possible collapse.

Sloping/Benching (1926 Subpart P Appendix B)

a. Scope and application. This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in § 1926.652(b)(2).

b. Definitions.

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

c. Requirements –
   1. Soil classification. Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.
   2. Maximum allowable slope. The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.
   3. Actual slope.
      i. The actual slope shall not be steeper than the maximum allowable slope.
      ii. The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.
      iii. When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with § 1926.651(i).
   4. Configurations. Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1 MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)(1) FOR EXCAVATIONS LESS THAN 20 FEET DEEP(3)
STABLE ROCK	VERTICAL (90º)
TYPE A (2)	3/4:1 (53º)
TYPE B	1:1 (45º)
TYPE C	1 ½:1 (34º)

Footnote(1) Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
Footnote(2) A short-term maximum allowable slope of 1/2H:1V (63º) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53º).
Footnote(3) Sloping or benching for excavations greater professional engineer

FIGURE B-1
SLOPE CONFIGURATIONS

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8·1.1 EXCAVATIONS MADE IN TYPE A SOIL

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Simple Slope •General

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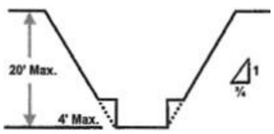
Simple SlopeShort Term

2. All bench.cld nc.avatlons 20 fttt cw ltu ln depth tht0 have a IMXimum aUOWibttslope of 3/4:1 .and maximum IMneh dlmanslona 1 1 follow•



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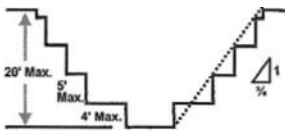

MuiUplo Bench

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Unsupported Vertically Sided Lower Portion- Maximum 8 Feet In Oeplh

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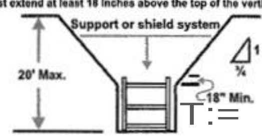
Un•upporttd Vertically Sldod lower Portion - Maximum 12 Feel in Depth

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of 3/4:1. The support or shield system must extend at least 18 inches above the top of the vertical side.



Supported or Shielded Vertlcally Sldod Lower Portion

4. All other almplt t1, compound slope, and vHtloally tWtd lowttportion tJlcavatlont shaJl be naccOtdanc:a wltl'rl IM othtt oplloM rmttt.d und..- §1t26 6S2(b)

Ednor's Note: In Figure B-1, the CFR contains text that states "2." As it appears clear based on the figure and Its context that this was a typographical error, the text is correc:led In Rgure 8-1 appearing above.

FIGURE B-1.2
EXCAVATIONS MADE IN TYPE B SOIL

1. All timpla alope excavations 20 fttt or ltssln depth shall hove. a mulmum aJIOWlblt tlopa of 1:1.

Simple Slope

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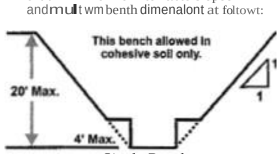
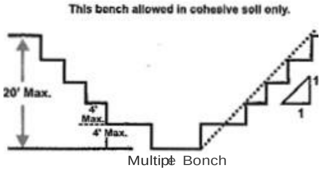


Single Bench

This bench allowed in cohesive soil only.



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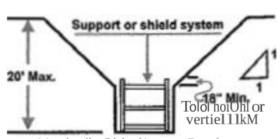
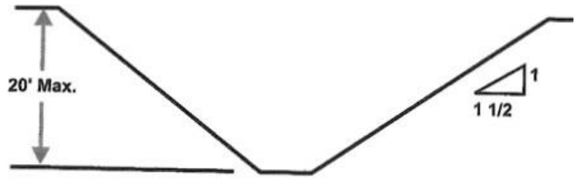


Vertically Sidod Lower Portion

4. Alb thtr tlofMCI oxeavatlons shab t l nauordaiK• wtut IM othtr., uons pttmittecl ln §112UIS1(0).

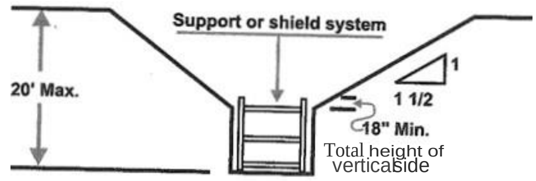
FIGURE B-1.3
EXCAVATIONS MADE IN TYPE C SOIL

1. All simple slope excavations 20 feet or less In depth shallhave a maximum allowable slope of 1 Yt:1



Simple Slope

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 Inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1!'.:1.

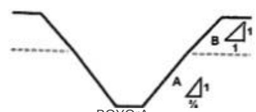


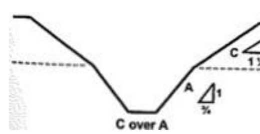
Vertically Sided Lower Portion

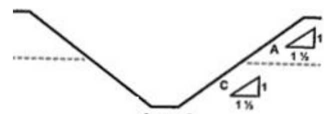
3. All other sloped excavations shall be in accordance wi1h the other options permitted in §1926.652(b).

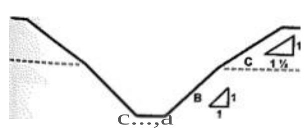
FIGURE B-1.4
EXCAVATIONS MADE IN LAYERED SOILS

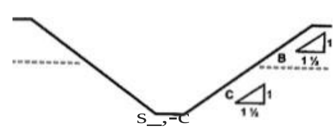
1. All txt;WIUon• 20ftor lw.ss ffl deptn rn•d•M fIytr•d aoas shaD haw a m J Imum allow ble •lOpe fOl'•!loCh l.ytf' 1 1 ut fOfth btWw.











2. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

Design of support systems, shoring, shields and other protective systems

Option 1. Designed using the 1926.652 Appendices A, C and D.

- **Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to this subpart.**
- **Designs for aluminum hydraulic or air shoring shall be in accordance with in accordance with Appendices D.**

Option 2. Designs using manufacturer Tabulated Data.

Option 3. Designed by a Professional Engineer.

Shoring supports the walls from caving. Shoring is installed from the top down. Below is Table D-1.4 in CFR 1926.652 Appendix D for aluminum hydraulic or air shoring. However, when available, Options 2. and 3. are the preferable methods for designing a shoring system.

Air shores must be installed with sheeting in accordance with Table D - 1.4 in Type C soil.

Table D-1.4

Aluminum Hydraulic / Air Shoring

Waler Systems for Soil Type C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX. HORIZ. SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	*SECTION MODULUS (IN^3)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN.	6.0	**2 IN.	6.0	3 IN.	3x12	---	---
		7.0	6.5	2 IN.	6.5	**2 IN.	6.5	3 IN.			
		14.0	10.0	3 IN.	10.0	3 IN.	10.0	3 IN.			
OVER 10 UP TO 15	4	3.5	4.0	2 IN.	4.0	**2 IN.	4.0	3 IN.	3x12	---	---
		7.0	5.5	3 IN.	5.5	3 IN.	5.5	3 IN.			
		14.0	8.0	3 IN.	8.0	3 IN.	8.0	3 IN.			

OVER 15 UP TO 20	4	3.5	3.5	2 IN.	3.5	**2 IN.	3.5	3 IN.	3x12	---	---
		7.0	5.0	3 IN.	5.0	3 IN.	5.0	3 IN.			
		14.0	6.0	3 IN.	6.0	3 IN.	6.0	3 IN.			
OVER 20	For applications other than those listed in the tables, refer to CFR 1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to CFR 1926.652(c)(2) and CFR 1926.652(c)(3).										

*Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.
** 2-inch diameter cylinders, at this width, shall have structural steel tube (3.5 x 3.5 x 0.1875) over sleeves, or structural over sleeves of manufacturer's specification, extending the full, collapsed length.

Shielding

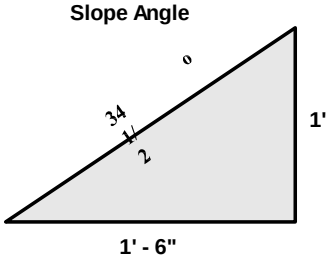
- Trench shields or trench boxes are different from shoring because they are intended primarily to shield workers from cave-ins and similar incidents rather than support the walls from caving.
- The excavated area between the outside of the trench box and the face of the trench should be as small as possible. The space between the trench box and the excavation side must be backfilled to prevent lateral movement of the box. Shields may not be subjected to loads exceeding those which the system was designed to withstand.
- Trench boxes are generally used in open areas, but they also may be used in combination with sloping and benching.
- The trench box must extend at least 18 inches above the surrounding area if there is sloping toward the excavation. This can be accomplished by providing a benched area adjacent to the box.
- Any modifications to the shields must be approved by the manufacturer.
- Shields may ride two feet above the bottom of an excavation, provided they are calculated to support the full depth of the excavation and there is no caving under or behind the shield.
- Workers must enter and leave the shield in a protected manner, such as by a ladder or ramp.
- Workers shall not be permitted to remain in the shield while it is being moved.

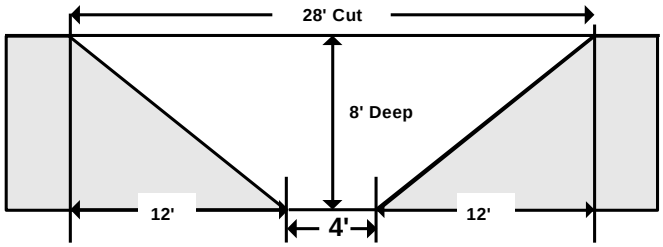
4.16.5 Daily Excavation Checklist

Daily Excavation Checklist

Competent Person:		Date:	
Site Location:		Job Number:	
Soil Type:	Excavation Depth:	Excavation Width:	
Type of Protective System Used:			
Indicate for each item: Yes – No – or N/A for not applicable:			
1. General Information:	**Yes**	**No**	**N/A**
A. Is excavation less than five feet in depth?			
B. Is there a potential for a cave-in? ***IF YES, excavation must be sloped, shored, or shielded.**			
C. Is excavation deeper than five feet in depth? *** IF YES, excavation must be sloped, shored, or shielded.**			
D. Is sloping used as your protective system?			

Slope information to keep in mind:





Example of a Simple 34-degree Slope
commonly used around the site for cave-in protection.

2. Inspection of Job-site:			
A. Excavations, adjacent areas, and protective systems inspected by a competent person daily before the start of work.			
B. Competent person has the authority to remove employees from the excavation immediately.			
C. Surface encumbrances removed or supported.			
D. Employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation.			
E. Hard hats and safety glasses worn by all employees.			
F. Spoils, materials, and equipment set back at least two feet from the edge of the excavation.			
G. Adequate barriers provided at all excavations, wells, pits, shafts, etc.			
H. Warning vests or other highly visible clothing provided and worn by all employees exposed to vehicular traffic. It's a good practice to wear vests at all times around heavy equipment.			
I. Employees required to stand away from vehicles being loaded or unloaded.			
J. Warning system established and utilized when mobile equipment is operating near the edge of the excavation.			
K. Employees prohibited from going under suspended loads.			
3. Utilities:			
A. Location of utilities marked.			
B. Prior to the use of equipment, underground utilities have been located by hand			

digging.			
C. Underground utilities are protected, supported, or removed when excavation is open.			
4. Means of Access and Egress:	**Yes**	**No**	**N/A**
A. Travel distance to means of egress no greater than 25 feet in excavations four feet or more in depth.			
B. Straight ladders used in excavations extend at least three feet above the edge of the trench.			
C. Ramps being used for employee access have been designed by the competent person.			
D. Employees protected from cave-ins when entering or exiting the excavation.			
5. Wet Conditions:			
A. Precautions have been taken to protect employees from the accumulation of water.			
B. Water removal equipment monitored by a competent person.			
C. Surface water or runoff diverted or controlled to prevent accumulation in the excavation.			
D. Inspections have been made after every rainstorm or other hazard-increasing occurrence.			
6. Hazardous Atmosphere: **The atmosphere within the excavation must be tested where there is a reasonable possibility of an oxygen deficiency, combustible or other harmful contaminant exposing employees to a hazard.**			
A. Are there exposed sewer or natural gas lines in excavation?			
B. Is excavation near a landfill area, or are hazardous substances being stored close to the excavation?			
If you answered YES to A or B, then treat excavation as a confined space. **See Confined Spaces Subject Area.**			
C. Employees will contact Fire/Rescue Group at extension (631) 344-2222 prior to entry and in case of emergencies.			
7. Support Systems:			
A. Materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads.			
B. Materials and equipment used for protective systems inspected and in good condition.			
C. Materials and equipment not in good condition have been removed from service.			
D. Protective systems installed without exposing employees to the hazards of cave-ins, collapses, or threat of being struck by materials or equipment.			
E. Members of support system securely fastened to prevent failure.			
F. Support systems provided to ensure stability of adjacent structures, buildings, roadways, sidewalks, walls, etc.			
G. Excavations below the level of the base of a footing have been approved by a Registered Professional Engineer.			
H. Removal of support systems progresses from the bottom and members are released slowly so you can note any indication of possible failure.			
I. Backfilling progresses with removal of support system.			
J. Excavation of material to a level no greater than two feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth.			
K. Shield system placed to prevent lateral movement.			
M. Employees are prohibited from remaining in shield system during vertical movement.			
8. Training:			
A. All employees have had Excavation Safety Awareness Training.			

4.16.6 Excavation Program Appendix

REVISION	ISSUE DATE
INITIAL DEVELOPMENT	8/1/2006
CF Second Draft	6/21/2013
Third Draft	7/8/2013
Fourth Draft	9/13/13
Fifth Draft	3/17/14
Sixth Draft	4/1/14

Approved 5/12/14

5.0 Accident Reporting and Investigating Revised 2/4/2010

Thorough reporting and investigation of accidents helps determine where accidents occur; how they occur; why they happen; and reveals accident trends. Areas can also be identified where safety training methods need to be improved or safety programs developed to help increase awareness of workplace hazards.

Administrative Duties

The reporting, investigation and processing of all injury reports, near-misses (where an injury was avoided) and exposures to toxic ingredients is, within the requirements of 29 CF 1904 and Worker's Compensation laws and regulations, the responsibility of the Campus Facilities Safety Coordinator and Director of Facilities Administration. This section prescribes methods and practices for reporting, investigating and dealing with workplace accidents via the Report of Injury form (See Appendix 1.)-Update Form

Procedure for Reporting and investigating Work Related Injuries and Illnesses

1. Form UM WC-1 should be completed by the injured employee's supervisor and sent to the HR Manager. Injuries shall be reported as soon as possible, but no later than the end of the next business day after occurrence. CF HR will report the injury to Risk & Insurance Management.

2. The manager/supervisor of the injured employee must:

    a. Ensure all injured employees receive necessary medical attention at an authorized medical facility if needed.
    b. Ensure that no other employees can be injured from the unsafe condition that led to the injury.
    c. Investigate the injury.

3. Authorized medical facilities:

    a. Work Injury Services at University Hospital from 6:30 am to 4:30 pm Monday through Friday.
    b. After hours, supervisors should direct employees to University Hospital Urgent Care. Hours of operation are 8:00 am to 8:00 pm Monday through Friday.
    c. For emergencies or after hours care – Emergency Room at University Hospital.

4. All medical reports should be forwarded to CF HR as soon as received. The manager/supervisor and the HR Manager will evaluate the injured employee's medical restrictions to determine an appropriate limited restriction or modified duty assignment if the employee is unable to return to his/her regular job.

5. The manager/supervisor should complete the Supervisor's Accident Investigation Report and return to the CF Safety Coordinator within 48 hours of the employee's injury. The manager/supervisor should conduct interviews and physically survey the injury site as part of the investigation.

6. For injuries resulting in lost time, a lost time injury investigation must be conducted by the employee's supervisor within five (5) days of the injury.

   a. The information obtained during the investigation should be shared with the department's Director and CF Safety Coordinator as soon as possible.

   b. Copies of the completed lost time investigation forms should be sent to the Associate Vice Chancellor-Facilities, the Director of Facilities Administration, and the CF Safety Coordinator within five (5) days of the injury.

   c. The supervisor should contact the Director of Facilities Administration's Administrative Associate to schedule a lost time injury review.

   d. A preliminary lost time review may be conducted in the absence of the injured employee. The final lost time review should be updated when the employee returns to work.

7. For injuries resulting in an employee being placed on modified duty the same procedure used for lost time injuries should be followed with the following exception: the Associate Vice Chancellor-Facilities and Director of Facilities Administration need not attend the modified duty accident review. A copy of the accident and review notes should be forwarded to both the Associate Vice Chancellor-Facilities and the Director of Facilities Administration.

_____

Gary L. Ward
Associate Vice Chancellor-Facilities

Accident Investigation Procedures

- Conduct the accident investigation as soon as possible and at the scene of the injury.
- Obtain descriptions – in separate interviews – from the victim and witnesses.
- After the accident has been documented, question the victim about its cause.
- Remind the victim that the investigation is for locating the cause and determining corrective action to prevent its reoccurrence.
- Complete and, with the victim, review the accuracy of the Report of Injury Form.

Functions of the Accident Investigation Report:

- Track and report injuries on a monthly basis
- Track injuries by type; use; part of body affected; time of day injury occurs; and process involved
- Determine if injury is part of a trend
- Identify common equipment, materials, or environmental factors involved in accidents
- Managers and safety representatives discuss causes of and solutions to injuries

Record Keeping

The C.F. Safety Coordinator is responsible for maintaining the following:

- Accident investigation reports
- Training records

Training

Accident reporting and investigating has the potential to adversely affect employee behavior. Such procedures must be explained during new-employee orientation and at departmental meetings in order to maintain an on-the-job safety consciousness and cooperation.

Program Evaluation

Safety evaluations by CF's Safety and Personnel departments consist of:

1. Weekly tracking of accident reports and investigations
2. Monthly reporting to a CF Leadership Group member
3. Annual review by Directors and C.F. Safety Committee

5.1 Lost-Time Injury Reporting

Once a department receives notice from a medical provider that one of their employees was injured at work and will not be able to return to work the following steps should be taken:

1. Contact CF Human Resources or departmental contact - they need to know in order to be in contact with Risk Management and Work Injury Services.

2. A lost time injury investigation should be launched the same day or as soon as possible, never to extend beyond 5 days after the injury by the employees supervisor. The sooner an investigation can be accomplished the fresher the information and the faster an unsafe condition may be corrected. When the employee is not available a preliminary investigation should be conducted with any witnesses.

3. The information acquired during the investigation should be shared with the Department Director and the CF Safety Coordinator as soon as possible.

4. The Supervisor should then contact Lisa Jones to schedule a lost time Injury Review with the appropriate personnel and Gary Ward.

5. Copies of the investigations should be sent to Associate Vice Chancellor, Director of CF Administration, and the CF Safety Coordinator within 5 days of the accident.

The lost time injury investigation forms can be found on L drive or the CF Safety Coordinator can send them to the department upon request. Facts, documentation, pictures or any other information pertaining to the accident should be part of the accident report.

The CF Safety Coordinator is available to assist supervisors develop the information needed to complete their investigations.

6.0 Housekeeping and Material Storage Procedures

Purpose

Proper housekeeping is critical to Campus Facilities' fire-prevention and accident-prevention programs. Attention to general cleanliness, storage and housekeeping, prevents numerous accidents. This section covers issues not discussed elsewhere and is not intended to cover all specific housekeeping requirements.

Management and Employee Responsibility

Employees share the responsibility for following established housekeeping procedures and practicing good housekeeping. As part of unit safety inspection procedures, managers, supervisors, the safety coordinator and safety committee members are responsible for monitoring housekeeping practices and promoting compliance with the Health & Safety Program in maintaining a safe working environment.

Tobacco (Smoking) Regulations

Smoking is prohibited inside buildings and within 50 feet of materials stored outside. In recognition of the health, safety and comfort benefits of smoke-free air and the responsibility to provide and maintain an optimally healthy and safe working and living environment for faculty, students, staff and visitors, the University of Missouri is establishing the goal of being smoke free by January 1, 2014, in all its owned or leased buildings and University owned or leased vehicles. Effective July 1, 2011 smoking will only be allowed in designated outdoor areas. The University reserves the right to specify additional designated smoking and non-smoking areas on its campus grounds. To prevent fire and keep the grounds neat and orderly, dispose of all cigarette/cigar ashes and butts in butt cans or ash-trays.

Note: Business Policy and Procedure Manual: Smoking Policy Section 1:160

General Rules for a Safe and Professional Environment:

Office Areas

- Keep all aisles, emergency exits, and fire extinguishers accessible at all times.
- Maintain orderly storage areas. Store received supplies promptly.
- Properly dispose of waste and Immediately clean up spills
- Line all waste receptacles with a plastic trash bag to avoid direct contact while handling contents. Custodial Employees will use rubber gloves and compaction bar when handling wastes.
- Keep file and desk drawers closed when unattended to avoid injuries. Open one drawer at a time to prevent tipping over file cabinets.
- Turn off all lights and office equipment (area heaters, lamps, coffee-maker, computers, etc.) at the end of the business day to save energy and prevent fires. Unplug space heaters at the end of the day to be sure they are off.

Shop Areas

- Keep all aisles, emergency exits, fire extinguishers, and eye-wash stations accessible at all times.
- Clean up spills and immediately dispose of waste.
- Report process leaks to supervision for immediate clean-up and repair.

- Keep aisles and work floors clear of excessive debris and waste materials during shift operations, between breaks and at shift change. Employees are responsible for bringing slippery floors to the attention of supervision for immediate clean-up.
- Place all refuse and waste materials in appropriate waste containers.
- Sort pipe stock by size and store horizontally on racks. .
- Sort metal stock by size and store horizontally on racks.
- Sort sheet metal stock and store vertically in racks.
- Sort and store all fittings, etc., by type and use in bins on shelves.
- Store all flammables in OSHA-approved fire cabinets and self-closing cans.

Surrounding Areas

- Discard all trash in waste containers provided.
- Park only in the designated areas.
- Keep grounds mowed and trimmed and remove ice and snow prior to each day's operations.

Rest Rooms, Locker Rooms & Break Areas

- Be courteous to co-workers and clean up areas after use
- Do not bring flammable materials to, or store in, the workplace or lockers
- Do not store perishable food overnight in lockers or cafeterias.
- Line all waste receptacles with a plastic trash bag to avoid direct contact with contents while handling. Custodial and Special Services employees will use rubber gloves and compaction bar when handling waste.
- Place all refuse and waste materials in appropriate containers for disposal and recycling.

Storing Material

Dry, raw materials, finished product flammables and compressed gases, require special storage procedures:

Storage and Store Room Areas

- Stack materials no closer than 18 inches from walls or overhead sprinkler heads. A minimum side clearance of 3 feet side must be maintained around doorways and emergency exits. Passageways and aisles must be a minimum of 6 feet wide, be marked properly and free of all obstructions.
- Keep aisles and passageways clear of debris. Immediately clean up all spills.
- Display the maximum load capacity for all platforms and racks. Do not exceed this capacity.

Flammable Storage

- Store all flammable material inside in OSHA-approved flammable storage cabinets, or store outside at least 50 feet from any structure
- Fuels, solvents and other flammables (not stored in original shipping containers) will be stored in OSHA-approved, self-closing containers with flame arresters. Flammables may not be stored in open containers (open parts baths, etc.).

- Flammable storage areas will be kept dry and well-ventilated. Storage of combustible materials, open flames or exposed electrical components is prohibited.
- Flammable or combustible materials are prohibited in electrical rooms. Electrical rooms must at all times be kept clean and dry.

Part 7: Supervisor Safety Handbook

University of Missouri - Columbia
Campus Facilities

Supervisor Safety Handbook

University of Missouri - Columbia Campus Facilities
Supervisor Safety Handbook

Description of Course Topics

- **Hazard Analysis**
- **Personal Protective Equipment**
- **Job Briefing**
- **Accident Reporting**
- **Conducting a Safety Meeting**

Introduction

Safety Statement

The mission of the Campus Facilities Safety Department is to provide for the employees of the department, a safe and healthy workplace free of dangerous or debilitating conditions.

Chapter 1

It is the responsibility of all employees to correct situations that could cause injury or illness.

It is not the aim of safety to force in anyway, any agency standards, Federal, State, or Local that do not apply to the University. The costs associated with such programs shall be brought to the proper levels of management for review before any are adopted. However, the guidelines for various training are worthy tools and will be used whenever appropriate to our needs. They serve a twofold purpose. To provide a standardized format for training, and in civil action, to be used as documentation of accepted training. It is not the intention of C.F. safety to blanket the departments with unnecessary rules and regulations because they exist. Documented hazards, Unsafe Conditions, Accidents and causes will direct appropriate action.

The goal of the C.F. Safety Program is to develop positive attitudes regarding safety among all persons in the Campus Facilities organization. It is essential that all levels of the workforce and staff take an active part in initiating proactive measures to control hazards associated with activities under their direction. Safety is a major part of all operation where Campus Facilities is involved and the success of the program depends upon the cooperation of everyone.

It has long been recognized that an injury free work environment is a more cost effective and productive operation. Supervisors are closest to the performance of the work tasks of employees. They are in a position to observe and control the day to day operations of the workforce which includes safe working conditions and safe work practices. It is the group that can have the greatest impact on accident prevention and productivity.

Course Goals

- To ensure compliance with University safety policies and procedures
- Identify unsafe work practices and unsafe conditions
- Recognize, eliminate, or abate jobsite hazards as far as possible
- Conduct jobsite briefings which include hazards and unsafe conditions
- Learn proper Personal Protective Equipment essentials
- Become familiar with accident reporting requirements and other forms
- Conduct safety meetings or request safety training when necessary

Chapter 2

Jobsite Hazard Assessment

Safe Conditions and operations are determined by correct assessment of Jobsite Hazards. Developing skills to determine, recognize, abate and correct known hazards and/or potential hazards is paramount to supervisors in Campus Facilities.

Part of the supervisor's job is to see that the work assigned to the crews is completed in an efficient and timely manner. Who better to observe the work being performed than the supervisor! Supervisors know the personalities, work habits, attitudes and mannerisms of their employees. Safety committees and other safety personnel can assist but ultimately, the most knowledgeable person for the job is YOU.

WHY SAFETY IS GOOD BUSSINESS

Accidents, injuries, and lost time often cause pain and suffering to affected employees. They can disrupt crew schedules, make down time, and create morale problems. Most often however, they cause headaches for the supervisor in charge. Work needs to be done in spite of the injuries or accident caused absenteeism. You have a lot to gain from a safe workplace.

The following are excerpts from an article by Jeannette Jacobson Hazard Hunting-Looking for Trouble

ONE OF YOUR JOBS IS TO LOOK FOR TROUBLE

"Let's call this strategy a "Hazard Hunt," since the terms "safety inspection" and "safety audit" tend to remind us of OSHA and IRS visits. Preventing accidents should be an internal process, and it has to be planned and scheduled. It's not enough just to keep your eye out for danger. You must periodically set aside time to focus on the work environment and your crewmembers with "new eyes." Instead of looking for hidden objects in a picture, or a good-looking face in a crowd, your goal is to find and eliminate possible sources of danger. "

Hazard Hunting:

The author of the article above compared "Hazard Hunting" to the game we played as children - "find the hidden object in this scene". Too often supervisors feel that a formal safety audit takes too much time and employees see it as threatening. Employees sometimes see the safety audits as a way for a supervisor to find fault with them. Full safety audits have their place in a safety program and as supervisors you may find yourself involved in them, at some given point in time. It needs to be understood however, that the day to day hazard assessments only takes a few minutes. Some safety programs call this audit "Take 5 for safety", others call it “Tailgate Conferences”, and other still, “A Job Briefing”. No matter what we name it, the purpose of the

exercise is to assess the jobsite for hazards, determine the proper PPE, and review the work plan prior to starting the job. Conducting a Job Briefing will be covered later in the program. For now, let's look at the mechanics of "Hazard Hunting".

Why Hazard Assessment?

The purpose of hazard assessment is to ensure a safe jobsite by correcting unsafe conditions as far as possible. ***Engineering Controls*** are always the first consideration in a safe operation. Engineering controls however can be very expensive or impractical. Changing building plans are not always the answer. The second avenue for hazard control is ***Administrative Controls***. Administrative controls are decisions that often become procedures. A roof may be unsafe to walk across at night because there is no lighting and lighting the area is too costly or ineffective. As a supervisor having a job ticket for work normally done by night crews you have a decision to make. What are the options? Don't do the work, (yeah right--): Take a flashlight along, (might work if the employee doesn't have to carry anything else), Do the work during daylight only. Hopefully that latter option would be the choice. Looking at other options, for instance, "the way we *Do* the job" may be simpler and just as safe. Using power tools instead of hand tools, using mechanical personnel lifts instead of ladders etc. are examples of administrative controls that supervisors use regularly.

The Third control is the need for ***Personal Protective Equipment*** (PPE). It is always a consideration in planning a job. How do we determine the need for PPE? Hazard Assessments!!!!

The following pages describe typical hazards, some preventative measures and ways of determining PPE. They are just guidelines to assist you. The safety department, the C.F. safety committees, and the C.F. Risk Assessment Committee has the responsibility for determining the particulars of safety policy and safe work practices.

Where Do We Begin?

Jobsite Hazards are broken down into several categories. Major job risks include air contaminants, chemical, biological, physical, and ergonomic hazards.

Air contaminants are commonly classified as particulate, gas, or vapors. Below are some common definitions:

Dusts are solid particles formed by mechanical processes --crushing, grinding, drilling, abrading or blasting.

Fumes are suspensions of particles in a gas (Air)

Mists are fine liquids suspended in the air usually caused by the liquid breaking up -- splashing, foaming, atomizing.

Fibers are solid particles that are longer than they are wide.

Gases are fluids without form which expand to occupy the space they are in. Usually come from operation of internal combustion engines. - Carbon Monoxide

Vapors are gases from substances that are normally in solid or liquid state at room temperature. They are formed by evaporation - vapors from solvents is an example.

Chemical Hazards are harmful compounds in solid, liquid, gaseous state. They have harmful effects by breathing them in, being absorbed through the skin, or from eating or drinking. The degree of worker risk from exposure depends on the nature, potency and length of exposure. Material Safety Data Sheets (MSDS) provide information on how to protect your workers.

Biological Hazards are organisms that can cause infections by entering the body directly or through the skin. Proper personal hygiene is an effective measure for worker protection. Attention to minor cuts, scratches especially on the hand and forearms help reduce risks.

Ergonomic are problems resulting from poorly designed job tasks that could cause conditions of excessive vibration, eye strain, repetitive motion, and heavy lifting problems.

Physical Hazards are hazards that include improper tools, low overhangs, tripping hazards. Machine guards, Electrical hazards and falling and many others are included in this category.

Basic Physical Hazards:

Impact

Penetration

Compression (Roll Over)

Chemical Contacts

Heat

Harmful Dust

Light, Radiation (Optical)

Sunlight,

Welding Light,

Electrical Arc

Other these hazards include: The Public, Non-University workers as well as other department's crews working at the site

A Guide for Assessment

Begin with a survey of your workplace. Observe the environment in which your employees work. Ask employees how they perform their tasks. Look for sources of potential injury such as the following:

- Objects that might fall from above.
- Exposed pipes or beams at work level.
- Exposed liquid chemicals.
- Sources of heat, intense light, noise, or dust.
- Equipment or materials that could produce flying particles.
- Tripping/Falling/Slipping
- Housekeeping Clutter (JOBSITE JUNK)
- All feasible engineering and work practice controls are in place
- Unguarded machinery or tools
- Sources of electricity
- Heavy equipment operation/trenchers/loaders etc.

Personal Protective Equipment - PPE

Chapter 3

The preferred way to eliminate hazards is through Engineering Controls or Work Practice and Administrative Controls. When these controls are not feasible or do not provide sufficient protection, an alternative or supplementary method of protection is to provide workers with Personal Protective Equipment (PPE) and the knowledge to use it properly.

Although the information presented in this guide is intended to help you, please keep in mind that it is general in nature and does not address all workplace hazards or PPE requirements.

What is personal protective equipment?

Personal protective equipment, includes a variety of devices and garments to protect workers from injuries.

YOU CAN FIND PPE DESIGNED TO PROTECT

Eyes
Face,
Head,
Ears,
Feet,
Hands and arms, and Whole body.

PPE includes such items as Goggles, Face shields, Safety glasses, Hardhats, Safety shoes, Gloves, Vests, Earplugs, and Earmuffs.

NOTE: Respirators and Rubber insulating equipment (gloves, sleeves, blankets) are also considered PPE. There are specific requirements for these types.

This general guide does not address such equipment. You will need assistance in determining the need for and the appropriate choice of respiratory protection for your employees. The Respiratory Protection Program for the University is handled through EH&S. Contact Janet if you need help with this type of protection.

This program sets out procedures for selecting, providing, and using PPE as part of your routine operation. A written PPE program based on University policy is easier to evaluate and maintain than an unwritten one. The C.F. Safety Standards Committee is presently putting the PPE policy in place. You have already begun to establish a PPE program however by thinking about how best to protect your employees from potential hazards. Use the information provided here for actions that are needed in regard to PPE.

Working through the PPE selection process in this guide will produce the foundation for your understanding of what is to come in Campus Facilities Safety. In the future, any information that you will need will be written down in a "Safe Work Practices Manual". All employees will have, at

their fingertips, a source of information about safety procedures and PPE.

The Need For PPE

We must provide PPE for your employees if:

Their work environment presents a hazard or is likely to present a hazard to any part of their bodies;

OR

Their work processes present a hazard or are likely to present a hazard to any part of their bodies;

OR

During their work, they might come into contact with hazardous chemicals, radiation,

OR

Mechanical irritants;

You are unable to eliminate their exposure or potential exposure to the hazard by engineering, work practice, or administrative controls.

How do I identify potential hazards in my workplace?

Begin with a survey of your workplace. Observe the environment in which your employees work. Ask employees how they perform their tasks.

Look for sources of potential injury such as the following :

Objects that might fall from above.

Exposed pipes or beams at work level.

Exposed liquid chemicals.

Sources of heat, intense light, noise, or dust.

Equipment or materials that could produce flying particles.

And many others discussed earlier

You must examine each likely hazard very carefully and determine the nature of the threat the hazard poses to your employees. Then choose the appropriate PPE for protection against that hazard, and make sure that any PPE you choose will fit the employee(s) who must wear it. Next, make sure that your employees are trained in the proper use and care of the PPE. Use Checklist B to assess the work environment and procedures. Remember that this is not an exhaustive list,. Many workplace operations create hazards; not all of them could be listed here. If you don't find a specific task on the checklist, look for similarities between your workplace operations and those on the list on the list.

Try to anticipate whether such operations also might create similar hazards

Remember that an operation need only have the potential to cause injury to require PPE.

Checklist 8:
NeedforPPE

Suggsttld Quetionlj	1)1)ical Operations of Concern	Yes	No
Eyes			
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Suggested Questions	Typical Operations of Concern	Yes	No
When your employees stand or bend, are there heads near exposed beams, machine parts, or pipes?	Construction, confined space operations, and building maintenance.	☐	☐
Do your employees work with or near exposed electrical wiring or components?	Building maintenance; utility work; construction; wiring; work on or near communications, computer, or other high-tech equipment; and arc or resistance welding.	☐	☐
Feet			
Could tools, heavy equipment, or other objects roll, fall onto, or strike your employees' feet?	Construction, plumbing, smithing, building maintenance, trenching, utility work, and grass cutting.	☐	☐
Do your employees work with or near exposed electrical wiring or components?	Building maintenance; utility work; construction; wiring; work on or near communications, computer, or other high-tech equipment; and arc or resistance welding.	☐	☐
Do your employees work with explosives or in explosive atmospheres?	Demolition, explosives manufacturing, grain milling, spray painting, abrasive blasting, and work with highly flammable materials	☐	☐
Hands			
Do your employees' hands come into contact with tools or materials that might scrape, bruise, or cut?	Grinding, sanding, sawing, hammering, and material handling.	☐	☐
Do your employees handle chemicals that might irritate skin, or come into contact with blood?	Pouring, mixing, painting, cleaning, syphoning, dip tank operations, and health care and dental services.	☐	☐
Do work procedures require your employees to place their hands and arms near extreme heat?	Welding, pouring molten metal, smithing, baking, cooking, and drying.	☐	☐

Eye and Face Protection

WHEN MUST I PROVIDE EYE PROTECTION FOR EMPLOYEES?

You must provide eye protection for employees whenever they are exposed to potential eye injuries during their work if work practice or engineering controls do not eliminate the risk of injury. Some of the things that might cause eye injuries include the following:

Dust and other flying particles, such as metal shavings or wool fibers.

Molten metal that might splash.

Acids and other caustic liquid chemicals that might splash.

Blood and other potentially infectious body fluids that might splash, spray, or splatter.

Intense light such as that created by welding arcs and lasers.

Selecting Protective Eyewear For Employees

MUCH OF WHAT YOU WILL NEED HAS BEEN SELECTED AND MAY BE PURCHASED BY EACH DEPARTMENT REPRESENTATIVE.

Begin with the following criteria:

Eye protection must protect against the specific hazard(s) encountered in the workplace.

It must be reasonably comfortable to wear.

Eye protection must not restrict vision or movement.

Eye protection must be durable and easy to clean and disinfect.

Eye protection must not interfere with the function of other required PPE.

An Employee who wears eyeglasses with corrective lenses can obtain their eyeglasses from EH&S.

OR

The employee may wear goggles that can fit comfortably over corrective eyeglasses without disturbing the alignment of the Goggles. Protective eyewear is provided to employees wearing contact lenses and who are exposed to potential eye injury. Eye protection provided to these employees may also incorporate corrective eyeglasses. Thus, if an employee must don eyeglasses in case of contact lens failure or loss, he or she will still be able to use the same protective eyewear.

TYPES OF EYE & FACE PROTECTORS

Safety spectacles. These protective eyeglasses are made with safety frames constructed of metal and/or plastic and are fitted with either corrective or plano impact-resistant lenses. They come with and without side shields, but most workplace operations will require side shields.

Impact-resistant spectacles. This eyewear can be used for moderate impact from particles produced by such jobs as carpentry, woodworking, grinding, and scaling.

Side shields. These protect against particles that might enter the eyes from the side. Side shields are made of wire mesh or plastic. Eye-cup type side shields provide the best protection.

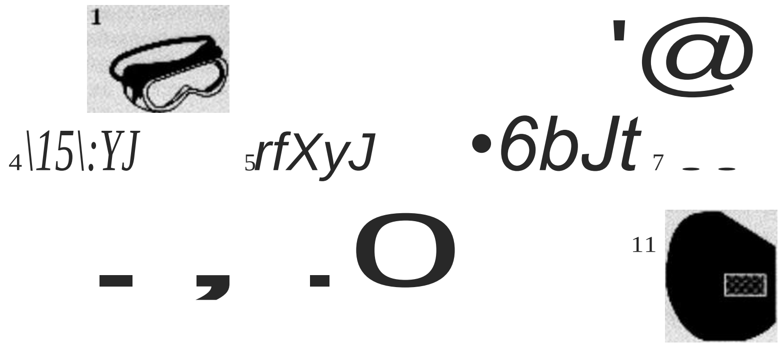
Goggles. You may choose from many different types of goggles, each designed for specific hazards. Generally, goggles protect eyes, eye sockets, and the facial area immediately surrounding the eyes from impact, dust, and splashes. Some goggles fit over corrective lenses.

Welding shields. Constructed of vulcanized fiber or fiberglass and fitted with a filtered lens, these protective devices are designed for the specific hazards associated with welding. Welding shields protect your employees' eyes from burns caused by infrared or intense radiant light, and they protect face and eyes from flying sparks, metal spatter, and slag chips produced during welding, brazing, soldering, and cutting.

Laser safety goggles. Laser safety goggles provide a range of protection against the intense concentrations of light produced by lasers. The type of laser safety goggles you choose will depend upon the equipment and operating conditions in your workplace.

Face shields. These transparent sheets of plastic extend from the brow to below the chin across the entire width of the employee's head. Some are polarized for glare protection. Choose face shields to protect your employees' faces from nuisance dusts and potential splashes or sprays of hazardous liquids.

Figure 1. Recommended Eye and Face Protectors



Eye :met l'ce protectorurc idenlifi,·tl bclvw by number aml typ;. Refer to *Table I* for rrconm1cndcd usage applications.

1. C..oggles, flex ihle fitci ng, regu htr venOlalliou
2. Cog les, fkxibh: fitting. huoded ventilation
3. Goggles, cushioned fitti ng, rigid bod}'
4. Spectacles, rnetal frame, with id\) b.ie!Lls'"
5. Spcctadcs, plu tic lhime, with side shields*
6. Speclad-., metal pi<Ltic frame, with flacfold si d.?hield
7. Welding Goggles, eyecup type. tinted lenses*

7A. <.:hip[Jiog Goggles, eyecup type, clear afcty lcnse(not illusrmre(l)

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Table 1.
Eye and Face Protector Selection Guide

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Grim.liug - lighl	r'lyrng p::tnJdes	I,3,4.5.6.10
Grimling- ha vy	Flyrng parlrcle	I,3,71\,8:\<!'or senT cxvos urc adu 10)
Ltroonrtory	Chemicalplah, glass brcabgc	2 (10 when in L'ombimrlion with 4.5.6)
f\lachiniu	!-'lying particle	1,3.4.5.6,10
Molten rnclab	lle<ll, ,;|n,-e.spnr-l'' ,pla<h	''!,R \10 in combination witb 4.5.6 in tirlll len :;)
Spul wddiug	Flying particles.pu'b	1.3.<l.5.6.10

Source: 29 CFR 1926.102(a)(5)

CAN FACE SHIELDS PROTECT EMPLOYEES INSTEAD OF GOGGLES OR PROTECTIVE SPECTACLES?

Face shields do not protect employees from impact hazards. You may use however, face shields in combination with goggles or safety spectacles, to protect against impact hazards, even in the absence of dust or potential splashes, for additional protection beyond that offered by goggles or spectacles alone.

Each kind of protective eyewear is designed to protect against specific hazards. By completing the hazard assessment of your workplace outlined in the previous section, you will identify the specific workplace hazards that pose a threat to your employees' eyes and faces.

HOW DARK DO LENSES ON WELDING HELMETS AND GOGGLES NEED TO BE?

The intensity of light or radiant energy produced by welding, cutting, or brazing operations varies according to a number of factors including the task producing the light, the electrode size, and the arc current. Table 2 shows the minimum protective shade for a variety of welding, cutting, and brazing operations. To protect employees who are exposed to intense radiant energy, begin by selecting a shade too dark to see the welding zone. Then try lighter shades until you find one that allows a sufficient view of the welding zone without going below the minimum protective shade.

HOW DO I PROTECT EMPLOYEES FROM EXPOSURE TO LASER BEAMS?

You must provide safety goggles specifically designed to protect the employees' eyes from the specific intensity of light produced by the laser. The level of protection will vary according the level of radiation emitted by the laser. If your employees are exposed to laser beams, you must determine the maximum power density, or intensity, that the lasers can produce. Based on this knowledge, you must select lenses that will protect against this maximum intensity.

HOW CAN I BE SURE THAT LASER SAFETY GOGGLES PROVIDE ENOUGH PROTECTION?

Every pair of safety goggles intended for use with laser beams must bear a label with the following information: The laser wavelengths for which they are intended to be used. The optical density of those wavelengths. The visible light transmission.

MAINTAINING PROTECTIVE EYEWEAR. MY WORKPLACE GETS DIRTY. HOW WILL EMPLOYEES KEEP THEIR PROTECTIVE EYEWEAR CLEAN AND EFFECTIVE?

Train your employees how to clean the eye protectors. Allow them time at the end of their shifts to do the following:

Disassemble goggles or spectacles,

Thoroughly clean all parts with soap and warm water,

Carefully rinse off all traces of soap, and

Replace all defective parts.

Occasionally, you must disinfect the protective eyewear. To do so, after cleaning you can do the following:

Immerse and swab all parts for 10 minutes in a germicidal solution.

Remove all parts from the solution and hang in a clean place to air dry at room temperature or with heated air.

Do not rinse the parts after submerging them in the disinfectant. Rinsing will remove the germicidal residue that remains after drying. Also use ultraviolet disinfecting and spray-type disinfecting solutions also may be used after washing.

EMPLOYEES WORK IN SHIFTS. COULD I PROVIDE ONE PAIR OF PROTECTIVE EYEWEAR FOR EACH POSITION INSTEAD OF EACH EMPLOYEE?

Yes. If you do this, however, you must disinfect shared protective eyewear after each use. If the goggles or spectacles do not have to be individually designed to incorporate an employee's corrective lenses and you disinfect the eyewear between uses by different employees, more than one employee may use the same set of protective eyewear.

Head Protection

You must provide head protection for your employees if:

Objects might fall from above and strike them on the head;

They might bump their heads against fixed objects, such as exposed pipes or beams;

OR

They work near exposed electrical conductors.

In general, protective helmets, or hard hats, should

Resist penetration by objects,

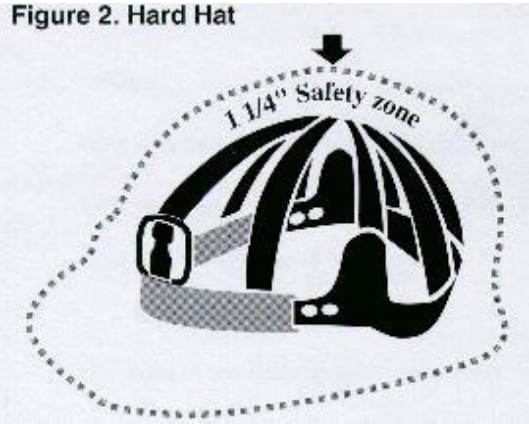
Absorb the shock of a blow,

Be water resistant and slow burning, and

Come with instructions explaining proper adjustment and replacement of the suspension and headband.

NOTE :Hard hats require a hard outer shell and a shock-absorbing lining. The lining should incorporate a head band and straps that suspend the shell from 1 to 1 1/4 inches (2.54 cm to 3.18 cm) away from the user's head. This design provides shock absorption during impact and ventilation during wear.

Figure 2. Hard Hat



TYPES OF PROTECTIVE HEADWEAR

Hard hats are divided into three industrial classes:

Class A. These helmets are for general service. They provide good impact protection but limited voltage protection. They are used mainly in mining, building construction, shipbuilding, lumbering, and manufacturing.

Class B. Choose Class B helmets if your employees are engaged in electrical work. They protect against falling objects and high-voltage shock and burns.

Class C. Designed for comfort, these lightweight helmets offer limited protection. They protect workers from bumping against fixed objects but do not protect against falling objects or electric shock.

Look at the inside of any protective helmet you are considering for your employees, and you should see a label showing the manufacturer's name, the ANSI standard it meets, and its class.

HOW DO I CHOOSE THE CORRECT PROTECTIVE HELMETS FROM AMONG THE DIFFERENT TYPES?

Each kind of protective helmet is designed to protect against specific hazards. By completing the hazard assessment outlined above, you will identify the specific workplace hazards that pose a threat to your employee's head.

I HAVE PURCHASED NEW HARD HATS THAT MEET THE ANSI REQUIREMENTS. HAVE I FULFILLED MY RESPONSIBILITY TO PROTECT EMPLOYEES' HEADS?

No. Issuing appropriate head protection to employees is a major first step, but you must make sure that the hard hats continue to provide sufficient protection to your employees. Do this by training your employees in the proper use and maintenance of hard hats including daily inspection of them.

REMOVING HARD HATS FROM SERVICE

If your employees identify any of the following defects, remove the hard hats from service:

The suspension system shows signs of deterioration such as:

- Cracking,
- Tearing, or
- Fraying.

The suspension system no longer holds the shell from 1 inch to 1 1/4 inches (2.54cm - 3.18cm) away from the employee's head.

The brim or shell is cracked, perforated, or deformed.

The brim or shell shows signs of exposure to heat, chemicals, ultraviolet light, or other radiation.

Such signs include:

- Loss of surface gloss,
- Chalking, or
- Flaking (a sign of advanced deterioration).

MAINTAINING HARD HATS. COULD EMPLOYEES WEARING HARD HATS AND WORKING AT ELEVATIONS CREATE A POTENTIAL HAZARD FOR THE EMPLOYEES WORKING BELOW?

To protect employees working below, you must provide chin straps for the protective helmets worn by employees working at higher elevations, whether in an aerial lift or at the edge of a pit. The chinstraps should be designed to prevent the hard hats from being bumped off the employees' heads.

Information you will want to consider when training employees on how to care for their hard hats includes the following:

Paints, paint thinners, and some cleaning agents can weaken the shell of the hard hat and may eliminate electrical resistance.

Keep in mind that paint and stickers can also hide signs of deterioration in the hard hat shell. Limit their use

Ultraviolet light and extreme heat, such as that generated by sunlight, can reduce the strength of the hard hats. Therefore, employees should not store or transport hard hats on the rear-window shelves of automobiles or otherwise in direct sunlight.

Also, instruct employees to clean the protective helmets periodically by:

Immersing for one minute in hot (approximately 140o F, or 60o C) water and detergent, Scrubbing, and Rinsing in clear hot water.

Foot and Leg Protection

POTENTIAL HAZARDS YOU MIGHT IDENTIFY:

Heavy objects such as barrels or tools that might roll onto or fall on employees' feet.

Sharp objects such as nails or spikes that might pierce the soles or uppers of ordinary shoes.

Molten metal that might splash on feet or legs

Hot or wet surfaces.

Slippery surfaces.

What are the types of protection and where do I use them?

The type of foot and leg protection you provide your employees will depend upon the specific Workplace hazards you identify and the specific parts of the feet or legs exposed to potential injury.

TYPES OF FOOT AND LEG PROTECTION

Leggings. Use these to protect the lower legs and feet from heat hazards, like molten metal or welding sparks. Safety snaps allow leggings to be removed quickly.

Metatarsal guards. Made of aluminum, steel, fiber, or plastic, these guards maybe strapped to the outside of shoes to protect the instep area from impact and compression.

Toe guards. Toe guards may be made of steel, aluminum, or plastic. They fit over the toes of regular shoes. These guards protect only the toes from impact and compression hazards.

Combination foot and shin guards. These guards may be used in combination with toe guards when greater protection is needed.

Safety shoes. These sturdy shoes have impact-resistant toes and heat-resistant soles that protect against hot work surfaces common in roofing, paving, and hot metal industries.

The metal insoles of some safety shoes protect against puncture wounds. Safety shoes may also be designed to be electrically conductive to prevent the buildup of static electricity in areas with the potential for explosive atmospheres, or nonconductive to protect workers from workplace electrical hazards.

Generally, safety shoes must be sturdy and must have impact-resistant safety toes, instep protection, and heat-resistant soles (see Figure 3). All safety shoes must comply with the ANSI standard. In addition, depending on the types of worker exposures, you may need to provide specially designed safety shoes such as conductive or electrical-hazard safety shoes.

Conductive Shoes

Electrically conductive shoes protect against the buildup of static electricity. Essentially, these shoes ground the employees wearing them. Employees working in explosive and hazardous locations such as explosives manufacturing facilities or grain elevators must wear conductive shoes to reduce the risk of static electricity buildup on an employee's body that could produce a spark and cause an explosion or fire. During training, employees must be instructed not to use foot powder or wear socks made of silk, wool, or nylon with conductive shoes. Foot powder insulates and retards the conductive ability of the shoes. Silk, wool, and nylon produce static electricity.

NOTE: Conductive shoes are not general-purpose shoes and must be removed upon completion of the tasks for which they are required. Employees exposed to electrical hazards must never wear conductive shoes.

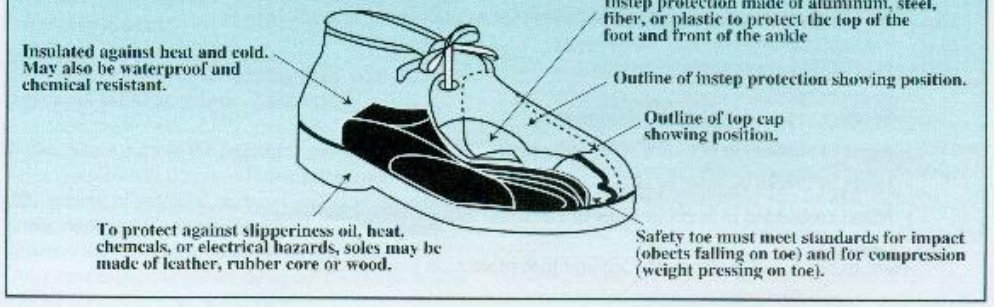
Non-Conductive Shoes - Electrical Hazard, Safety-Toe Shoes

Electrical hazard, safety-toe shoes are nonconductive and will prevent your employees' feet from completing an electrical circuit to the ground. They can protect employees against open circuits of up to 600 volts in dry conditions. Electrical hazard, safety-toe shoes should be used in conjunction with other insulating equipment and precautions to reduce or eliminate the potential for your employees' bodies or parts of their bodies to provide a path for hazardous electrical energy.

NOTE: Nonconductive footwear must not be used in explosive or hazardous locations; in such locations, electrically conductive shoes are required.

If your employees...	*Then...*
Work near explosive or hazardous atmosphere.	You must provide them with conductive shoes.
Work near exposed electrical conductors or components.	You must provide them with electrical-hazard, safety-toe shoes.
Work with molten metal.	You must provide them with foundry shoes.

Figure 3. Safety Shoes



SAFETY SHOE FAILURE. TRAIN YOUR EMPLOYEES TO RECOGNIZE THAT THE INSULATING

PROTECTION OF ELECTRICAL HAZARD, SAFETY-TOE

Shoes may be compromised if :

The shoe is wet

The rubber sole is worn through

Metal particles become embedded in the sole or heel; or

Other parts of the employees' bodies come into contact with conductive, grounded items.

Hand and Arm Protection

If your workplace hazard assessment reveals that your employees risk injury to their hands and arms, and engineering and work practice controls do not eliminate the hazards, you must provide your employees with appropriate protection.

Suggested Questions	Typical Operations of Concern	Yes	No
Are your employees' hands and arms placed near exposed electrical wiring or components?	Building maintenance; utility work; construction; wiring; work on or near communications, computer, or other high-tech equipment; and arc or resistance welding.	☐	☐
Body			
Are your employees' bodies exposed to irritating dust or chemical splashes?	Pouring, mixing, painting, cleaning, syphoning, dip tank operations, machining, sawing, battery charging, installing fiberglass insulation, and compressed air or gas operations.	☐	☐
Are your employees' bodies exposed to sharp or rough surfaces?	Cutting, grinding, sanding, sawing, glazing, and material handling.	☐	☐
Are your employees' bodies exposed to extreme heat?	Welding, pouring molten metal, smithing, baking, cooking, and drying.	☐	☐
Are your employees' bodies exposed to acids or other hazardous substances?	Pouring, mixing, painting, cleaning, syphoning, and dip tank operations.	☐	☐
Ears/Hearing			
Are your employees exposed to loud noise from machines, tools, or music systems?	Machining, grinding, sanding, work near conveyors, pneumatic equipment, generators, ventilation fans, motors, and punch and brake presses.	☐	☐

POTENTIAL HAZARDS. The injuries you may need to guard against in your workplace include the following:

Burns

Bruises

Abrasions

Cuts

Punctures

Fractures

Amputations

Chemical exposures.

For many workplace operations, machine guards such as point-of-operation guards will be sufficient. For example, install a barrier that makes it impossible for employees to put their hands at the point where a table saw blade makes contact with the wood it cuts.
For other hazardous operations, you may be able to institute work procedures that eliminate the risk of injury to your employees' hands or arms. When such measures fail to eliminate the hazard, however, protective gloves will be the primary means of protecting employees' hands. When the risk of injury includes the arm, protective sleeves, often attached to the gloves, may be appropriate.

GLOVES/DESIGN, MATERIALS. IS THERE ONE KIND OF GLOVE THAT WILL PROTECT AGAINST ALL WORKPLACE HAZARDS?

No. The nature of the hazard(s) and the operation to be performed will determine your selection of gloves. The variety of potential occupational hand injuries may make selecting the appropriate pair of gloves more difficult than choosing other protective equipment. Take care to choose gloves designed for the particular circumstances of your workplace.

Gloves made from a variety of materials are designed for virtually every workplace hazard. In general, however, they may be divided into four groups:

Durable work gloves made of metal mesh, leather, or canvas.

Fabric and coated fabric gloves.

Chemical and liquid resistant gloves.

Insulating rubber gloves.

Sturdy gloves made of metal or leather or canvas:

Metal Mesh, Leather, or Canvas Gloves Sturdy gloves made from metal mesh, leather, or canvas provide protection against cuts, burns, and sustained heat.

Leather gloves protect against sparks, moderate heat, blows, chips, and rough objects. Welders in particular need the durability of higher-quality leather gloves.

Aluminized gloves. These gloves usually are used for welding, furnace, and foundry work because they provide reflective and insulating protection against heat. Aluminized gloves require an insert made of synthetic materials that protect against heat and cold.

Aramid fiber gloves. Aramid is a synthetic material that protects against heat and cold. Many glove manufacturers use aramid fiber to make gloves that are cut- and abrasive-resistant and wear well.

Other synthetic materials. Several manufacturers make gloves with other synthetic fabrics that offer protection against heat and cold. In addition to protection against temperature extremes, gloves made with other synthetic materials are cut- and abrasive-resistant and may withstand some diluted acids. These materials do not stand up against alkalis and solvents.

Fabric and Coated Fabric Gloves These gloves are made of cotton or other fabric to provide varying degrees of protection.

Fabric gloves. These gloves can protect against dirt, slivers, chafing, and abrasion. These gloves do not provide sufficient protection, however, to be used with rough, sharp, or heavy materials. Adding a plastic coating to some fabric gloves strengthens them and makes them effective protection for a variety of tasks. Coated fabric gloves. Manufacturers normally make these gloves from cotton flannel with napping on one side. By coating the unnapped side with plastic, fabric gloves are transformed into general-purpose hand protection offering slip-resistant qualities. These gloves are used for tasks ranging from handling bricks and wire rope to handling chemical containers in laboratory operations. When selecting gloves to protect against chemical exposure hazards, always check with the manufacturer (or review the manufacturer's product

literature) to determine the gloves' effectiveness against the specific chemicals and conditions in the workplace.

Chemical- and Liquid-Resistant Gloves Gloves made of rubber (latex, nitrile, or butyl), plastic, or synthetic rubber-like material such as neoprene protect workers from burns, irritation, and dermatitis caused by contact with oils, greases, solvents, and other chemicals. The use of rubber gloves also reduces the risk of exposure to blood and other potentially infectious substances.

Body Protection/Design, Materials

You must provide body protection for employees if they are threatened with bodily injury of one kind or another while performing their jobs, and if engineering, work practice, and administrative controls have failed to eliminate these hazards. Workplace hazards that could cause bodily injury include the following:

Intense heat

Splashes of hot metals and other hot liquids

Impacts from tools, machinery, and materials

Cuts

Hazardous chemicals

Contact with potentially infectious materials, like blood

Radiation.

As with all protective equipment, protective clothing is available to protect against specific hazards. You need to provide personal protective equipment only for the parts of the body exposed to possible injury.

Depending upon hazards in your workplace, you may need to provide your employees with one or more of the following:

Vests

Jackets

Aprons

Coveralls

Surgical gowns

Full body suits

If your hazard assessment indicates that you must provide full body protection against toxic substances or harmful physical agents, you must:

Inspect the clothing carefully,

Ensure proper fit, and

Make sure the protective clothing functions properly

Conduct your hazard assessment. Identify the sources of any possible bodily injury. Install any feasible engineering controls, and institute work practice controls to eliminate the hazards.

If the possibility of bodily injury still exists, provide protective clothing constructed of material that will protect against the specific hazards in your workplace. Materials for protective clothing include the following:

Paper like fiber. Disposable suits made of this material provide protection against dust and plashes.

Treated wool and cotton. Protective clothing made from treated wool and cotton adapts well to hanging workplace temperatures and is comfortable as well as fire resistant. Treated cotton and wool clothing protects against dust, abrasions, and rough and irritating surfaces.

Duck. This closely woven cotton fabric protects employees against cuts and bruises while they handle heavy, sharp, or rough materials.

Leather. Leather protective clothing is often used against dry heat and flame.

Rubber, rubberized fabrics, neoprene, and plastics. Protective clothing made from these materials protects against certain acids and other chemicals.

Be aware that different materials will protect against different chemical and physical hazards. If you have questions about protection when chemical or physical hazards are present, check with the safety department.

Hearing Protection

Determining the need to provide hearing protection can be tricky. Employee exposure to excessive noise depends upon a number of factors: Will Be conducted by EH&S with cooperation from C.F. Safety and the various C.F. departments.

Generally, the louder the noise, the shorter the exposure time before you must provide hearing protection. For instance, employees may be exposed to a noise level of 90 dBA for 8 hours per day before you must provide hearing protection for them. Suppose, however, that the noise level reaches 115 dBA in your workplace. Then you must provide hearing protection if their anticipated exposure exceeds 15 minutes.

POTENTIAL HAZARDS. WILL EARPLUGS REDUCE EMPLOYEE EXPOSURE TO HIGH NOISE LEVELS?

As with other types of hazards, you must implement feasible engineering controls and work practices before resorting to PPE such as earplugs or earmuffs. If engineering and work practice controls do not lower employee exposure to workplace noise to acceptable levels, then you must provide employees with appropriate PPE.

WHAT IF MY EMPLOYEES ARE EXPOSED TO DIFFERENT LEVELS OF NOISE THROUGHOUT THE DAY?

If employees move from location to location and the noise level is different in each location, or if the noise levels in an area change throughout the day (e.g., equipment turns on or off), EH&S must calculate "equivalent noise factors to determine whether you must provide hearing protection.

EAR PROTECTION/EAR PLUGS, OTHER DEVICES. WHAT KINDS OF DEVICES PROTECT AGAINST HIGH NOISE LEVELS? IS COTTON SUFFICIENT AS EARPLUGS?

Plain cotton does not effectively protect against occupational noise. There are however several products that are effective at protecting your employees' hearing.

Single-use earplugs. Made of waxed cotton, foam, or fiberglass wool, these earplugs are self-forming and, when properly inserted, work as well as most molded earplugs.

Preformed or molded earplugs. Sometimes single use and disposable, these plugs must be individually fitted by a professional.

Nondisposable plugs should be cleaned after each use.

Earmuffs require a perfect seal around the ear. Glasses, long sideburns, long hair, and facial movements such as chewing may reduce the protective value of earmuffs. You may purchase special earmuffs designed for use with eyeglasses or beards.

IF I PROVIDE EMPLOYEES WITH HEARING PROTECTION, CAN THEY THEN WORK IN AREAS WITH ANY LEVEL OF NOISE FOR ANY PERIOD?

No. Hearing protectors reduce only the amount of noise that gets through to the ears. The amount of this reduction is referred to as attenuation. Attenuation differs according to the type of hearing protection used and how well they fit. The hearing protectors you choose must be capable of achieving the attenuation needed to reduce the employee's noise exposure to within the acceptable limits. estimating the attenuation of a particular hearing protector based on the device's noise reduction

EH&S will determine proper hearing protection.

Summary

Many factors must be considered when selecting PPE to protect your employees from workplace hazards. With all of the types of operations that can present hazards and all of the types of PPE available to protect the different parts of a worker's body from specific types of hazards, this selection process can be confusing and at times overwhelming. Because of this, a PPE program to help you systematically assess the hazards in the workplace and select the appropriate PPE that will protect your workers from those hazards.

Information taken for OSHA 3151 1977, Assessing the Need for Personal Protective Equipment.

Chapter

4

Job Briefing

The purpose of a job briefing is simply to look at the work plan, assess and correct hazards, assign tasks, address any issues, and ascertain that everyone at the jobsite understands their task.

Trial and error is not the way to figure out a job plan. Employees who are too "in a hurry " to perform this simple task are the most hazardous conditions at the worksite!

When the plan changes during the day it is a good idea to communicate the changes to everyone on the crew -- In doing so, everyone is kept up to date and less likely to make errors.

As a supervisor, you are a leader. Employees look to you for direction and communication. The way in which you approach safety in your workplace influences the employees on your crews. As the leader you are responsible for the safety of your employees but ultimately, it is each employee who must hold themselves accountable.

Safe work procedures are learned skills, and like any other skill, they need to be practiced. Job briefings need to be practiced before they become smooth and simple too. At first employees may feel uncomfortable, but as they become aware that it helps the job run smoother, they will become more at ease. Whether there are crews or a single person working a job, a briefing can be performed effectively.

Conducting the Job Briefing

The Supervisor, crew leader, or other person in charge of the operation should conduct the job briefing. Make every effort to hold the briefing in an area where distractions are minimal. (not next to running machinery etc.) Have paper and pencil handy. It is very important that all employees be able to recognize and identify hazards at the jobsite. It is the leader's responsibility to point them out.

A person who cannot identify hazards should not conduct the briefing.

ELEMENTS OF A JOB BRIEFING

Hold the briefing at the jobsite

Explain the job at hand

Assign specific tasks to employees.

Make sure that everyone is qualified and possesses the proper skill of the assignment.

Don't assume knowledge and skill level.

Do a hazard assessment to identify obvious or potential hazards

Identify the need for personal protective equipment

Know emergency numbers/first aid kit location etc.

Identify any hazards that might be created by the job itself

Make sure that everyone knows the job assignments.

The more complex the job, the more important it becomes to make sure that everyone at the briefing understands.

Allow for employee questions, suggestions, and comments pertaining to the job or assignments. Keep comments focused.

If the plan changes significantly, conduct another briefing.

Chapter

5

Accidents

An Unforeseen, Unpredictable and Unplanned event or Circumstance (Webster)

ACCIDENTS DON'T "JUST HAPPEN" they are caused.

Campus Facilities can offer to our employees the best safety program in the country, but without employee "buy-in" the program will fail. Training, upgrades of equipment, technology, safer policies and procedures, are only tools of accident prevention. Employee attitudes and behaviors guide the ultimate success of effective accident prevention and a sound safety program.

An understanding of human nature when dealing with accident prevention is helpful but not as important as your own attitude toward safety. The essential position and task of the supervisor is observation. Walk around, keep your eyes open, correct unsafe conditions as you go about your day to day tasks. The procedure should begin with ***your*** commitment to safety. When attitudes change eventually behaviors change. Who best to begin the process but YOU!

Leadership and Accidents. Good leaders are made not born: A supervisor must

- Inspire workers
- Create teamwork
- Set an example
- Keep employees informed
- Must have realistic goals
- Must understand the diversity of the employees

A KEY TO UNDERSTANDING HOW ADULTS LEARN IS TO REALIZE SOME BASIC FACTS

The following is based on Malcolm Knowles, characteristics of adult learners

Adults are self-directed they need to be free to direct themselves

Adults come with life experiences

Life experiences
Prior education
Family responsibilities

Adults are goal oriented they have a goal in mind when they take classes

Adults need relevancy they must see the need/reason for learning

Adults are practical knowledge must relate to their work etc.

Adults need to be respected

As a supervisor you are expected to instill in your employees the goals and requirements of the University. Safety and safe work practices are included.

Accident Investigations / Reviews

Accident prevention is the key to eliminating possibility of injury to employees and property loss to the University.

In most cases, the Safety Coordinator conducts the *investigation,* with the supervisor as a participant*. Accident Reviews,* will be completed by the supervisor. Direct supervisors are familiar with employee's work environment & assigned tasks. The Supervisor is the person who must take the accident situation under control and immediately eliminate or control hazards to others.

When an accident occurs

Provide First *Aid* for any injured persons.
Eliminate or control hazards
Document the accident scene to determine the cause
Interview the witnesses immediately.
Complete an accident report
Forward report to C.F. Human Resources

Investigating an accident

The form helps the supervisor:

Define the accident review
Descriptions of accident
Events prior to the accidents
The accident
What abnormalities (if any) occurred
The sequence of events
Most probable cause

Full Investigative Procedures

Lost Time/ Serious Accidents/ Potentially Fatal/Fatal

Accidents are usually complex. Any accident can easily have 10 or more events leading up to it. The basic causes of an accident are Direct and Indirect. An example of direct cause would be if someone was electrocuted. The DIRECT cause are unsafe conditions or unsafe acts leading to the accident. Indirect causes are symptoms. Some indirect causes are poor management procedures, policies, decisions etc.

When accident investigations are to take place, the supervisor will be a participant and observer. The safety coordinator and other members of management, safety committee, and workforce will be present. The Accident Investigation is more formal and in-depth that the Accident Review.

The Supervisor and the Accident Review

As a supervisor, you will be required to fill out the following accident report and review:

Campus Facilities

Report of Injury

☐ Check Box if this is a Near Miss

Days You Work Per Week_____ Time of Day Work Began _____a.m./p.m.

EMPLOYEE SECTION: (Use back of page for additional comments.)

Name:	SSN:	Department:

Date of Incident:	Time:	A.M. ☐ P.M.	Location:	Body Part/s:

Task You Were Doing:	What Injured You?

☐ No Treatment

☐ First Aid Only – Who gave you treatment? ☐ Self ☐ Supervisor ☐ Other Employee

☐ Medical Treatment – Where? ☐ E.R. ☐ Urgent Care

Incident Type:

☐ Slip, Fall – Same Level	☐ Overexertion – Strains / Sprain	☐ Inhalation	Exposure to:
☐ Slip, Fall – Different Level	☐ Struck By or Struck Against	☐ Ingestion	☐ Temperature Extremes
☐ Caught In, On, or Between	☐ Burn - Chemical or Heat	☐ Absorption	☐ Chemicals
☐ Abrasion / Cut / Puncture	☐ Contact with Electrical Current	☐ Bites / Stings	☐ Dusts / Particles

Comments:

***** Thanks for reporting your injury, please sign and date this and give it to your immediate supervisor today. *****

Injured Signature/Date:

SUPERVISOR SECTION: Incident / Accident Cause:

☐ Lack of Knowledge, Experience, or Skill
☐ No PPE Available
☐ PPE Available But Not Used

* Understood the Risk ☐ Yes ☐ No

☐ Human or Physical Limitation
☐ Faulty Tool or Equipment
☐ Unguarded Machine

* Understood the Hazard ☐ Yes ☐ No

☐ Hazardous Condition – What? _____

Hazardous Condition Beyond Your Control – Explain? _____

Corrective Action:

☐ Recommended employee see a doctor.
☐ Provided training (date) _____.
☐ Posted warning signs.
☐ Fixed identified hazard.
☐ Equipment taken out of service and tagged.
☐ Will fix identified hazard by (date) _____.

☐ Provided PPE.
☐ Replaced / Repaired equipment.
☐ Counseled employee (date) _____.
☐ Will schedule employee for training _____.
☐ Requested repairs from: _____.
☐ Will send hazard information to my superior.
☐ None.

Other: (Explain in space provided or on back.)

Additional information or comments:

SUPERVISOR SIGNATURE AND DATE:

Chapter

6

Conducting Safety Meetings

First Thing Monday Morning is a great time to get your employees together, shake off the weekend, and help them focus on the week ahead.

What better way to start the week than with a short safety meeting.

Safety meeting should have pertinent information. Example: accidents that have occurred in the area., Hazards that might exist, Safety concerns of the workers, Items that might have to be taken to the departmental safety committee for review. Topics on new tools or a new procedure. Any number of things can be discussed in those meetings.

Formal meetings have their place in a safety program but the most effective meetings are those conducted at the jobsite(briefing) or those short weekly meetings.

There is much discussion about the difference of safety meetings and safety training……..Both have their place in the safety program, and both can help to heighten safety awareness and prevent accidents. HOWEVER, it should NEVER be the responsibility of the supervisor to provide safety training. It takes some doing to plan a class or training session. It takes practice, it takes expertise, and it takes a "gottawanna" attitude. (Ya gotta wanna) Those supervisors that enjoy the training part of the job may look forward to developing a one hour program occasionally. However, most of us would rather not.

There is a time and place for training. There is also a time and place for the safety meeting……."never together" and never interchangeably.

Receipt of Campus Facilities

Supervisor Safety Handbook

I, (Please Print) _____,

have been shown the Campus Facilities Supervisor Safety Handbook. I understand that it is my responsibility to read and understand the policies and procedures outlined within it. If I have questions or concerns about a policy or procedure, I will discuss it with the Campus Facilities Safety Coordinator.

Signature:_____

Date:_____

Appendix 1: Reports, Checklists, Forms, Instructions, etc.

ASTM – F2412-05/ F2413-05: General Requirements

Section	Protection	Identification Code
1	**Impact and Compression Resistance**: To protect the foot from falling objects or rolling objects such as a wheel on a forklift. Class 75 is the highest level and shall be the standard within Campus Facilities.	**I/C**
2	**Metatarsal**: Protection of the upper foot (metatarsal bones) and toe areas. Designed to prevent or reduce injuries when the toe and metatarsal areas of the foot are exposed to "drop" hazards. Class 75 is the highest level and shall be the standard within Campus Facilities.	**Mt**
3	**Conductive Footwear**: Designed to facilitate/discharge static electricity from the body through the shoes into grounded floors. Floors must be grounded so that the charge can be dissipated. Used to minimize static electricity and to reduce the possibility of ignition of volatile chemicals or explosives. WARNING: Footwear shall NOT be worn near open electrical circuits of highly charged objects of any kind that require Electrical Hazard (Non Conductive) footwear. This footwear is NOT ACCEPTABLE FOR CAMPUS FACILITIES EMPLOYEES.	**Cd**
4	**Electrical Hazard Protective Sole and Heel**: The sole construction is designed to reduce the hazards due to the contact of the sole with electrically energized parts and to provide secondary electrical hazard protection on substantially insulated surfaces. The soles of electrical hazard footwear are designed to reduce the potential of electrical shock when soles are exposed to open circuits of 600 Volts AC or less. Footwear with electrical hazard protective soles and heels is recommended for general use to reduce the risk of injury following accidental contact with live electrical conductors of less than 600 Volts AC. Because of the possibility that the shock resistance property may be degraded when worn, the footwear must never be used in place of conventional insulating rubber mats, etc. The shock resistance properties can be maintained if the footwear is used in dry conditions and if the outer sole remains free from chemical contaminants (road salt etc) and embedded conducting materials (metal particles, thumb tacks etc.) The sole and heel of the footwear should be inspected regularly. Under no circumstances should modifications be made to the footwear that negates the electrical hazard properties. WARNING: Electrical Hazard non-conductive footwear shall not be worn near	**EH**
5	**Sole Puncture Resistant Protective Device**: Footwear includes a sole puncture device, usually a metal mesh layer in the soles. This reduces the possibility of puncture wounds to the soles of the feet. The protective plate must be an integral part of the shoe.	**PR**
6	**Static Dissipative:** Footwear designed to reduce the accumulation of excess static electricity by conducting body charge to ground, while maintaining a high enough specified level of electrical resistance between 10 6 and 10 9 Ohms according to test procedures in ASTM-F2412-05. NOT ACCEPTABLE FOR CAMPUS FACILITIES EMPLOYEES.	**SD**

Other pertinent characteristics:

The following protective properties are not part of the ASTM – F2412-05 requirement, but may be included based on the hazards assessments of the job.

- Resistance to Heat/Cold
- Slip Resistance – Note: Surfaces and conditions, sole shape and tread design, heel shape and hardness cannot guarantee the quality of slip resistant data.
- Water Resistant
- Chemical Resistance - Outsole Properties:
    - Call C.F. Safety for information concerning various sole and upper properties. I.E. Leather is not recommended for alkalis, concentrated mineral acids.
- Defined heel –
- Ankle protection
- Chain Saw Protective Footwear (see ANSI/ASTM F1818-97)

EMERGENCY Procedures

In all emergency circumstances, it is important to remain calm and follow the steps indicated. If there are any questions concerning these procedures, please refer to the emergency numbers listed. More information is available at http://ehs.missouri.edu.

http://ehs.missouri.edu/other/pdf/emergency-poster.pdf

A. FIRE

1. Activate fire alarm.
2. From a safe location call the Fire Department (911). Give the nature and location of the fire.
3. Evacuate the building and help individuals needing assistance.
4. Use a fire extinguisher, if trained to do so.
5. Notify MU Police (882-7201) if not already notified.
6. Notify Campus Facilities (days 882-8211, nights 882-3333).
7. Report to your supervisor.

B. MEDICAL EMERGENCY

If the Individual is Unconscious:

1. Call for an ambulance (911). (If at the University Hospital call 882-7979, Ellis Fischel Hospital call 911, or Columbia Regional Hospital call 9333.)
2. Do not move the individual unless there is an imminent hazard.

If the Individual is Conscious:

1. Call for an ambulance (911) if requested by the individual. (If at the University Hospital call 882-7979, Ellis Fischel Hospital call 911, or Columbia Regional Hospital call 9333.)
2. If the injured party is a University employee, contact a care facility authorized by Worker's Compensation (882-7019).
3. If the individual is a student call Student Health Services (882-7481).

In All Cases:

1. Have someone meet the ambulance.
2. Call MU Police (882-7201), if not already notified.
3. Notify appropriate supervisors.

C. EARTHQUAKE

1. Stay indoors if already there.
2. Take cover under sturdy furniture (e.g. desks) or in doorways, halls, or against inside walls.
3. Stay near the center of the building.

4. Stay away from glass windows or doors.

5. Avoid running through or near buildings where there is the danger of falling debris.

6. Persons outdoors should stay in the open, away from buildings and structures, and a safe distance from utility wires.

7. After tremors have stopped, stay away from damaged buildings and structures.

MU Emergency Website:

http://mualert.missouri.edu

D. TORNADO

If Indoors:

1. Move away from windows and into the basement or interior hallway on a lower floor. Avoid auditoriums, gymnasiums, or other areas having a wide, free-span roof.

2. Take cover under heavy furniture.

If Outdoors:

1. Lie flat in the nearest depression, such as a ditch or ravine.

2. If there is time, move away from the path of the tornado at a right angle.

E. BIOLOGICAL, CHEMICAL, OR RADIATION EMERGENCY

Fire Involving these Materials:

1. Follow procedures for fire.

2. Inform emergency personnel about the specific hazard.

3. Contact EHS (882-7018). At night, on weekends, or holidays call MU Police (882-7201).

Medical Emergency Involving these Materials:

1. Follow procedures for medical emergency.

2. Inform medical personnel about the specific hazard.

3. Contact EHS (882-7018). At night, on weekends, or holidays call MU Police (882-7201).

Release of these Materials:

1. Take action to contain release if it is possible to do so safely. Close doors and windows.

2. Evacuate area to the extent appropriate.

3. Assemble all personnel in nearby safe area until released hazards can be assessed.

4. Warn fellow workers and supervisors. Control access to release area and post warning signs.

5. After imminent hazards are addressed, prevent the spread of contamination. If possible, turn off air equipment that might spread contamination.

6. Contact EHS (882-7018). At night, on weekends, or holidays call MU Police (882-7201).

7. Decontamination shall be performed in consultation with

EHS.

EMERGENCY NUMBERS

Ambulance Service.....911

Campus Facilities 882-8211

Columbia Regional Hospital Emer. Response.....9333

Ellis Fischel Emergency Response 911

Environmental Health and Safety (EHS)

Days 882-7018

Nights, Weekends, Holidays (MU Police) 882-7201

Fire.....911

Mid-Missouri Crisis Line..... 445-5035

Police 911

Poison Control 1-800-222-1222

Student Health Center 882-7481

University Hospital and Clinics Emer. Response. 882-7979

Worker's Compensation 882-7019

March 2010

September 28, 2010

CAMPUS FACILITIES DIRECTIVE NO. 207C

http://www.cf.missouri.edu/infolib/directives/index.html?file=207_2010.09.28_Protective_Eyewear.pdf

SUBJECT: To provide guidelines for requirements for the wearing of protective eye wear and acquiring protective eye wear.

CANCELLATION: Campus Facilities Directive 207B dated February 15, 2000

1. Employees will be required to wear protective eye wear with attached side shields when they are assigned to work in areas or on tasks requiring such eye wear. Type of protection eye wear will be determined by the type of equipment being used and the task being performed.

2. Requests for non-prescription safety glasses or goggles are to be made by the employee to his/her immediate supervisor. The supervisor will determine the type of protective eye wear required and will furnish the appropriate protective eye wear to employee.

3. Request for prescription safety eye wear- The employee should request an employee application for Protective eye wear and an Authorization/Order Form for Protective eye wear from their immediate supervisor or CF Personnel Services.

A. The supervisor should complete the employee application Form. If the employee is requesting the Uvex XC with insert lens, the supervisor must initial on the line in Section II, Group #4 on the Authorization/order Form for Prescription Safety Wear.

B. The employee will take the form to the University Optical which is located inside the Mason Eye Clinic in the main lobby of the University Hospital and Clinics. When the glasses are ready for pick up, the employee will be notified by University Optical.

C. A wide variety of frames are now available in addition to standard frames. If the employee chooses a frame or lens other than the standard one, there will be a charge to the employee for the difference in price. Exception: there is no extra charge if the employee selects the Uvex XC frame and insert lens or eye glasses with Progressive 1 or 2 lenses.

D. Under normal circumstances, an employee is eligible for 1 pair of prescription safety glasses per year. Exceptions are:

a. Damaged frames or lenses.

b. Change of **prescription.**

5. Failure to wear **protective** eye wear with attached side shields when required may result **in** disciplinary **action.**

Eye and Face Protectors. Recommendations

Figure 1. Recommended Eye and Face Protectors

Eye anc1 r1:c protector liiC idcnlilktl below by number and typ,·. Refer to *Table I* for rrcommendcd usage applicacion.

1. ('.,.oggles, flex ihle fiHing, regular ventilation
2. Goggles, lll.:xibh: lilting. hooded '']''llilation
3. Goggle, cushioned fitring, rigid bOO}'
4. Spectacles, metal frame. with sidhiclLk•
5. Spcetndcs, plu tic lramc. wilh sith.: shidds*
6. Spt!'Ciadt!., metal pi<L tic frame, with flacfold side hield
7. Welding Goggles, eyecup type. tinted lenses*

7A. l:hip[JiGoggles. eyecup type• .:lear safety lense-.; (not illu rra red)

lt Welding GQggles, ccwer pec t)-pe. tinred len*''

8A. Cb.Jppl..og Cog. covcrsp.:c type, ck:<-tr safety kn c(nm illustrated)

9. Welding f'nlggles, cov'ei'!x-cype, tinred plate lens"'

10. .I''IIC.<' Sb.icld (uvaih1blc with ph1. 1ic or mesh ,;ndow, tintcd/tntnsparem)

I l. \\'elding Helmets''•

'\() rr: 19 CFR T926 102 (ujf5) Tuulc [-J
f771f.i.f'' ort: f'l' cwt.ula.bhl tuliwut lide lltie',dx.fvr limited wat req tiri11J'. m:ly.f'rmr.tl p;n!Et:tirm.
•• Sn: T<1/Jlr 2. Filler V.hsc - far J'rui!Tiimr ,tgwmt Rad imot /:.'lli'1/ '.

Table 1.
Eye and Face Protector Selection Guide

011erution	Ha: .:m:Js	R.onttnudtd p1-otedurs: (numhers nl'er tu k'igure I)
Acerylene-hurning, acetylene• cLJtting, acctylcnc-wclc.ling	Sp.rks. harmful ra)·S. mul len mt:laL rtying l),µtid-	7.S.9
Cl1emical hanulin	Spla:.h. acicl bul1ls, t\Hne<	2.10 (for severe exposure add 10 ov<r 2)
Chippi ng	Flying pm'tid, ·	l ,.l,45.6,7A,R,\
F.lect.ric (arc) welding	Spark- intmsc ray. moil<'ll mc lll	9,1 1 1 1 in c.,mhinatio n wir.h +,5(, in tinted lenses ad\'i ahlc)
Furnace llpmtillns	GlflJ\', hear, m o.c:n meml	7,R,9 (fm severe exposure ac.lc.l 10)
Grim]iug - li!!-hl	rlying particles	1.3,4,5.6.10
Gri.lll.ling- h<'avy	t'lymg port1cles	J.3.71\. A ifor !>cw x JXlS urc adc.l 10)
Ltlb<Jratory	Chemical plah. gl abreakage	2 (10 when in l'ombirmlion with 4.5.6)
rvla<hiuiu	!-'lying panicle	1,3,4.5.6,10
l\-lollcn mclals	lle'll, gl •-e. spo-l,,, pla<h	7.?. \10 in combination with 4-.5.6 in lirH oJ lcnc;)
Spul W<''ldiu	Flying Jlaniclcs. spark	1.3.4.5.6.!0

sowcc: l.l ('f.'R I920.JO?tr.:l5J

EMPLOYEE APPLICATION FOR PROTECTIVE EYEWEAR

Please complete this form and hand carry it to:
University Optical
DO NOT MAIL

EMPLOYEE INFORMATION:

Date: _____

Name: _____ Title:

Dept: _____ Phone:

Address: _____

Describe the duties you perform which expose you to eye hazards:

_____

_____

_____

_____

Are prescription lenses needed? _____

Employee's department will be billed for required safety eye protection.

SUPERVISOR APPROVAL

Signature: _____ Phone Number _____

_____

Account Code to be billed to: _____ _____

EH&S 6/00

Instructions Dispensers Optical Service Order Form

- ***WILL BE COMPLETED BY UNIVERSITY OPTICAL STAFF***

SECTION IV – LENS OPTIONS & ENHANCEMENTS

- ***WILL BE COMPLETED BY UNIVERSITY OPTICAL STAFF, HOWEVER, THE DEPARTMENT MAY PAY FOR LENS OPTIONS & ENHANCEMENTS***

Lens options will be discussed with the staff member. If the staff member elects to take any of these options then it will be at the employee's expense. If the department wishes to pay for any of the options in this section you may cross off the price in the "Employee Pays" column and rewrite the price in the "Company Pays" column. You must also initial by this charge on the form.

An authorized staff member **MUST** sign the form in the "Purchase Authorized By" box at the very bottom of the form.

VERY IMPORTANT—PLEASE EXPLAIN TO THE STAFF MEMBER

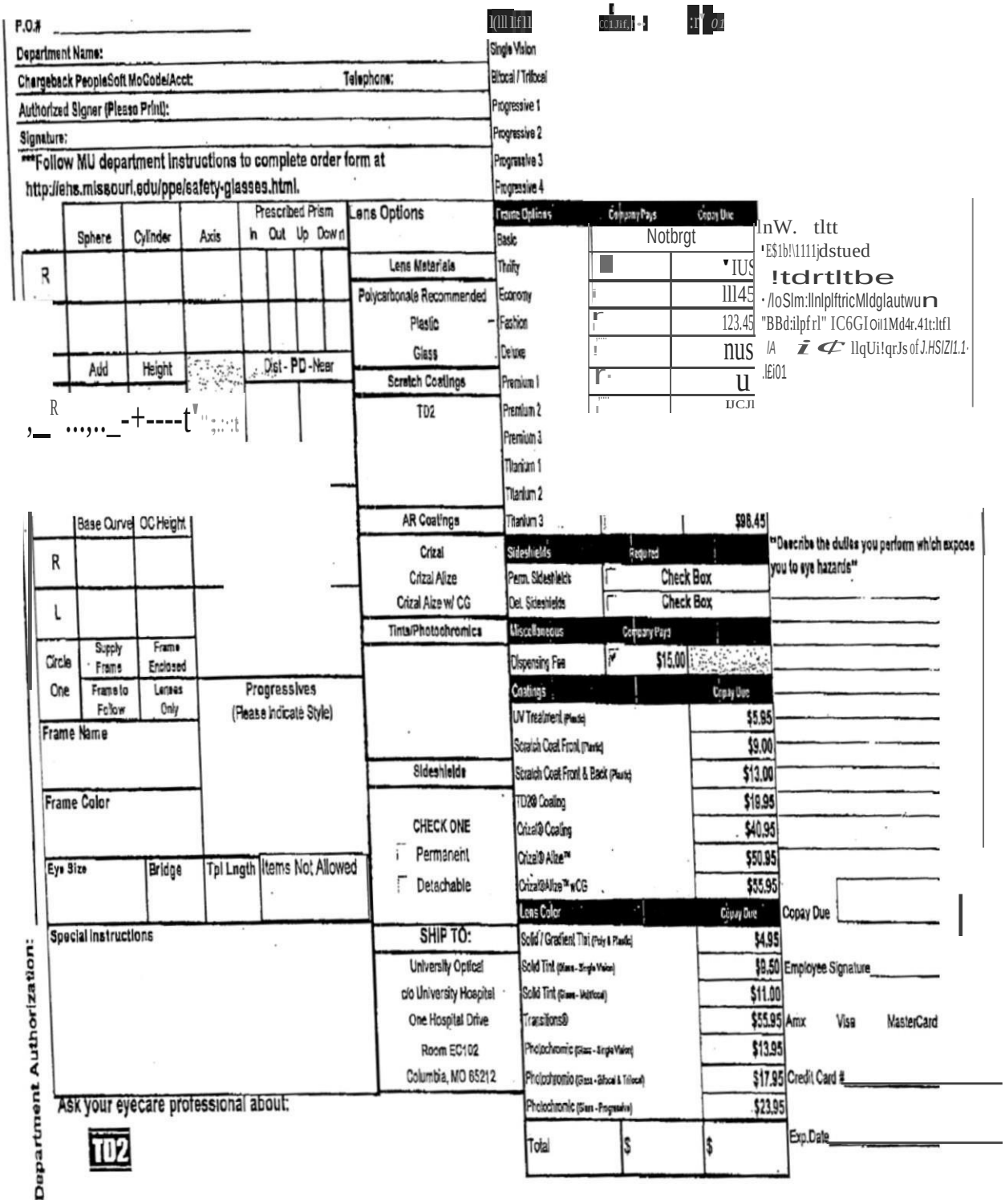
THE EMPLOYEE PORTION OF THE PAYMENT WILL BE EXPECTED AT THE TIME THAT UNIVERSITY OPTICAL STAFF COMPLETE THE ORDER FORM. PAYMENT MUST BE EITHER CHECK OR CASH.

CHECKLIST OF ITEMS TO BRING TO UNIVERSITY OPTICAL

- ❑ Prescription from Eye Doctor/Optometrist
- ❑ Employee Application for Protective Eyewear signed by Supervisor (You may copy the application on the reverse of this form)
- ❑ Dispensers Optical Authorization/Order Form with signature of authorized staff member
- ❑ Employee payment portion of order—either check or cash

Prescription Eyewear- Authorization/Order Form

Use Website Form: http://www.cf. missouriedu/safety/forms!EyeReqForm. pdf



P.O.#
Department Name:
Chargeback PeopleSoft MoCode/Acct: Telephone:
Authorized Signer (Please Print):
Signature:
***Follow MU department instructions to complete order form at http://ehs.missouri.edu/ppe/safety-glasses.html.

	Sphere	Cylinder	Axis	Prescribed Prism In	Out	Up	Down
R							
	Add	Height		Dist - PD - Near			

Lens Options

Lens Materials: Polycarbonate Recommended; Plastic; Glass

Scratch Coatings: TD2

AR Coatings: Crizal; Crizal Alize; Crizal Alize w/ CG

Tints/Photochromics

Sideshields: CHECK ONE — Permanent; Detachable

	Base Curve	OC Height
R		
L		

Circle One: Supply Frame / Frame to Follow; Frame Enclosed / Lenses Only

Progressives (Please indicate Style)

Frame Name
Frame Color

Eye Size	Bridge	Tpl Lngth	Items Not Allowed

Special Instructions

SHIP TO:
University Optical
c/o University Hospital
One Hospital Drive
Room EC102
Columbia, MO 65212

Ask your eyecare professional about:
TD2

Department Authorization:

Single Vision
Bifocal / Trifocal
Progressive 1
Progressive 2
Progressive 3
Progressive 4

Tints: Options	Company Pays	Copay Due
Basic	Notbrgt	
Thrifty		
Economy		
Fashion		
Deluxe		
Premium 1		
Premium 2		
Premium 3		
Titanium 1		
Titanium 2		
Titanium 3		$98.45

Sideshields	Required
Perm. Sideshields	Check Box
Det. Sideshields	Check Box

Miscellaneous	Company Pays	
Dispensing Fee	$15.00	

Coatings	Copay Due
UV Treatment (Plastic)	$5.95
Scratch Coat Front (Plastic)	$9.00
Scratch Coat Front & Back (Plastic)	$13.00
TD2® Coating	$18.95
Crizal® Coating	$40.95
Crizal® Alize™	$50.95
Crizal® Alize™ w/CG	$55.95

Lens Color	Copay Due
Solid / Gradient Tint (Poly & Plastic)	$4.95
Solid Tint (Glass - Single Vision)	$9.50
Solid Tint (Glass - Multifocal)	$11.00
Transitions®	$55.95
Photochromic (Glass - Single Vision)	$13.95
Photochromic (Glass - Bifocal & Trifocal)	$17.95
Photochromic (Glass - Progressive)	$23.95

Total	$	$

Describe the duties you perform which expose you to eye hazards

Copay Due
Employee Signature
Amx Visa MasterCard
Credit Card #
Exp.Date

July 7, 2010

Campus Facilities Directive No. 214D

Cancellation of directive 214C dated January 1, 2008.

SUBJECT: **Protective Footwear Policy** (Service and Maintenance)

PURPOSE: To establish clear and consistent guidelines regarding purchasing and requiring protective footwear.

1. General Requirements

a. Campus Facilities employees shall wear protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where employee's feet are exposed to electrical hazards.

b. Campus Facilities employees not required to wear protective footwear shall wear full enclosed shoes/boots constructed of leather and/ or approved uppers. No opened toe footwear is allowed.

c. Protective footwear shall comply with ASTM (American Society for Testing Materials) F 2412-05 and F 2413-05 for "Personal Protection- Protective Footwear".

d. Protective footwear is defined by the directive as shoes and boots including insoles. All other shoe accessories such as replacement of shoestrings, polish, etc, are employee's responsibility.

2. Determining Who Should Wear Protective Footwear

a. Certain job classifications by the nature of the work require protective footwear.

b. Other job classifications may or may not require protective footwear.

Departmental directors working with the safety director will determine what other job classifications are required to wear protective footwear.

c. The type of protective footwear to be worn by the employee is a function

of the employee's job duties and exposure to injury. Recommended footwear types are listed on Attachment 1. In special circumstances, the employee's supervisor, department director, and the Campus Facilities Safety Coordinator will determine what type of protective footwear shall be worn.

3. Eligibility for Protective Footwear Subsidy

a. Campus Facilities departments will provide up to a maximum subsidy of

$125.00 per fiscal year toward the purchase of protective footwear for “eligible” employees working in a job classification requiring footwear. Eligible employees are full time employees who have successfully completed their probationary or qualifying period.

b. New full time employees working in job classifications that require protective footwear will be required to furnish protective footwear until such time as they completed their probationary period. After completion of their probationary period the employee will furnish their supervisor with a copy of the sales receipt for the protective footwear. The employee will then be reimbursed for their protective footwear and will be eligible for the $125.00 per fiscal year maximum subsidy.

c. Temporary and student employees that are hired to work in jobs requiring protective footwear must provide protective footwear at their own expense.

4. Purchasing of Protective Footwear

a. Protective Footwear Purchased from Approved Vendors Including

Approved Shoe Truck/Trucks

i. After employee obtains a University Protective Footwear Voucher, he/she takes it to an approved vendor. Employee selects appropriate footwear and pays any additional costs over annual subsidy of $125 to vendor. Employees will be charged tax on any additional costs over subsidy allowance.

ii. Vendor fills in cost and description of protective footwear, keeps original copy of voucher and gives the yellow copy of the voucher back to employee. Vendor charges a maximum of $125.00 (tax exempt) to University and charges the remainder with tax to the employee. Employee’s portion is paid at the time of purchase. *Employees may not use their individual procurement cards to purchase safety shoes.*

iii. Employees signs and returns the voucher to his/her supervisor that day or the next business day.

iv. Supervisor will inspect the footwear to determine if the footwear meets departmental requirements and will give the yellow copy to

the department fiscal personnel.

v. The departmental fiscal person calls the vendor to authorize the charge to the credit card. If the employee does not provide completed “University of Missouri Protective Footwear Voucher” to the department for timely payment to the vendor, the vendor can fax the form or call the Campus Facilities Departmental contact number listed on the “University of Missouri Footwear Voucher”.

b. Protective Footwear Purchased from Unapproved Vendors

i. It is the employee's responsibility to obtain footwear that meets the requirements for his/her job. Employee pays vendor full amount including tax. Employee returns receipt and "University of Missouri Protective Footwear Voucher" to his/her supervisor the next business day. The supervisor will inspect the footwear for compliance with departmental protective footwear compliance and give the receipt to the departmental fiscal personnel. *Employees may not use their individual procurement cards to purchase safety shoes.*

ii. Departmental accounting office will process receipt of shoe purchase to reimburse employee for up to the maximum annual subsidy of $125 per fiscal year, not including tax. Employee pays all taxes.

c. Protective Footwear purchased on-line

i. On-line purchase must be less than $125.

ii. Employee should take a catalog picture or computer screen print with order number and size to department for on-line purchase. This purchase will be paid via Department's University Credit Card. *Employees may not use their individual procurement cards to purchase safety shoes.* If the employee is dissatisfied with the boots, he/she must pay for return shipping. The employee will only be able to purchase replacement boots when the University's Credit Card is credited.

d. Paid Time Allowance for Protective Footwear Purchases

i. Purchases of Protective Footwear from approved shoe truck while on University property and the purchase of Protective Footwear

on-line will be allowed during the employee's work hours.

ii. Searching for Protective Footwear from approved vendors or unapproved vendors via on-line browsing or shopping must be done on the employee's own time, before or after work hours, vacation, etc.

5. Replacing Protective Footwear

a. Campus Facilities departments will provide up to a maximum subsidy of

$125.00 per fiscal year for replacing protective footwear.

b. Protective footwear that becomes worn or damaged and no longer provides the required safety protection, must be replaced.

i. It is the employee's responsibility to replace such footwear.

Protective footwear that is damaged on the job due to extra ordinary circumstances may be replaced by the department if approved by the Departmental Director

ii. It is the employee's supervisor's responsibility to continually assess the condition of his/her employee's protective footwear.

c. After the second issue of protective footwear and for subsequent issues of protective footwear, the employee may be required to turn in a worn out or damaged pair of protective footwear to receive the shoe subsidy.

6. Wearing of Protective Footwear

Failure to wear protective footwear when required will result in appropriate disciplinary action; including absence without pay until such time that protective footwear is purchased.

Gary L. Ward

Associate Vice Chancellor

PROCEDURE FOR OBTAINING PROTECTIVE FOOTWEAR

Effective: July 1, 1998

FIRST AND SECOND ISSUANCE OF PROTECTIVE FOOTWEAR TO EMPLOYEE

1. Supervisor fills out Protective Footwear Voucher, including the type of protective footwear required for job classification.

2. Manager reviews voucher for accuracy and gives approval with signature.

3. Employee obtains protective footwear from approved shoe truck vendors:

   A. Employee signs voucher and pays any additional costs over annual subsidy of $100 to vendor. Employees will be charged tax on any additional costs over subsidy allowance.

   B. Shoe truck vendor fills in cost and description of protective footwear, keeps original copy of voucher and gives remaining copies of voucher back to employee.

   C. Employee returns voucher to his/her supervisor.

   D. Supervisor keeps the green supervisor copy, gives employee gold copy, sends department fiscal pink copy to the departmental accounting area, and personnel yellow copy to C.F. Personnel Office.

4. Employee obtains protective footwear from sources other than approved shoe truck vendor:

   A. Employee shows vendor shoe voucher, stressing the protective footwear required for his/her job classification. It is the employee's responsibility to obtain footwear that meets the requirements for his/her job classification.

   B. Employee pays vendor full amount including tax for protective footwear.

   C. Employee fills out voucher showing amount paid and returns voucher with original receipt of purchase to his/her supervisor.

   D. Supervisor inspects protective footwear for conformance to job classification requirements. Supervisor keeps the green supervisor copy of voucher, gives employee gold copy, sends department fiscal pink copy along with paid receipt to departmental accounting office, and personnel yellow copy to C.F. Personnel.

   E. Departmental accounting office will process receipt of shoe purchase to reimburse employee for up to the maximum annual subsidy of $100 per fiscal year, not including tax. All taxes are paid by employee.

THIRD AND SUBSEQUENT ISSUANCE OF PROTECTIVE FOOTWEAR TO EMPLOYEE

1. Employee requests protective footwear and shows proof (worn-out or damaged pair of protective footwear) to supervisor.

2. Supervisor labels protective footwear as needing replacement by punching hole in tongues of shoes with hole punch.

3. Supervisor and employee follow procedures 1 through 4 under First and Second Issuance of Protective Footwear.

TYPES OF PROTECTIVE FOOTWEAR

Job Classification	Maintenance		PD&C		Energy Mngt.		Grounds		Bldg Service		Total
	Type	Total	Type	Total	Type	Total	Type	Total	Type	Total	
administrative assistant	AF	1									1
arborist							ABDF	2			2
asbestos worker					ABF	2					2
asbestos worker (lead)					ABF	1					1
assistant superintendent	ABF	2									2
BTS/locksmith	ABF	2									2
BTS/carpenter	ABDF	5	ABDF	11							16
BTS/mason			ABDF	10							10
bldg a/c specialist	ACDEF	1									1
bldg main. Mechanic	ABDF	3									3
bldg security specialist	ABF	1									1
chiller equipment specialist					AEF	1					1
chiller technician					ABF	1					1
clerk typist					AF	1					1
construction project manager			AEF	12							12
cooling tower technician					ABCF	2					2
custodial equipment mechanic									ABCDF	1	1
driver	ABDF	1					ABDF	1			2
electrical distribution specialist					ABF	1					1
electronic systems technician					ABF	5					5
engineering technician					ABF	1					1
equipment operator							ABDF	1			1
fleet vehicle attendant							ABF	1			1
fire protection specialist	ABF	1									1
groundskeeper							ABDF	12			12
groundskeeper II							ABDF	6			6
groundskeeper (lead)							ABDF	4			4
HVAC specialist	ACDEF	1									1
high voltage electrician					AEF	6					6
instrumentation & electrical superv					AEF	1					1
landscape architect							*	1			1
In r											

A-Slip Resistant B-Steel Toed C-Chemical Protection D-6" Height Minimum
E-Composition Toed F-Full Leather Upper

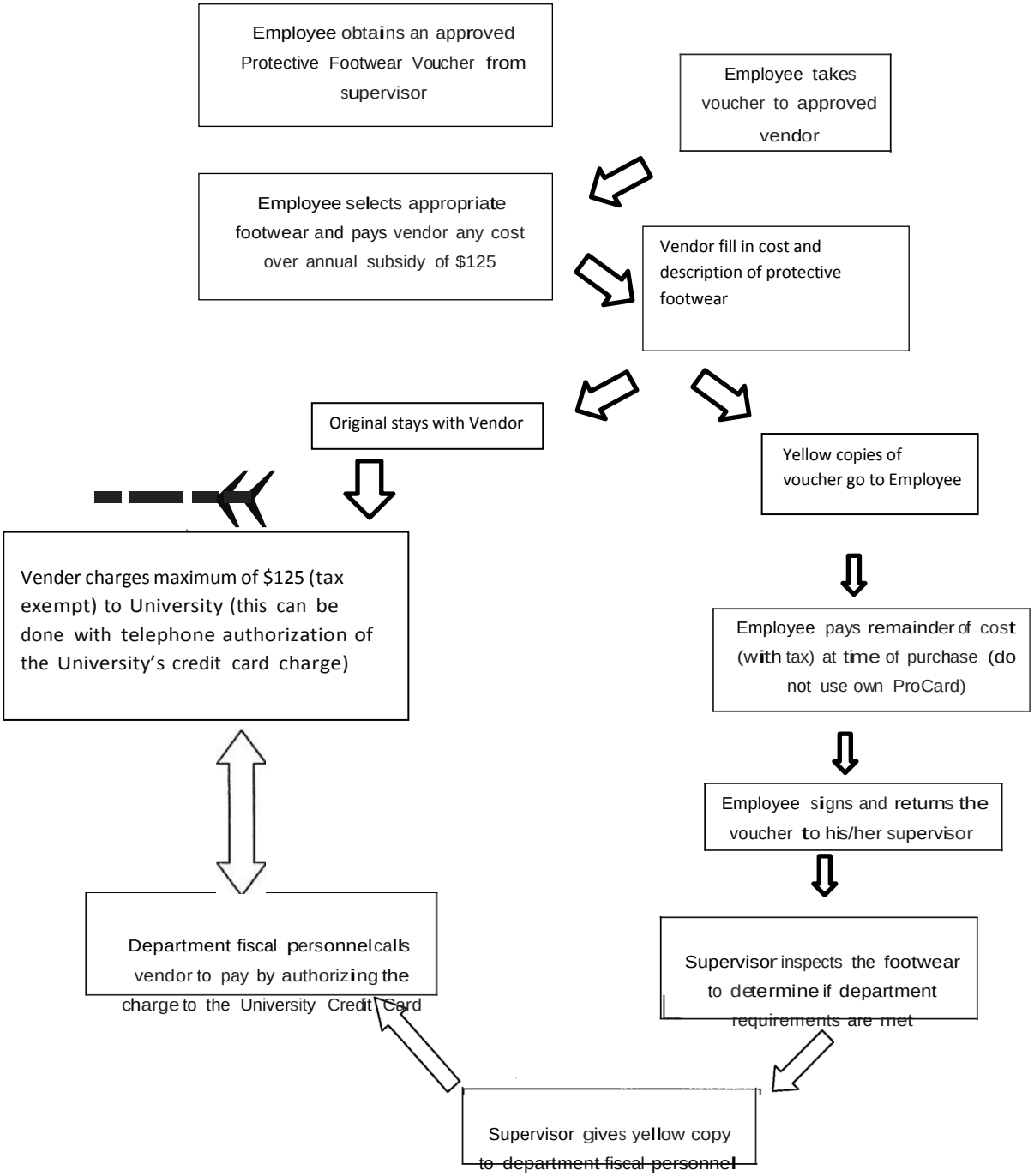
Job Classification	Maintenance		PD&C		Energy Mngt.		Grounds		Bldg Service		Total
	Type	Total	Type	Total	Type	Total	Type	Total	Type	Total	
landscape gardner							ABDF	4			4
maintenance service attendant	ABDF	17			AEF	2					19
maintenance systems coor.	AF	1									1
maintenance supervisor					ABF	1					1
manager,engineering					ABF	3					3
MTS/controls	ADEF	1			AEF	3					4
MTS/electrician	ADEF	1	ADEF	11	ADEF	1					13
MTS/machinist	ABDF	2	ABDF	2							4
MTS/plumbers	ABDF	0	ABDF	6							6
MTS/pipefitter	ABDF	8			ABF	4					12
MTS/refrigeration	ADEF	4	ADEF	2	ADEF	1					7
MTS/sheet metal			ABDF	4							4
MTS/welder			ABDF	1	ABDF	1					2
mover									ABCDF	5	5
mover, lead									ABCDF	1	1
office support staff III	AF	1									1
painter	ABF	5	ABF	9							14
pest controllers	ABF	2									2
plaster			ABDF	2							2
p. plant control systems tech.					AEF	3					3
p. plant equipment operator					ABF	3					3
p. plant equipment operator (lead)					ABF	1					1
p. plant maint. spec. 111/milwright					ABF	3					3
p.plant maint. spec. III/welder					ABF	2					2
p.plant maint. spec. II					ABF	6					6
p. plant maint. spec. I					ABF	2					2
p. plant operator					ABCF	10					10
p. plant operator trainee					ABCF	5					5
p.plant superintendent (assistant)					ABF	1					1
p.plant superintendent					ABF	1					1
p. plant supervisor					ABF	5					5
roofer	ABDF	2									2
roofing systems specialist	ABDF	1									1
sr.secretary	AF	1					*	1			2

A-Slip Resistant B-Steel Toed C-Chemical Protection D-6" Height Minimum
E-Composition Toed F-Full Leather Upper

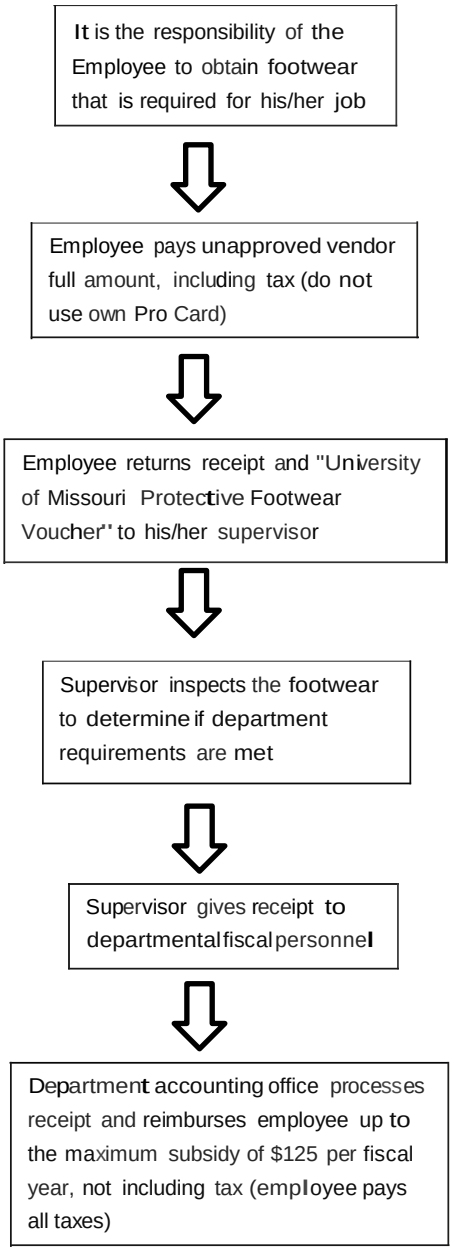
Job Classification	Maintenance		PD&C		Energy Mngt.		Grounds		Bldg Service		Total
	Type	Total	Type	Total	Type	Total	Type	Total	Type	Total	
sr. staff (maintenance) engineer	AB	1			ABF	1					2
sr. staff engineer					ABF	3					3
small engine mechanic							ABDF	2			2
staff engineer					ABF	2					2
steam & water distribution spec.					ABF	1					1
stores keeper									ABCDF	1	1
superintendent	ABF	1					*	1			2
trades assistant			ABDF	1							1
trades helper	ABDF	5	ABDF	2	ABDF	2			ABCDF	1	10
supervisor							ABF	2			2
supervisor skilled trades	ABF	6			ABF	1					7
truck driver			ABDF	1							1
utility attendant					ABF	4					4
utilty attendant trainee					ABF	1					1
water chemistry specialist					ABCF	2					2
window wall washer									ABCDF	1	1
window wall washer (lead)									ABCDF	1	1
Total											298

A-Slip Resistant B-Steel Toed C-Chemical Protection D-6" Height Minimum
E-Composition Toed F-Full Leather Upper

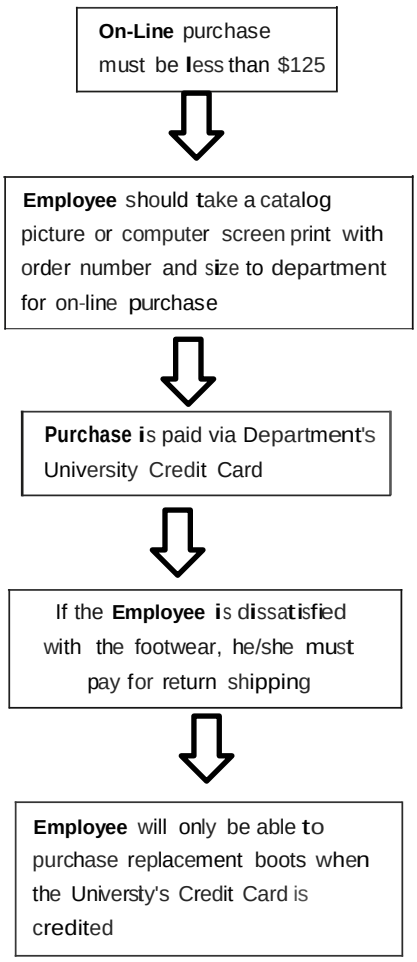
Purchase of Protective Footwear from Approved Vendors



Purchase of Protective Footwear from Unapproved Vendors



Purchase of Protective Footwear On-Line



University of Missouri Protective Footwear Voucher

Campus Facilities

Employee Name:

Employee's Department:

All footwear shall meet ANSI Z41 PT 99 Class 75 and/or ASTM 2413-05 and/or ASTM 2412-05 and OSHA 29 CFR 1910.136.
—No shoe or boot shall be static dissipative SD

REQUIRED:

[X] Oil, Chern. & Acid Resistant Soles
[X] Leather or Combination Uppers
[X] Steel or Composition Toe
[X] Defined Heel

[ ] Electrical Hazard EH
[ ] Metatarsal Protection Mt
[ ] Temperature Insulated H/C
[ ] Puncture Resistant-Stainless Steel Mid Sole PR
[ ] Water Resistant
[ ] No Minimum Height
[ ] Dress Shoe Style
[ ] Other _____

I authorize the above named employee to obtain the Protective Footwear described above.

Supervisor's Signature:_____ Date: _____

Manager's Signature: _____ Date: _____

Campus Facilities Departmental Contact Information:

Name: Phone#: _____
Address: _____

Columbia, MO 65211-3200

Vendor Name: _____ Date Purchased: _____

Protective Footwear Charge: _____ less $125 = _____ [University's tax exempt portion is the lesser of footwear charge or $125]

Manufacturer:_____ Stock #_____

Accessories Charge: _____ _____
Style _____
Size _____
_____

Subtotal: _____
Sales Tax: _____

Total: [Employee's taxable portion]

I have received the Protective Footwear described above and by my signature, I am aware that protective footwear must be worn at all times while performing my job duties at Campus Facilities.

Employee Signature:_____ Date: _____

Supervisor Signature:_____ Date:_____

This voucher authorizes the above employee to select one pair of approved Protective Footwear as described above, from an approved Protective Footwear vendor. This voucher is valued up to $125 and may be used for the sole purpose of purchasing Protective Footwear for use by the employee name above. This voucher may not be used to purchase any other items from vendor such as socks, mink oil, silicone, insoles, etc. Any employee who falsifies this form shall be subject to disciplinary action in

Types of Gloves and the Protection Examples: **Type of G OVE** -	**PROTECTS AGAINST**
Rubber	Acids, bases, caustics, solvents, diluted-water solutions of chemicals, alcohol: **High resistance to cuts**
Canvas ,Cloth, or Leather	Dirt, wood slivers, sharp edges
Metal Mesh	High resistance to cuts and scratches
Insulated	Electrical charges
Insulated	Heat and cold extremes
Heat-resistant	Heat and Flames
Hypoallergenic and powder free	Skin problems in workers with allergies
Cuffed	Liquid trickling down into the glove

Special Materials for Gloves	**PROTECTION**
Nitrile (synthetic rubber)	Oils, many solvents, esters, grease, and animal fat; **High resistance to cuts and abrasions**
Neoprene	Broad range of chemicals, oils, acids, caustics and solvents; **less resistant to cuts, punctures and abrasions than nitrile.**
Polyvinyl Chlorine (PVC)	Acids, caustics, alkalis, bases and alcohol; **Good abrasion and cut resistance** **** some types of PVC are susceptible to cuts**
Polyvinyl Alcohol (PVA)	Aromatics, chlorinated solvents, esters, and most ketones; **Resists cuts, punctures and abrasion** **** some PVA breaks down when exposed to water and light alcohol**
Ethylene vinyl alcohol (EVOH), also called flat flim	Highly resistant to chemicals and hazardous materials; **Little or no resistance to cuts and tears**

	(usually worn as a liner under PVC or Nitrile)
Butyl	Acetone and dimethyl formamide; **Not useful against cuts, punctures and abrasions**
Vitron	Benzene, methylene chloride and carbon disulfide; **Little resistance to cuts, punctures and abrasion**

Proper Fit, Care and Maintenance of Hand Protection

1. Check gloves for cracks, and holes, especially at the tips and between the fingers
2. Replace worn or damaged gloves promptly.
3. Keep gloves clean and dry.
4. Make sure gloves fit properly -- a small glove tires the hand and a large one is clumsy to work in.
5. Check MSDS sheets or contact your supervisor for any chemical you handle to see if a particular glove is needed
6. Cover all cuts before you put on your gloves.

April 6, 2000

CAMPUS FACILITIES DIRECTIVE NO. 215

SUBJECT: Personal protective equipment “hand and arm protection”

PURPOSE: To provide guidelines for the requirements of wearing hand and arm protection and acquiring such protective gear.

1. Employees will be required to use appropriate hand and arm protection when they are assigned to work in areas, or on tasks that expose them to potential hazards. Examples: Skin absorption of harmful chemicals, severe cuts, severe lacerations, severe abrasions, or punctures, chemicals or thermal burns, and extreme temperature; as well as rubber goods for electrical work. See personal protective equipment rules.

2. Requests for protective gear are to be made by the employee to his/her immediate supervisor. The supervisor and employee will determine the type of protective gear required. The supervisor will furnish the appropriate protective gear to the employee.

   No one type of hand or arm protection provides protection against all potential hazards. It is the responsibility of each department to determine the scope and degree of potential hazards as related to specific tasks and to provide gear that is appropriate for that hazard.

3. Failure to wear protective equipment when required may result in disciplinary action.

ACTION: The guidelines set forth are effective immediately and all departments in Campus Facilities must be in full compliance with this directive by May 1, 2000.

Alan R. Warden
Asst. Vice Chancellor-Facilities

UMC

JOB SAFETY ANALYSIS

Facility: **Analysis By:** **Date Created:**

Department: **Supervisor:** **Date Modified:**

Category: Approved By: **Frequency:**

Job Title: Job Performed By: **JSA Number:**

REQUIRED PERSONAL PROTECTIVE EQUIPMENT:

GENERAL NOTES:

JOB SAFETY ANALYSIS:

Step	Description	Hazard	Controls

AUTHORIZED EMPLOYEE INFORMATION:			

ID NUMBER:	**LAST NAME:**	**FIRST NAME:**	**REMARKS:**

JOB HISTORY INFORMATION:

DATE:	**REMARKS:**

Approval Signature:_____ Date:_____

Work Area - Task Hazard Assessment Worksheet

Work Areas _____ **Completed By** _____

Tasks _____ **Date** _____

List the Specific Hazard in each block below

	Eyes/Face	Head	Torso/Back	Leg/Ankle/ Foot/Toes	Arm/Hand/ Wrist/Fingers	Breathing	Skin	Hearing dB
(1) Impact - Crushing								
(2) Impact - Flying Objects								
(3) Impact – Overhead								
(4) Piercing								
(5) Laceration								
(6) Skin Exposure								
(7) Amputation								
(8) Dust - Mist – Fume								
(9) Electrical								
(10) Sprains/Strains								
(11) Slips/Trips/Falls								
(12) Noise								
(13) Chemical								
(14) People								
(15) Other								

Work Area -Task Hazard Prevention & Control Work Sheet

To be completed after Hazard Assessment Worksheet

Work Areas _____ **Conducted By** _____

Tasks _____ **Date** _____

Note: Respiratory & Ergonomic Assessments are conducted under separate programS

List the Specific Hazard Control Method in each block below

	SPECIFIC HAZARD	REQUIRED PPE	ENGINEERING CONTROLS	ENVIRONMENTAL CONTROLS	ADMINISTRATIVE CONTROLS	NOTES
Head						
Eyes / Face						
Skin						
Hand						
Foot						
Hearing						

Work Injury Services Treatment Requirements

Work Injury Services Treatment Requirements

Recently there have been a few instances of delayed treatment at Work Injury Services (WIS) primarily due to changes in UM Risk Management policy. To help control costs Risk Management has asked WIS to always obtain a First Report of Injury form.

Work Injury Services must have a First Report of Injury form signed by a supervisor-manager or designee. In an emergency situation (see below) the form can be sent later.

All CF employees are required to take a First Report of Injury form by a supervisor/manager (J; the supervisor/manager should accompany the employee to WIS and fill out the report in person.

Emergency situations are defined as situations where:

- Waiting for treatment will further complicate the injury.
- The injury is life-threatening.
- There is serious bleeding.

Departments that have employees working shifts when no manager is on duty must have a designee appointed to sign the First Report of Injury form.

Supervisor/manager/designee signature on the First Report of Injury form Q.!!]¥ indicates that the individual is an employee and is approved to visit WIS. WIS will treat the individual and the UM third-party administrator will determine the nature of the claim and appropriate follow-up actions.

If there Is POssible chemical exposure. the Material Safety Data Sheet MSDS must be sent with employee or faxed when the employee goes to WIS.

Work Injury Services fax: 884-5735
Work Injury Services phone: 884·9924

Workers Compensation third-party administrator will not approve treatment for complications from InJuries that are two or more years old until the empbyee has been interviewed.

Work Injury Services will contact third-party administrator or instruct employee to contact third-party administrator at (800) 449-2264.

Contact campus Facilities Safety and Training Coordinator Ron Dunkle at 882 3224 or dunkler@missouri.edu for all Work Injury Services issues.

Report of Injury

http://www.cf.missouri.edu/safety/forms/Report%20of0/o201njury%20Form%20&%20WIS%20Guidelines.pdf

University of Missouri

Report of Injury

This form should be completed for all employees injured on the job.

The supervisor should complete the following report *within 24 hours of emo(ovee's injurv*

EMPLOYEE INFORMATION

Date of Incident | I Employee Number | IICampU$ O Columbia D Kansas City ORella O St. Louis O UM System O Hospital

Name Qaat. fnt, mIddle IniUal) | IDepartmenVTille

Home Address | Phone Number

SupervisOf's Name | Supervisors Phone Number

ACCIDENT INFORMATION

Injury Time | Time Work Began | Last Wort< Date | Date University NoUfied | Salary Con nued DYes D No | Date Returned To Wort< | Ntonber or Days Worl<edMeek

Incident Type (slip, fall. sprain, etc.)

Body Part (specify right left, 1st. 2nd, etc.) | Prerrises DYes D No

Location and Zip Code | I Cause of Injurynttness

cause of Injuryntlness (description)

Employee's Activity (What was the employee doing?)

Employee's Wort< Proeess (How was Hbeing accomplished?)

Equipment. Materials in Use

Witrless Names | Witness Phones | Witness Names | Witness Phones

1

Safeguards Provided DYes D No | Safeguards Used DYes D No | Death Date

MEDICAL TREATMENT

Initial Treatment

O No Medical Treatment
D Emergency Case
D Minor:By Employer
D Hospitalized > 24 Hours
O Minor Clinic HospHal
O Future Major MedicalLost Time Antidpated

Name of Treating Physician, Clinic or HospHat

Address (street. cHy, state, zip)

I Supervtsor's Stgnature | Date

UM V.CI (JAN 09)

The completed repon should be faxed, • - mailed, or sent through campus mail to the Campus Workers Compensation Coordinator. If the employee cannot return to work, a written statement from the physician is required. This statement should be sent to the Campus Workers'Compensation Coordinator. See page 2 for appropriate campus information and Authorized Providers/Facilities.

PPE Needs Checklist

Checklist 8:
Need for ***PPE***

Suggs1L Questions	Typical Operations of Concern	Yes	No
Etes			
Do emr)loyce> perform tasks. or work ncar employt'l"whu pt·rlbn n t.1sks. that might produe airbt•rne dut ur flying patticlcs?	Saw ing, cutti ng, drilling, sanding. grinding.ham mering, chop ping. ahra,ive hlaring. and punch pre' opera11n.ns.		
Do your employeehn ncllc.or work near em ployeewh<> handle, hazardou-; liquid chemicals or cncounrer blood splash f"·>	Pounng. m ixi n g. paHlting, deauiug. s.yphoning, dip tallk opcrmions. and dt'ntal clld lieallh <.:<rl' sen·icc .		
J\rc your cmplnyees' eye'- exp,)seli rn nther pntential physical or chemical irrir: uu·.'	Hillll"ry chal}l.i.nl!, iust<lliug litmlas in ulu tiun. .1nd rumpresscd air or gas operations.		
Art' yOur employee e.\pused to intene light ur laser·!	Wl'ldi ng. curling. and laer opcrati nns.		
Face			
Do your employeeh3ncll e. nr wnrk near cm ph>yees who h3ncile. ha7arrlonliqu td chcmicah?	Pounng, milling.painting, dc:uuiug. sy phouiu. and Liip tauk upenttiuus.		
Are yonr ernploye..s' fas, expo tcl to ext remhear'	Weldin. pouring mullen metal. mi thing. baking. cook ing. and dryiug.		
Are yOU!' l lllpluy.::.::s· fa<:es t'XplN.d w other puteu ti;l irrit;ml·>	Culling, sanding. grinding. hammering. chopping. pouring. mixing, paitltllg, cle.a ninp,, and)y phollin .		
Head			
:Vlight wolor other nhjecr< fall fmm above and <trike your employeeon rhe he:td?	Work statiouor tntllis routes bc.il'd und ::r ,·atwlllkor l'UU\·t:yor lx:hs. <.:onLrul'lion. trench ing.and utility 'ork.		

Safety Action Memo

Date: _____

ACTION REQUEST: _____

The Situation:

_____

_____

_____

_____

Date Action Taken: _____ **Sent To:**_____

Response Date:_____

Response: _____

_____

___

_____

___

Forwarded To:

_____ ***Date:***_____

2nd Date of Response:_____

Response: _____

FINAL
ACTION:_____

_____

_

_____

_

PENDING: Y/N
Complete Y/N

Safety Inspection Checklist

Inspected By:_____ _____
Date:

1. WORKSITE INFORMATION: (Mark N/A as appropriate)

- Posting OSHA and other work site working posters _____
- Are Safety Meetings conducted periodically? When was the last meeting? _____
- First aid equipment properly stocked _____
- Are work site injury records being kept? _____
- Are emergency telephone numbers conspicuously posted? _____
- Is the EMERGENCY INFORMATION form posted? (Page 8) _____

Describe Violation – Location – Remedy Taken

2. HOUSEKEEPING AND SANITATION:

- Are emergency lights fully operational? _____
- General neatness of working areas _____
- Regular disposal of waste and trash _____
- Passageways and walkways clear _____
- Waste containers provided and used _____
- Sanitary facilities adequate and clean _____
- Adequate supply of water _____
- Adequate lighting _____
- Trash receptacle for drinking cups _____
- Are handrails and stair treads in good repair? _____
- Is smoking restricted to certain locations? _____
- Are electrical cords and plugs in good condition? _____

- Is a clearance of 3’ maintained around hot water heaters _____ electric breaker panels, heating units, and fire sprinkler riser? _____
- Are electric circuit breakers free of obstructions? _____

Describe Violation – Location – Remedy Taken

3. FIRE PREVENTION:
    - Fire instructions to personnel _____
    - Fire extinguishers identified, accessible and fully charged _____
    - “No Smoking” signs posted where needed — and enforced _____
    - Good housekeeping _____
    - Storage, use and handling of flammables properly done _____
    - Gasoline contained in UL Listed containers _____

Describe Violation – Location – Remedy Taken

4. Handling and Storage of Materials

Are materials properly stored and stacked _____

Are passageways cleared _____

Shelves in stockrooms in good repair and properly anchored _____

Stacks on firm footing – not too high _____

Are employees lifting loads correctly _____

Are materials protected from weather conditions _____

Exit and stairway areas free of stored flammable liquids _____

Describe violation – Location – Remedy Taken

5. Hand Tools

Proper tools used for jobs _____

Electric tools grounded _____

Neat storage, safe carrying _____

Inspection and maintenance _____

Describe Violation -- Location – Remedy Taken

6. Personal Protective Equipment

Eye protection _____

Respirators and masks _____

Helmets, hoods, head protection _____

Gloves, apron, sleeves _____

Hearing protection _____

Safety harnesses and Lifeline _____

Shirts are to be worn _____

Back-support belts _____

Describe Violation – Location – Remedy Taken

7. Hazardous Materials

MSDS binder available for supplies with hazardous chemicals _____

MSDS “Available on Request” signs posted conspicuously _____

Is the hazardous waste inventory log maintained _____

Are hazardous waste storage areas inspected weekly _____

Is the hazardous material dispositioning log maintained _____

All containers identified clearly _____

Proper storage practices observed _____

Proper storage temperatures and protection _____

Proper types and number of extinguishers nearby _____

Describe Violation – Location – Remedy Taken

Unsafe Acts and/or Practices Observed

Review & Updates

DATE:

DESCRIPTION: Manual review

SIGNATURE:

DATE:

DESCRIPTION:

SIGNATURE:

DATE:

DESCRIPTION:

SIGNATURE:

DATE:

DESCRIPTION:

SIGNATURE:

DATE:

DESCRIPTION:

SIGNATURE:

DATE:

DESCRIPTION:

SIGNATURE:

C.F. Weekly Safety Meeting : ST-53

DATE:_____ (Please Circle) EMO MTCE CSS LAND CONST.

From: _____ How Long Did The Meeting Last:_____

TOPIC: _____

Please List (or circle below) Absentees:

Add crew names here or on back: Please include presenter/supervisor

Welding Protection Recommendations

OPERATION	RECOMMENDED PROTECTION
Acetylene Burning, Cutting, Welding	Eyecup or Cover-type goggles with tinted lenses
Electric Arc Welding	Welding Helmet over safety glasses
Furnace Operations	Eyecup or Cover-type goggles with tinted glass

WELDING OPERATIONS	**Suggested Shade Number ******
Shielded Metal-Arc Welding up to 5/32 inch electrodes	10
Shielded Metal-Arc Welding 3/15 - 1/4 inch electrodes	12
Shielded Metal-Arc Welding over 1/4 inch electrodes	14
Gas Metal-Arc Welding (non-ferrous)	11
Gas Metal-Arc Welding (ferrous)	12
Torch Soldering	2
Torch Brazing	3 or 4
Light Cutting up to one inch	3 or 4
Medium Cutting, 1-6 inches	4 or 5
Heavy Cutting, over 6 inches	5 or 6
Gas Welding (light) up to 1/8 inch	4 or 5
Gas Welding (medium) 1/8 to 1/2 inch	5 or 6
Gas Welding (heavy) over 1/2 inch	6 or 8

**** The Choice of a filter shade may be made based on visual acuity and may vary

Contact Lenses Warning:

The wearing of Contact Lenses in hazardous locations is discouraged

No current studies suggest a higher incident of eye injuries to contact lens wearers. However, when hazards exist from dusts, vapors, mists, fumes, radiant heat, molten metal, or chemicals they should not be worn. The wearing of contacts can result in increased irritation; materials trapped behind them, and increased eye injury from burns. Safety eyewear is required by contact lens wearers and therefore covered by the prescription eyewear policy. Some employees elect to remove their lenses when necessary and don prescription glasses.

Whenever irritation or discomfort exists it is important to remove the contacts immediately.

Checklist for General Work-Site Inspections

Y _ N_ N/A

1. ☐☐☐ Are emergency telephone numbers posted where they can be readily found in case of emergency?

2. ☐☐☐ Are signs concerning exiting from buildings, room capacities, floor loading, exposures to x-ray, microwave, or other harmful radiation or substances posted where appropriate?

3. ☐☐☐ Are “toolbox” or “tailgate” safety briefings conducted every 10 days or sooner if appropriate?

4. ☐☐☐ If medical and first aid facilities are not in close proximity of your workplace, is at least one employee on each shift currently qualified to render first aid?

5. ☐☐☐ Are emergency medical telephone numbers posted in a conspicuous location?

6. ☐☐☐ Are first-aid kits easily accessible to each work area, with necessary supplies available, periodically inspected and replenished as needed?

7. ☐☐☐ Have first-aid kit supplies been approved by a physician, indicating they are adequate for a particular area or operation?

8. ☐☐☐ Are means provided for quick drenching or flushing of the eyes and body in areas where corrosive liquids or materials are handled?

9. ☐☐☐ Do you have an emergency fire prevention plan in place?

10. ☐☐☐ Does your plan describe the type of fire protection equipment and/or systems in place?

11. ☐☐☐ Have you established practices and procedures to control potential fire hazards and ignition sources.

12. ☐☐☐ Are employees aware of the fire hazards of the materials and processes to which they are exposed?

13. ☐☐☐ Is your local fire department well acquainted with your facility's location and specific hazards?

14. ☐☐☐ If you have a fire alarm system, is it certified as required?

Y _ N_ N/A

15. ☐☐☐ If you have outside private fire hydrants, are they flushed at least once a year on a routine preventive maintenance schedule?

16. ☐☐☐ Are fire doors and shutters in good operating condition?

17. ☐☐☐ Are fire doors and shutters unobstructed and protected against obstructions, including their counterweights?

18. ☐☐☐ Are fire door and shutter fusible links in place?

19. ☐☐☐ Are portable fire extinguishers provided in adequate number and type?

20. ☐☐☐ Are fire extinguishers mounted in readily accessible locations?

21. ☐☐☐ Are fire extinguishers recharged regularly and noted on the inspection tag?

22. ☐☐☐ Are employees periodically instructed in the proper selection and use of extinguishers and fire protection procedures?

23. ☐☐☐ Are approved safety glasses required to be worn at all times in areas where there is risk of eye injuries such as punctures, abrasions, contusions or burns?

24. ☐☐☐ Are employees who need corrective lenses (glasses, contact lenses) in working environments with harmful exposures, required to wear only approved safety glasses, protective goggles, or to use other medically approved precautionary procedures?

25. ☐☐☐ Are protective gloves, aprons, shields, or other means provided against cuts, corrosive liquids and chemicals?

26. ☐☐☐ Is appropriate foot protection required where there is a risk of foot injuries from hot, corrosive, poisonous substances, falling objects, crushing or penetrating actions?

27. ☐☐☐ Are approved respirators provided for regular or emergency use where needed?

28. ☐☐☐ Is all protective equipment maintained in a sanitary condition and ready for use?

Y _ N_ N/A

29. ☐☐☐ Do you have eye-wash facilities and a quick-drench shower within a work area where employees are exposed to injurious corrosive materials?

30. ☐☐☐ When lunches are eaten on the premises, are they eaten in areas where there is no exposure to toxic materials or other health hazards?

31. ☐☐☐ Are adequate work procedures, protective clothing and equipment provided and used when cleaning up spilled toxic or otherwise hazardous materials or liquids?

32. ☐☐☐ Are all worksites clean and orderly?

33. ☐☐☐ Are work surfaces kept dry and appropriate means taken to assure the surfaces are slip-resistant?

34. ☐☐☐ Are all spilled materials or liquids cleaned up immediately?

35. ☐☐☐ Is combustible scrap, debris and waste stored safely and removed from the worksite promptly?

36. ☐☐☐ Are covered metal waste cans used for oily and paint-soaked waste?

37. ☐☐☐ Are the minimum number of toilets and washing facilities provided (e.g. is potable water available; are toilet facilities provided for non-mobile work crews?)

38. ☐☐☐ Are all toilets and washing facilities clean and sanitary?

39. ☐☐☐ Are all work areas adequately illuminated?

40. ☐☐☐ Are pits and floor openings covered or otherwise guarded?

41. ☐☐☐ Are aisles and passageways kept clear? Are permanent aisles/walkways adequately marked?

42. ☐☐☐ Are aisles and walkways marked as appropriate?

43. ☐☐☐ Are wet surfaces covered with non-slip materials?

44. ☐☐☐ Are holes in the floor, sidewalk or other walking surface repaired properly, covered or otherwise made safe?

Y _ N_ N/A

45. ☐☐☐ Are spilled materials cleaned up immediately?

46. ☐☐☐ Are materials or equipment stored in such a way that sharp projectives will not interfere with the walkway?

47. ☐☐☐ Are changes of direction or elevations readily identifiable?

48. ☐☐☐ Is adequate headroom provided for the entire length of any aisle or walkway?

49. ☐☐☐ Are standard guardrails provided wherever aisle or walkway surfaces are elevated more than 30 inches above any adjacent floor or the ground?

50. ☐☐☐ Is the glass in windows, doors, glass walls, which are subject to human impact, or sufficient thickness and type for the condition of use?

51. ☐☐☐ Are standard stair rails or handrails on all stairways having four or more risers?

52. ☐☐☐ Are all stairways at least 22 inches wide?

53. ☐☐☐ Do stairs have at least a 6’6” overhead clearance?

54. ☐☐☐ Are stairway handrails located between 30 and 34 inches above the leading edge of stair treads?

55. ☐☐☐ Do stairway handrails have at least 1-1/2 inches clearance between the handrails and the wall or surface they are mounted on?

56. ☐☐☐ Are stairway handrails capable of withstanding a load of 200 pounds, applied in any direction?

57. ☐☐☐ Do stairway landings have a dimension measured in the direction of travel, at least equal to the width of the stairway?

58. ☐☐☐ Are surfaces elevated more than 30 inches above the floor or ground provided with standard guardrails?

59. ☐☐☐ Are all exits marked with an exit sign and illuminated by a reliable light source?

Y _ N_ N/A

60. ☐☐☐ Are the directions to exits, when not immediately apparent, marked with visible signs?

61. ☐☐☐ Are doors, passageways or stairways, that are neither exits nor access to exits and which could be mistaken for exits, appropriately marked “NOT AN EXIT”, “TO BASEMENT,” “STOREROOM,” etc.?

62. ☐☐☐ Are exit signs provided with the word “EXIT” in lettering at least 5 inches high and the stroke of the lettering at least 1/2 inch wide?

63. ☐☐☐ Are exit doors side-hinged?

64. ☐☐☐ Are all exits kept free of obstruction?

65. ☐☐☐ Are there sufficient exits to permit prompt escape in case of emergency?

66. ☐☐☐ Are doors which are required to serve as exits designed and constructed so that the way of exit travel is obvious and direct?

67. ☐☐☐ Are exit doors able to be opened from the direction of exit travel, without the use of a key or any special knowledge or effort, when the building is occupied?

68. ☐☐☐ Is the work area’s ventilation system appropriate for work being performed?

69. ☐☐☐ Are employees instructed in the proper manner of lifting heavy objects?

70. ☐☐☐ Are combustible scrap, debris and waste materials (i.e. oily rags) stored in covered metal receptacles and removed from the worksite promptly?

71. ☐☐☐ Are employees trained in the safe handling practices of hazardous chemicals such as acids, caustics, and the like?

72. ☐☐☐ Are employees aware of the potential hazards involving various chemicals stored or used in the workplace such as acids, bases, epoxies, solvents, etc.?

Y _ N_ N/A

73. ☐☐☐ Is employee exposure to chemicals kept below permissible exposure limits?

74. ☐☐☐ Are eye wash stations and safety showers provided in areas where corrosive chemicals are handled?

75. ☐☐☐ Have standard operating procedures been established and are they being followed when cleaning up chemical spills?

76. ☐☐☐ Where needed for emergency use, are respirators stored in a convenient, clean and sanitary location?

77. ☐☐☐ Are respirators intended for emergency use adequate for the various uses for which they may be needed?

78. ☐☐☐ Are employees prohibited from eating in areas where hazardous chemicals are present?

79. ☐☐☐ Is personal protective equipment provided, used and maintained whenever necessary, and is it selected based on its protective properties for specific chemicals?

80. ☐☐☐ Is there a Material Safety Data Sheet readily available for each hazardous substance used?

81. ☐☐☐ Is there an employee training program for hazardous substances?

82. ☐☐☐ Does this training program include an explanation of what an MSDS is and how to use and obtain one?

83. ☐☐☐ Does this training program include MSDS contents for each hazardous substance or class of substances?

84. ☐☐☐ Does this training program include an explanation of “Right-to-Know?”

85. ☐☐☐ Does this training program identify where employees can see the employer’s written hazard communication program and where hazardous substances are present in their work area?

Y _ N_ N/A

86. ☐☐☐ Does this training program identify physical and health hazards of substances in the work area, how to detect their presence, and specific protective measures to be used?

87. ☐☐☐ Does this training program provide details of the hazard communication program including how to use the labeling system and MSDS.

88. ☐☐☐ Are electrical appliances such as vacuum cleaners, polishers, vending machines grounded?

89. ☐☐☐ Do extension cords being used have a grounding conductor?

90. ☐☐☐ Are multiple plug adapters prohibited?

91. ☐☐☐ Is exposed wiring and cords with frayed or deteriorated insulation repaired or replaced promptly?

92. ☐☐☐ Are flexible cords and cables free of splices or taps?

93. ☐☐☐ Are all cord, cable and raceway connections intact and secure?

94. ☐☐☐ In wet or damp locations, are electrical tools and equipment appropriate for the use or location, or otherwise protected?

95. ☐☐☐ Are all disconnecting switches and circuit breakers labeled to indicate their use or equipment served?

96. ☐☐☐ Do all interior wiring systems include provisions for grounding metal parts or electrical raceways, equipment and enclosures?

97. ☐☐☐ Are all electrical raceways and enclosures securely fastened in place?

98. ☐☐☐ Are all energized parts of electrical circuits and equipment guarded against accidental contact by approved cabinets or enclosures?

99. ☐☐☐ Are all unused openings (including conduit knockouts) in electrical enclosures and fittings closed with appropriate covers, plugs or plates?

Y _ N_ N/A

100. ☐☐☐ Are electrical enclosures such as switches, receptacles, junction boxes provided with tight-fitting covers or plates?

101. ☐☐☐ Is there safe clearance for equipment through aisles and doorways?

102. ☐☐☐ Are aisles designated, permanently marked, and kept clear to allow unhindered passage?

103. ☐☐☐ Are dock boards used when loading or unloading operations are taking place between vehicles and docks?

104. ☐☐☐ Are trucks and trailers attended and secured from movement during loading and unloading operations?

105. ☐☐☐ Are dock plates and loading ramps constructed and maintained with sufficient strength to support imposing loading?

106. ☐☐☐ Are hand trucks maintained in safe operating condition?

107. ☐☐☐ Are chutes equipped with sideboards of sufficient height to prevent the materials being handled from falling off?

108. ☐☐☐ Are employee transport vehicles equipped at all times with at least two reflective-type flares?

109. ☐☐☐ Is a fully-charged fire extinguisher, in good condition, with appropriate rating maintained in each employee transport vehicle?

110. ☐☐☐ When cutting tools with sharp edges are carried in passenger compartments of employee transport vehicles, are they place in closed boxes or containers which are secured in place?

111. ☐☐☐ Are employees prohibited from riding on top of any load which can shift, topple, or otherwise become unstable?

112. ☐☐☐ Are employees prohibited from smoking or eating in any area where contaminants are present that could be injurious if ingested?

Y _ N_ N/A

113. ☐☐☐ Have emergency escape procedures and routes been developed and communicated to all employees?

114. ☐☐☐ Is the employee alarm system that provides a warning for emergency action recognizable and perceptible above the ambient conditions?

115. ☐☐☐ Are alarm systems properly maintained and tested regularly?

116. ☐☐☐ Is the emergency action plan reviewed and revised periodically?

117. ☐☐☐ Are employees trained and do they know their responsibilities for reporting emergencies?

118. ☐☐☐ Can the work be done using the larger muscles of the body?

119. ☐☐☐ Can the work be done without twisting or overly bending the lower back?

Appendix 2: Campus Facilities Safety Handbook

Campus Facilities Safety Handbook

5/1/2001

Revision Number	Date	Revise d Section	Section Comments
1	8/2002	Manual	Stds. Group Revision
2	12/2002	Manual	Safety Dept.
3	1/2003	Manual	Shortened Sec. #1 Created Sec. #2
4	8/2011	Manual	

Manual Overview

No Safety Manual can describe in detail all safe work practices necessary for the safety of our employees. We have tried to organize this manual as quick access to necessary information for employee safety and Safe Operating Procedures within Campus Facilities. Other more detailed information is available from your supervisor or the C.F. Safety Office if you feel you have questions that need further attention.

This Manual is structured “General to Specific”. The First section applies to most general operations. The second section will contain more specific operations and the third, Trade, Equipment, or Departmental safety that is specific to only those trades, equipment or Departments. Section Four will contain reference information. Weights and measures, wire sizes, strength tables, rigging information and various other information that is used in your work. The information found in sections two or three will be more in depth and shall always be followed when it applies. Section One shall never be used “instead of” the more restrictive sections.

The safety and health of Campus Facilities employees is of the utmost importance. When our safety system fails, employees can be injured and equipment damaged. It is with that in mind that this manual was created and will be regularly updated. If you have corrections before the scheduled update, forward the information to your supervisor or the C.F. Safety Department.

One final note, OSHA definitions are used throughout the manual. (Competent, qualified, trained etc.) Where the word “potential” is used the meaning is that the situation is “likely to occur”.

100 Campus Facilities Safety Work Rules

.01 **Safety of life outweighs all other considerations.**

.02 **Work is never to be considered so important or urgent that the necessary steps cannot be taken to do it safely.**

.03 **Campus Facilities provides a safe and healthy work environment for all employees.** Management is responsible to make sure that employees have the knowledge, skills, and equipment to perform their jobs safely.

.04 **Training and retraining are available** and required in many of our operations. If you feel that you need training or retraining for any reason, contact your supervisor.

.05 **Negligence, horseplay, recklessness, carelessness and unsafe work practices are not tolerated.**

.06 **Employees are expected to challenge any carelessness or unsafe work practices**.

Where unsafe conditions or actions exist outside of your control, seek assistance from a supervisor, your Director, the C.F. Safety Department, or the C.F. Personnel Director.

.07 **Each employee is required and held accountable:**

- To know, use and be familiar with all protection, tools, equipment and procedures required for a job. If there are no specific work rules for a task, equivalent levels of injury prevention are provided. Consult with your supervisor.
- For his or her own safety
- For all safe work practices in the performance of their job. This includes assisting and safeguarding others.
- For correcting known or potential hazards.
- To follow safety instruction from management regardless of department.

.08 **No employee will:**

- Use intoxicants or drugs while on duty;
- Report for duty under the influence of intoxicants or drugs;
- Be relieved by another employee known to be under the influence of intoxicants or drugs.

.09 If an employee's physician has prescribed drugs or medication that will limit the employee's ability to perform certain jobs, the employee will inform the supervisor of that fact prior to beginning work. In most cases, alternate work or other assistance is

available.

.10 Infractions, violations, and misunderstandings will be resolved in a number of ways including training, retraining, counseling, coaching and if necessary, by the Campus Facilities Discipline Policy. Consideration is given for employee time on the job and the level of skill.

101 Barricades, Barriers, Warning Signs

.01 Heed all warning signs. Where hazardous conditions exist, use barricades, barriers and/or warning signs to warn employees and the public of the dangers.

.02 Where hazardous conditions exist in a poorly illuminated area or after dark provide barriers or barricades and adequate lighting with flashing warning lights. The lights must be visible on all sides of the hazardous area.

.04 Tag each barricade with information listing the responsible department, the phone number in case of questions or emergency, and the date the barricade was erected.

.03 Use approved railings to guard stairways and open-sided floors. Install toe boards or other suitable means where falling tools or materials create hazards to others.

102 Batteries

Note: In containments with 50-volt bus and above – see

Electrical Safety

.01 Adequate ventilation is required in battery and battery-charging areas. Use forced ventilation where natural ventilation does not constantly change the air. The manufacturers' recommendations are the minimum standards used when charging batteries.

.02 Make sure that the required signs are posted and observed in all battery areas. Signs read "Danger—No Smoking, Open Flames or Ignition Sources".

.03 Keep approved eye wash facilities available and located within 15 feet of the battery-charging area.

.04 Where spillage can exist wear acid-proof gloves, aprons, chemical mono-goggles and face shield when handling, repairing, or testing batteries.

.05 Prevent short-circuiting, generating a spark or ignition source when working on or near the battery or when cleaning or making repairs.

.06 When making up electrolyte for batteries always pour the acid slowly into the water.

Water into the acid can cause an explosion.

.07 If electrolyte is spilled on clothing, remove contaminated clothing and wash the skin with

water (or use the eyewash solution) as soon as possible. Report the incident and seek medical attention is necessary.

.08 Keep open flames, tools that can cause sparks, and other sources of ignition clear of the area during charging operations. (Not less than 15 feet)

.09 When working in battery rooms the battery charger must be turned OFF when possible. Adequately ventilate the room where sources of ignition exist.

.10 Properly position battery-powered vehicles within the specified charging area. Turn the engine off, and set the brakes before beginning charging operations.

.11 When charging batteries follow the manufacturer's specifications.

If Manufacturers specifications are not available perform the following:

Check vent caps and keep them in place. Use safe practices to ensure that vent caps are functioning properly. Keep battery compartment covers opened while charging to dissipate heat and vapors.

.12 Prevent grounding the case of a Ni-Cad cell, it is part of an electrical circuit.

.13 When removing a battery, the ground connection is the ***first*** connection removed. When installing a battery, the ground connection is ***last*** connection made.

.14 When using jumpers to start vehicles with a dead battery connect the first jumper to the positive terminal of the dead battery, then to the positive terminal of the live battery. The other jumper is then connected first to the negative terminal of the live battery and then to a suitable ground and ***not*** the negative terminal of the dead battery.

.15 Dispose of spent dry batteries in an environmentally safe area with good ventilation away from ignition sources and outside shops and employee workstations.

.16 For additional information refer to manufacturers' product information and Material Safety Data Sheet (MSDS).

Battery Charging

In Addition to section 102:

.17 Wear eye protection whenever working with the battery. Use extra care when working around the battery and charging equipment.

.18 Perform charging operations on acid proof surfaces.

.19 Inspect the charger AC and DC plugs for loose, bent, arced or dirty contacts. Inspect the vehicle receptacle for loose wires or damage. Tag out-of-service any damaged cords or parts.

.20 Insert plug fully into receptacle and check that the connection is tight.

.21 Position cords to prevent them from:

- Being pulled or snagged
- Driven over
- Creating a hazard to personnel working in the area.

.22 When connecting or disconnecting the charger to a vehicle, always make sure that the charger has completed its charge and is OFF (ammeter indicates 0 amps).

.23 Unplug chargers from the power source before disconnecting the golf cart.

103 Bloodborne Pathogens

.01 First aid providers and others who may reasonably anticipate having exposure to blood or other potentially infectious materials are required to follow the procedures in the University of Missouri's Exposure Control Plan developed and updated by EH&S

.02 Avoid direct contact with blood and bodily fluids. Whenever possible utilize a waterproof barrier (latex or plastic) between you and the wound or bodily fluids.

.03 Dispose of all contaminated materials properly.

.04 Practice universal precautions.

- Containment
- Clean-up
- Disposal
- Disinfecting
- Hand washing

.05 In case of an exposure notify your supervisor and/or safety coordinator as soon as possible.

104 Chain Saws

.01 Wear approved personal protective equipment when operating chain saws. (At a minimum, Hard Had, gloves, safety glasses, face shield, chaps, and hearing protection)

.02 Do not wear loose fitting clothing when operating.

.03 Make sure everyone is in the clear and the operator has good footing before using the saw.

.04 Always examine tree and area before felling the tree. Check for people, power lines, other trees, vehicles, and other hazards.

.05 Plan a safe retreat path from tree before cutting

.06 Always cut with saw to the outside of your body and with both hands

.07 Smoking or open flames are not permitted in the area during refueling. Stop the engine and allow it to cool before refueling.

.08 When standing in an aerial basket, place the saw on the edge of the basket to start.

.09 Store saws in carrying cases or put the guard over the blade when not in use. Use saw holders when carrying saws in aerial baskets.

105 Clothing, Jewelry, and Accessories

.01 When working around moving machinery or rotating parts the following is prohibited:

- Loose dangling jewelry
- Flapping clothing
- Neckties
- Unbuttoned cuffs
- Loose or dangling shirttails. Keep the shirt tucked in to avoid getting caught.
- Rings

.02 When work is performed within reaching distance of exposed energized parts or equipment, remove or render nonconductive all exposed conductive articles unless they do not increase the hazards associated with contact of the energized parts.

- Key or watch chains
- Rings
- Loose change or metallic objects
- Wrist watches or bands
- Metal frame glasses

.03 Craft and trade personnel should not wear rings or jewelry.

.04 Wear a hair net or equivalent where hair length is a hazard around moving machinery or a condition where straight or peripheral vision is impaired creating an unsafe condition.

.05 Wear a long sleeve shirt buttoned or pulled down to the wrist where there is danger of injury to the arms such as cuts, abrasions, or thermal burns.

.06 Clothing made from the following types of fabrics, either alone or in blends, is prohibited while working on energized circuits: acetate, nylon, polyester, and rayon

NOTE: The following will be included in the next revision

Where there is exposure to electric shock or arc flash hazards, affected employees shall wear approved fire retardant (FR) apparel as recommended by NFPA 70A.

.07 Personal headsets and earphones are prohibited except by special arrangement while on the job. Any use of headsets and earphones must have prior approval of management. Noise level of the device shall not limit the employee being able to hear normal conversation or exceed 85 db.

106 Confined Spaces

.01 Follow the procedures outlined in the Permit-Required Confined Spaces Program as well as the specific entry procedures for the location involved.

107 Cranes and Hoists

.01 Only certified personnel are permitted to operate cranes and hoists.

.02 Wear a hard hat when working in the immediate area around a crane.

.03 The operator takes all signals from the certified signal person. Should it be apparent that obeying a signal would result in an injury, the operator will not proceed but will notify the signal person at once. A STOP signal shall be obeyed regardless of who gives the signal.

.04 Use only qualified riggers

.05 Stay within the rated capacity and load limits of the equipment.

.06 Check all clearances before raising or lowering a load.

.07 Exercise extreme caution when working in the vicinity of a mobile crane that is operating near exposed energized equipment.

.08 If the mobile crane accidentally makes contact with energized equipment:

- **Do not** approach the crane until the contact is broken or the equipment is known to be de-energized.

- If it becomes necessary for the operator to leave the crane, jump clear rather than step down.

- Use proper walk to avoid step shock

.09 If an overhead crane or hoist loses power, secure it until the power is restored. Turn the controls to the OFF position and lock out if necessary.

108 Ergonomics

.01 Arrange workstations and/or work areas to accommodate a full range of required movements.

.02 Ensure that all machine controls are reachable and easily accessible prior to operation.

.03 Ensure that lighting is adequate to perform task activities.

.04 Ensure that adequate space is available to allow safe lifting of loads using both hands, while facing the load.

.05 Arrange workspaces and areas to avoid the need for carrying objects overhead and for overreaching.

.06 Tools should be selected for ergonomic features.

.07 Use vibration dampening products on vibratory type tools and equipment where applicable.

.08 Plan work activities to reduce or eliminate repeated manual lifting where possible.

.09 Position display screen slightly below eye level and avoid glare on the screen.

.10 Adjust work surfaces and space to comfortably perform work tasks.

.11 Adjust keyboard position to ensure proper position, angle, and comfort.

.12 Take rest pauses as necessary to relieve or delay fatigue.

.13 Sit upright to avoid straining neck and back.

.14 Use a footrest if feet don’t rest comfortably on the floor.

.15 Shift sitting position frequently to relax tension away.

.16 Blink frequently. Make a conscious effort of it so your eyes won't get dry.

109 Eye Protection

.01 Wear only approved (meeting ANSI Z-87.1 or most current) eye protection that is in good condition with permanently attached side shields.

.02 Wear eye protection equipment:

- On jobs or in areas where hard hats are required,
- In all designated eye protection areas,
- On all jobs where it has been specified that eye protection is required, and
- At any time a hazardous condition exists.
- When performing overhead work

.03 Standard eye protection is safety glasses with side shields.

* Additional or specialized eye protection is worn as required by the job.

.04 Contact lenses should not be worn with full-face respirators or when handling acids and caustics. *

* Note: Contact lenses tend to trap contaminants under or behind the contact lenses.

This does not allow for the eye to cleanse itself and can cause the eye to get irritated, damaged, develop ulcers etc. Employees who wear contact lenses should understand the cautions and potential hazards while wearing them. It is always a good idea to carry regular prescription glasses in addition to contact lenses.

110 Fall Protection

.01 Fall protection is required on all work above six feet unless on an approved work platform, a guardrail system or a safety net system is in place. (Does not apply to step ladders.)

.02 Where the working height is six feet and above, employees must be formally instructed in fall protection procedures before using equipment or setting up a job.

111 Fire Prevention

.01 Obey "No Smoking" signs. Do not use open flames or spark-producing tools in areas where flammable or combustible liquids, gases, dusts, mist or fumes may exist, are present or being stored. When working in these areas, use proper precautions in accordance with specific procedures.

.02 Recognize and eliminate fire hazards. If an employee has no control over the hazard report it to the person in charge or the supervisor.

.03 Know what action to take in case of fire, including whom to notify, where and how to sound available alarms and what fire fighting equipment to use.

.04 Tag and remove fire extinguishers that have been discharged, even partially. Replace the discharged extinguisher with a fully charged unit immediately.

.05 Keep:

- Exit routes clear of all obstructions at all times.
- Designated fire protection equipment in fire stations and using it only purposes of fire fighting or drills.
- Accesses to fire extinguishers and other fire protection equipment unobstructed
- All extinguishers at designated locations on a hanger or in a cabinet when not in use.
- Oily paper, oily rags and other combustible materials in metal containers with self-closing lids or self-extinguishing lids. Environmental Health and Safety supplies and collects containers

112 Flammable and Combustible Liquids and Gases

.01 Obey all "No Smoking" signs. No open flames are allowed or spark-producing tools or equipment used in the area where flammable or combustible liquids and gases are stored or transferred. When working in these areas the minimum safe distance requirement is 15 feet. Use non-sparking tools or other proper precautions in accordance with specific procedures when a safe working distance cannot be maintained.

.02 Flammable and combustible liquids and gases are kept and transported only in approved fire resistant and labeled containers showing the contents. Containers being transported must be properly secured.

.03 Flammable liquids shall be marked and the contents clearly identified.

.04 Dispose of flammable hazard or unwanted combustible liquid into approved waste containers. Unwanted liquid is never be emptied into any drain. Environmental Health

and Safety supplies and collects containers.

.05 Store combustible unwanted materials, such as oil or paint-soaked rags, in covered metal containers and dispose of daily. Environmental Health and Safety supplies and collects containers. NOTE: Unwanted is considered anything not reused.

.06 When pouring flammable liquid from one metal container to another, or in filling gasoline tanks, metal-to-metal maintain contact between the two containers or between the hose nozzle and the tank to prevent static buildup.

.07 Equip dispensing drums with self-closing spigots. Pipe connections on all drums and piped flammable liquids must be vapor and liquid-tight.

.08 Repair or remove from service, leaking hoses and nozzles.

.09 Bond bulk containers used to dispense flammable liquids into another container to the receiving vessel and to ground to prevent static spark.

.10 Contain all spills of gasoline, oil or other flammable liquids if possible and contact EH&S immediately.

.11 Keep the cutoff switch for electric pumps used to dispense flammable liquids clearly identified and easily accessible.

.12 Place containers on the ground when filling with flammable liquid instead of in the back of a truck with a bed liner to prevent static buildup.

.13 Use of any electronic equipment while fueling, which has the potential to arc or spark is prohibited. Turn the device off prior to fueling.

113 Foot Protection

.01 All employees who are exposed to foot hazards, such as falling, dropped, rolled or pivoted heavy loads or objects must wear safety shoes or boots (meeting ASTM) with steel toe/composite toe caps and non-slip soles.

.02 Additional foot protections may be required any time the job being performed creates additional hazards of foot injury, such as using a jackhammer or pavement breaker or in areas where work creates slipping hazards.

.03 Wear footwear that is in good repair and appropriate to the job.

.04 Where special hazards exist, high-top shoes or boots or puncture resistant soles may be required.

.05 Wear close fitting high-top shoes or boots when welding and cutting.

.06 Wear leggings when welding with low-quarter footwear. High-top shoes may be worn

instead of leggings as long as the tops of the shoes are close-fitting and covered by the pants leg when welding.

114 Forklift Operations

.01 Only trained and qualified personnel are permitted to operate a forklift. Operation of the forklift is in accordance with manufacturers' safe operating instructions and C.F. Powered Industrial Truck Procedures.

.02 Wear hardhats and safety glasses at all times when operating a forklift in a designated hardhat area or when exposed to overhead hazards. Hardhats are also worn when using a forklift to lift a load when the top of the load being lifted is higher than cab protection of the forklift.

.03 Passengers are not allowed to ride a forklift unless an approved passenger seat is provided. No one shall be permitted to ride the load at any time.

.04 Only an approved platforms are used as worker lifts. The platform must be properly secured to the mast or forks, and guards in place to prevent hands or materials from passing into the mast area.

.05 Secure fall protection to the fork-tine carriage and not to the platform or workbasket.

.06 The forklift operator must always be present in the vehicle while an occupied work platform/basket is elevated

.07 All persons are to stay to the outside of a forklift with elevated forks whether loaded or empty.

115 Gas Service

Note: This section applies to propane or natural gas systems.

.01 Check for hazardous conditions, such as, tripping hazards, or other potentially dangerous conditions and wear appropriate PPE.

.02 Smoking and open flames are prohibited when working on gas service installations.

.03 Visually inspect the gas service installation for hazards prior to beginning work

.04 Perform gas service reconnects and disconnects according to established procedures.

.05 Apply electrical bonding jumper straps during all gas service disconnects.

.06 Use approved thermal gloves for cold protection in LPG Fueling operations.

116 Golf Carts

.01 Comply with all traffic signs and directions, wear seatbelts where provided.

.02 Drive the vehicle only as fast as terrain and safety considerations allow. Consider the terrain and existing traffic conditions.

.03 Avoid sudden stops or change of direction as they may result in a loss of control.

.04 Travel directly up or down hills. If you must travel on across an incline as a last resort, use extra care.

.05 Keep feet, legs, hands, and arms inside the vehicle at all times.

.06 Check the area behind the vehicle before backing up.

.07 Capacities are limited to two occupants per seat unless otherwise stated on the nameplate or in the operating manual.

.08 Balance and secure loads before driving. Stay within the weight limits of the cart. Keep items from overhanging sides and within the width of the cart.

.09 Drive carts on Campus Facilities property only. Do not drive in heavy traffic areas except for the purpose of crossing through an intersection.

.10 Avoid distractions – drivers should not use cell phones while operating carts

.11 Drivers are responsible for the ignition key the entire time they use the vehicle. Keys are not to be left in carts while unattended.

.12 Pedestrians have the right-of-way. Speed must be reduced to a minimum when driving along or near pedestrians.

117 Hand Protection

.01 Wear approved cut resistant work gloves when handling sharp, rough, cold or heated materials or when the use of gloves will prevent hand injuries.

.02 Wear work gloves in good condition, free from holes and fraying.

.03 Wear “Special” gloves approved for use in handling acids, caustics or other potentially injurious substances when working with these materials. Conduct a safety check on the gloves prior to use.

.04 Except when using wire brush wheels, do not wear gloves when there is danger of their being caught in moving machinery or rotating parts

.05 Glove protectors are not worn in place of work gloves.

.06 Wear approved thermal gloves are used for cold protection in LPG Fueling operations.

.07 Wear NFPA – 70E recommended rubber insulated gloves with leather covers above 240 VAC or when working on or near exposed energized equipment or lines or equipment where the potential exists for contact.

.08 Wear rubber insulated gloves that are within the dielectric test period.

.09 Examine and safety check insulated rubber gloves prior to each use.

.10 Rubber insulated gloves require glove protectors.

118 Hand Tools

.01 Use UL approved tools and keep them maintained in good condition. Tools are subject to inspection at any time.

.02 Tag any unsafe tools/equipment "Out of Service" to prevent their use. Report it to the supervisor in charge. Supervisors will dispose of them or have them repaired. Specifically Remove from service:

- Impact tools (chisels, punches, drift pins and hammers) that are worn, mushroomed, or cracked.
- Wrenches with sprung or damaged jaws.

.03 Tools Tagged "Out of Service" will not be used for any reason.

.04 Use tools for their designed purpose only.

.05 When working on or near energized conductors or equipment use only:

- Hammers without metal handles;
- Screwdrivers without metal continuing through the handle
- Non-metallic measuring tapes.

.06 Place tools that must be raised or lowered from one elevation to another in a tool bucket or firmly attached to hand lines. Throwing tools from place to place or from person to person is unacceptable.

.07 Secure tools on scaffolds, platforms, or other elevated places where their falling could endanger employees below.

.08 Keep sharp-edged tools sharpened.

.09 Use hand tools in such a way as to prevent injury in case of a slip.

.10 Use suitable holders or tongs, (NOT hands), while chisels, drills, punches, ground rods and pipe are being struck by another employee.

.11 When using adjustable wrenches pull so force is applied to the side of the fixed jaw.

.12 For added leverage use approved extensions.

.13 Only wrenches designed for the purpose are struck.

.14 Handle and store tools with sharp edges so they will not cause injury. Avoid carrying tools in pockets. Keep all cutting tools properly guarded.

.15 Replace loose, cracked or splintered tool handles. Keep handles clean and free from oil and grease.

.16 When working on or above open grating, cover the grating to prevent tools or parts from dropping to a lower level, or barricade/guard the danger area below.

.17 The insulation on non-rated hand tools shall not be depended upon to protect users from electric shock.

.18 Handles and/or leather gloves are required with files and rasps. Files and rasps are not to be used as a pry, or ever to be struck.

119 Hazardous Materials

.01 Read and understand the Hazard Communication Program to include Material Safety Data Sheets (MSDS) and product warning labels for the products and substances with which you are working.

.02 Use Hazardous materials, chemicals and products approved by evaluation through the Chemical Safety Program. (EH&S)

.03 Only qualified and authorized employees are required to handle hazardous materials.

.04 Appropriate personal protective equipment as defined in the MSDS shall be worn to reduce exposure to injury and other risks.

.05 Practice good personal hygiene to reduce exposure to hazardous substances.

.06 Consult with a supervisor, C.F. Safety or EH&S if you have any questions about working safely with hazardous substances.

Hazardous Material Spills

.07 Any identified or unfamiliar hazardous material spill or leak should immediately be reported to the supervisor and Environmental Health and Safety and handled according to approved procedures.

.08 Only those employees who meet all safety and occupational health requirements shall gain access. Efforts shall be made to secure the area to only those persons.

.09 After hours contact the University Police.

120 Head Protection

.01 Only approved hard hats or caps (meeting ANSI Z - 89.1) are worn.

.02 Hardhats with a high dielectric strength are required for operations where high voltage exists.

.03 Hard hats that have had impact or penetration even with no visible damage must be immediately replaced as well as hard hats that show wear or have exceeded their useful service life.

.04 All decals must have manufacturer approved adhesive. Department management is responsible for documenting manufacturer approval.

.05 Head protection is worn by employees and non-employees under the following conditions:

- In designated hard hat areas
- On a power plant site
- By all operating personnel in the field where falling objects or other head hazards exist.
- By those indoors and in shops and storerooms, who are subject to falling objects or other hazards
- At any other work area where there is a danger of head injury and falling objects
- When work in ceilings presents a hazard

.06 Keep hard hats clean. When cleaning them use only mild non-solvent cleaners. Inspect hardhat at least once a day prior to use. Replace those found to be defective.

121 Hearing Protection

.01 Approved hearing protection shall be worn when employees are working in an area designated as requiring protection.

.02 Employees who normally work in areas where Hearing Protection Required signs are posted participate in the hearing conservation program and have regular audiometric evaluations.

.03 Approved hearing protection is recommended for use in noisy work areas even if the Time Weighted Average is within limits.

.04 Employees required to wear hearing protection shall be trained and shall comply with the proper use, limitation and care of the protectors.

.05 Permissible Noise Exposures

Duration Per Day (hours)	Sound Level (dBA) *
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
¼ or less	115

NOTE: Proper protection will be worn when exposed at or above these levels.

.06 Supervisors of high noise producing areas are responsible for employee compliance in their areas.

.07 Employees who are not included in the C.F. Hearing Conservation audiometric testing program must notify their supervisor when working in high noise producing areas. The employee's supervisor and the supervisor in charge of the high noise area (if they are different) will assist in specific hearing protection requirements.

122 High Heat Environments

.01 Employees who work in high heat environments follow all the provisions of the Heat Stress Program.

.02 Drink plenty of water and take regular breaks when working in high heat environments.

.03 Take extra precautions to prevent sunburn and heat stress when working in the direct sun.

123 Housekeeping

.01 Employees are responsible for maintaining a clean and orderly work place, whether on Campus Facilities property, in vehicles, or at a job site.

.02 Place tools and materials so they do not to create a tripping hazard. Keep aisles, passageways and stairs clear.

.03 Pick up and dispose of scrap materials and debris promptly.

.04 Remove or flatten protruding nails from boards.

.05 Vacuuming is the preferred method for dusty clean-up conditions.

Note: Coal dust vacuuming can cause static electricity buildup. Proper methods and procedures will be followed.

.06 Dispose of trash and debris in an approved environmentally safe manner.

.07 Leave the work area clean.

124 Indoor Air Quality

.01 Comply with smoke-free workplace guidelines.

.02 Review MSDS on all products and materials to identify those that should be used cautiously when applied indoor.

.03 Maintain adequate ventilation when work tasks such as cleaning, etc., may create potential airborne irritants.

.04 Minimize dusts and particulates. Follow housekeeping procedures. Avoid exposures through restricted uses of aerosols, solvents or other vapor producing products, if exposure cannot be avoided, use respiratory equipment if you are approved to wear it, or contact your supervisor.

.05 Report unusual conditions or concerns to supervisor.

125 Job Planning – Job Briefing

.01 The employee in charge is required to conduct a job briefing at the jobsite before work

begins. The briefing covers at least the following subjects: hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements and emergency procedures.

.02 The person in charge will assemble the crew and explain the work to be done, outline the steps to be followed, personal protective equipment required, and point out the hazards of the job. The person in charge ensures that each member of the crew understands the instructions.

.03 If the work or operations to be performed during the work day or shift are repetitive and similar, at least one job briefing will be conducted before the start of the first job of each day or shift. Additional job briefings are held if significant changes, which might affect the safety of the employees, occur during the course of the work.

.04 A brief discussion is satisfactory if the work involved is routine and if the employee, by virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job. A more extensive discussion is conducted: if the work is complicated or particularly hazardous, or if the employee cannot be expected to recognize and avoid the hazards involved in the job.

.05 An employee working alone need not conduct a job briefing. However, the employee will ensure that the tasks to be performed are planned as if a briefing were required.

.06 The person in charge is responsible for the accounting of all employees upon the completion of each job.

126 Ladders

.01 Only approved ladders will be used. Follow Manufacturers' weight limits and instructions label affixed to the ladder.

.02 Visually inspect ladders before use. To prevent broken ladders from being used, tag "Out of Service" and remove ladders that have loose rungs, cracked or split side rails, missing pads, or are otherwise damaged. The supervisor in charge will have them repaired according to the manufacturer or disposed of properly.

.03 Keep ladder rungs clean and free of grease and other buildup such as dirt or mud.

.04 When climbing up or down face the ladder, use both hands and take one-step or rung at a time.

.05 Raise or lower tools by using tool belts; tool buckets and lines, or securely attaching them to hand lines.

.06 Only one employee at a time is permitted on a ladder. Exception for rescue efforts or transmission work, or where the ladder is designed for more than one employee.

.07 Avoid overreaching. Keep your belt buckle between the rails as a guide and when necessary reposition the ladder as the work progresses.

.08 Use only approved extension ladders. Two ladders are never lashed together to make a longer one.

.09 When using straight or extension ladders, employees will not climb past the third rung from top.

.10 Ensure that both latches of an extension ladder are seated properly. The minimum overlap for extension ladders is three feet.

.11 Tie off extension and straight ladders at the top, and bottom, to a substantial support whenever practical. Under certain conditions it may be necessary for another employee to hold the ladder to prevent falling or slipping.

.12 Place the ladder at a proper angle, with the base set out one foot for every four feet of ladder length.

.13 Wear an approved safety belt as a positioning device when the job requires the use of both hands while working from an extension or straight ladder.

.14 If an employee is required to transfer from a ladder to a landing, the side rails shall extend at least three feet above the landing.

.15 Stand below the top step when using a stepladder.

.16 A stepladder will not be used as a substitute for a straight ladder. Chairs or other equipment are not acceptable substitutes for ladders.

.17 Make sure the spreaders are fully extended and locked before climbing a step or platform ladder.

.18 Climb the steps of a stepladder, not the support rungs.

.19 Before using a platform ladder check it to determine that the locking mechanism is functioning properly.

.20 Make certain that sections are properly locked together when assembling stack ladders. Assembled stack ladders are limited to three sections.

.21 Ladders will not be painted, except for non-skid paint applied to steps or rungs.

.22 Portable metal ladders and other portable conductive ladders are not used near exposed energized lines or equipment on rooftops or where tools or equipment could contact electricity.

.23 Before moving employees must step off of rolling ladders or scaffolds

.24 When possible store ladders in a horizontal position.

.25 Ladders must not be left unattended in public areas. Ladders not in use must be secured so that an unauthorized person cannot climb them or that it is not climbed by mistake by another employee.

127 Lifting and Carrying

.01 Size up the load before lifting and use correct procedures and techniques.

.02 When lifting, carrying or lowering objects, approved methods. Use mechanical aids whenever possible.

.03 Request assistance with lifting the load when needed.

.04 Approved methods include straight posture, lifting using leg muscles, good footing, and avoiding over-extending and twisting.

.05 Carry loads in such a way as to permit a clear view of the path to be followed.

.06 When two or more employees are required to lift or pull together as a team coordinate the lift. Decide upon one employee to give the signals for the group.

.07 When carrying pipes, conduit or other long objects, use special care when rounding corners and entering doorways.

.08 Carry long loads with the front of the load slightly higher than the back of the load to avoid contacting overhead objects.

128 Lighting

.01 Where natural illumination is not adequate use artificial lighting. Do not use open flames for purposes of illumination.

.02 Protect temporary lighting (except battery powered) with approved guards.

.03 Use equipment approved for the hazardous location in areas where flammable or combustible vapors, gases, liquids, dust or fibers may be present,

129 Live-Line Tools

.01 Use a silicone wiping cloth on live-line tools. Wipe clean and visually inspect for defects before use each day.

.02 If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is present after wiping, remove the tool from

service. It must be examined and tested before reuse.

.03 Live-line tools used for primary employee protection shall be removed from service every year (12 mos.) for examination, cleaning, repair, and testing as follows:

- Each tool shall be thoroughly examined for defects.
- If a defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is found, the tool shall be repaired and refinished or shall be permanently removed from service. If no such defect or contamination is found, the tool shall be cleaned and waxed.
- Live line tools shall be dielectrically tested at least every 24 months.

.04 Live-line tools shall not be painted.

130 Lockout/Tagout

Notes: Employees within Generation Transmission and Distribution locations must be familiar with and comply with the clearance and tagging procedures for their facility.

Within transportation operations (vehicle mechanics) employees must be familiar with and comply with the Lockout/Tagout Procedures for their location.

.01 Only approved and authorized personnel will apply locks or tags or other energy isolating devices to Campus Facilities equipment, machinery or vehicles. All other affected personnel shall be formally trained in the purpose and application of the procedures.

.02 Approved lockout/tagout, and application devices are the only devices used for controlling energy and tagging purposes, and are used for other purposes.

.03 Tagout devices are constructed and printed so that exposure to weather conditions or wet locations will not cause the tag to deteriorate or cause the tag message to become illegible.

.04 If more than one person is required to lockout or tagout equipment or machinery, each person will place their own personal lockout or tagout device on the energy isolating device.

.05 When an energy-isolating device cannot accept multiple locks or tags use a multiple lockout/tagout device such as a multi-holed hasp.

.06 To ensure the safe exchange of information and control of hazardous energies, shift changes are coordinated by the authorized employee in charge.

131 LP Gas Operations

.01 Only qualified employees will fuel liquefied petroleum (LP) gas-powered vehicles.

.02 Follow all procedures in the prescribed order, when fueling LP gas-powered vehicles and LP operations.

.03 Wear approved personal protective equipment when fueling LP-powered vehicles (at least safety glasses and rubber or leather gloves.)

.04 Shut OFF the main fuel line valve in LP gas -powered vehicles left in buildings overnight.

.05 Do not vent LP gas fuel tanks inside buildings.

132 Meters

.01 Only qualified personnel will work on meters. See your supervisor for specific metering operations.

133 Office Safety Practices

.01 Use handles to open and close file drawers or cabinets.

.02 Open one drawer at a time to prevent the file cabinet from tipping over.

.03 Do not lean back in chairs with feet propped or raised above seat level to prevent tipping over backward.

.04 Damaged chairs or office furniture will not be used. Removed from service and tag for repair using a Repair tag.

.05 Use approved step stools and ladders to reach elevated objects or locations.

.06 Turn OFF and unplug office machines prior to making adjustments, repairs, or performing maintenance.

.07 Keep overhead bins fully opened or closed.

.08 Keep trash and recycle containers at a reasonable weight and level to protect service employees from strains.

.09 Use only approved extension cords.

.10 Keep emergency exits areas free from obstructions.

.11 Keep reproduction chemicals capped.

.12 To prevent electrical overloads use only approved electrical strips and circuits.

.13 Electric portable space heaters are prohibited.

.14 Keep electrical panels, fire extinguishers, or fire exits clear of obstructions.

135 Paint and Paint Storage

.01 Review Material Safety Data Sheets and follow recommendations for personal protective equipment, storage and handling practices.

.02 No painting shall take place on or near energized electric equipment where contact with energized parts could occur.

.03 Maintain adequate ventilation in enclosed areas when painting. When adequate ventilation cannot be maintained, approved respirators are provided.

.04 Use approved solvents to clean brushes. Dispose of solvent properly in approved containers in accordance with EH&S procedures.

.05 Open flames are not be permitted in areas where painting is being done.

.06 Approved respirators are issued to formally trained employees for spray-painting operations.

.07 Regulate air pressure to paint spray guns according to manufacturer's recommendations.

.08 Store and transport oil-base paint, varnishes and paint thinners in approved containers.

.09 When oil-base paint is kept in the original container keep the lid properly sealed so vapors do not escape. When not in use, containers of paint, lacquer, varnish, and thinners are kept closed.

.10 Oil-base paint, lacquers, and thinners shall be stored in an approved storage area, where there is adequate ventilation and no excessive heat.

.11 Keep pressurized cans of paint, lacquer, etc. out of direct sunlight or excessive heat when not in use. Pressurized cans with recoverable product are stored in an approved storage area. Empty cans and cans with non-recoverable product shall be disposed of properly. They shall not be punctured or placed in a fire.

136 Personal Injuries

Notes: See C.F. Injury Reporting Procedures – CF Safety Manual for additional information

For all general injuries see the Work Related Injury Flowchart on the CF Safety Webpage. For injuries that require medical attention see Work Injury Services Treatment Requirements.

.01 If an employee is injured on the job; the employee's supervisor shall be notified immediately.

.02 The injured employee's supervisor and the employee will determine if medical attention is required and the supervisor will make arrangements for transporting the employee.

.03 On-the-job injuries and illnesses requiring medical attention will be referred to the authorized physician, clinic or hospital emergency room.

.04 The supervisor is responsible for completing the Injury Report form as well as any other required paperwork.

.05 Inspect first aid kits monthly and stock with approved supplies as necessary.

137 Pneumatic and Hydraulic Tools

.01 Only trained persons will operate pneumatic and hydraulic tools. Use tools in accordance with manufacturer's instructions.

.02 Use pneumatic and hydraulic tools with care. Keep them out of the direction of other persons.

.03 Secure pneumatic and hydraulic power tools to the hose by a positive means to prevent the tool from becoming accidentally disconnected. Operate tools at pressures described in the manufacturers' specifications.

.04 Securely install safety clips or retainers. Inspect and maintained pneumatic impact tools to prevent attachments from being accidentally expelled. Care shall be exercised to insure the trigger or control will not operate when the tool is laid down. Keep the hose free from kinks at all times.

.05 Unless equipped with quick-change connectors, shut off the air at the air supply valve ahead of the hose before making adjustments or changing pneumatic tools. Bleed off at the tool before breaking the connection.

.06 Conductive hoses will not be used near energized equipment.

.07 Open the air tank drain valve at regular intervals to prevent excessive moisture accumulation.

.08 Safety relief valves are required on air tanks. Test periodically to insure proper operating condition. Relief valves will be kept operational.

.09 Shut off the supply line should at the source before disconnecting the air hose.

.10 Use reducers or pressure relief devices ensure that compressed air used for equipment cleaning purposes is below 30 psi. For equipment requiring pressure greater than 30 psi, appropriate personal protective equipment and other protective measures shall be used.

.11 Compressed air less than 15 psi is acceptable to blow dust and dirt from clothing or the body.

.12 Follow manufacturers' stated safe operating pressures for hoses, pipes, valves, filters and other fittings.

.13 Hoses are not be used for hoisting or lowering tools.

.14 Use the appropriate tools to locate or stop leaks.

.15 Wear approved personal protective equipment required.

138 Portable Electric Tools

.01 Effectively ground the non-current-carrying metal parts of a portable electric tool, such as drills, saws and grinders when connected to a power source unless:

- The tool is an approved double-insulated type,
- The tool is connected to a ground fault interrupter,
- Connected by means of an isolating transformer, or
- Protected by an "assured grounding system."

.02 Inspect power tools prior to use.

.03 Use power tools within their design capability and operate in accordance with the instructions of the manufacturer.

.04 Keep tools in good repair and disconnect from the power source while repairs or adjustments are made.

.05 Electric tools shall not be used where there is a hazard of flammable vapors, gases or dust.

.06 Disconnect tools or cords by grasping the plug, not the cord. Maintain extension cords in good repair. Three-wire ground type cords are used for power tools.

Extension lamp cords will have guards and will not be used for tool operations. Tools will not be lifted or lowered by the cord.

.07 Ground fault interrupters will be used when an electric tool is used under damp conditions or in an enclosed vessel.

139 Powder Actuated Tools (.22 & .32 Caliber Shots)

.01 Only trained employees who are qualified will use powder actuated tools.

.02 Carry and transport explosive charges in approved containers.

.03 Operators and assistants using these tools must wear eye protection (safety goggles and/or face shield) and a hard hat.

.04 This equipment is used only upon approved materials. Operators must know the construction and composition of materials the tool is being used upon.

.05 Ensure that the protective shield is properly attached to the tool Prior to use.

.06 Powder actuated tools shall not be used in an explosive or flammable atmosphere.

.07 Load tool just prior to the intended firing. Unload tool immediately when work is suspended.

.08 Tools and cartridges shall not be left unattended.

.09 Tools, loaded or unloaded, shall not be pointed at any person.

.10 Give advance warning prior to firing a powder actuated tool.

140 Property Damage

Note: See Claim Category and Forms Needed on CF Safety webpage for directions

.01 Immediately reported any incident that results in personal injury or property damage to non-employees (either on University property or in connection with University operations) to the supervisor and to Risk Management Department.

.02 In accidents involving University vehicles immediately notify law enforcement agencies, and the employee's supervisor regardless of the amount of damage or who was at fault or whether the accident happened on private property.

.03 All incidents of property damage to the public must be reported promptly. Appropriate forms shall be completed, reviewed by the department head and forwarded to the Risk Management Department.

141 Public Safety

.01 Whether indoors or outdoors, take precautions to warn and restrict the public's exposure to hazards created by Campus Facilities operations.

.02 When working on or near streets and highways use signs, signals and other warning devices in accordance with the Manual on Uniform Traffic Control Devices, 2009.

.03 When a University operation affects pedestrian traffic, every effort shall be made to warn and limit the public from the hazards, which exist.

.04 Unattended holes or floor openings (See Section 101)

.05 Employees finding low or fallen wires, broken poles, holes, ice on roofs, or damaged electrical equipment shall guard them until relieved by personnel qualified to deal with the situation, or until informed by an authorized person that the condition has been made safe.

.06 Employees who recognize other hazardous conditions such as crane operations, drilling operations and erection of antennas adjacent to energized lines shall warn the individual and report the incident as soon as possible to their supervisor or Energy Management.

.07 Visitors will wear appropriate personal protective equipment when exposed to hazards or the job will be shut down.

142 Respiratory Protection

Note: Use of respirators requires formal training specific to the type used for protection. When various types of respiratory protection devices are available, care must be taken to make the proper selection. The device must provide adequate protection against the anticipated hazard. If there is doubt, the higher protective device must be used.

.01 Only approved respiratory protective equipment that is in good condition shall be worn.

.02 Wear the appropriate respiratory protective equipment any time a hazardous

atmospheric condition exists. The manufacturer's instructions for respirator use shall be followed.

.03 Employees will be clean-shaven prior to fit testing and use of negative pressure respiratory equipment.

.04 The Respiratory Protection Program requires regular fit-testing and pulmonary evaluations to determine physical ability to wear a respirator while performing work.

.05 Only formally trained and qualified employees will wear respiratory equipment.

.06 Negative pressure respirators are not used in atmospheres containing less than 19.5% or greater than 21.5 %oxygen.

.07 Class D grade air is used in supplied air applications.

.08 Breathing air hose connections must be incompatible with other fittings for industrial gases.

.09 Air pressure at the attachment point of the hood must be regulated within the ranges specified by NIOSH.

143 Scaffolding

Note: See CF Safety Infolibrary for scaffold procedure and daily checklists.

.01 Formally trained persons will design and erect scaffolds.

.02 The scaffold must be inspected by a competent person prior to each work shift and after any incident which could alter the scaffold's safety.

.03 Use adjusting screws, rather than blocking, to compensate for uneven ground.

.04 Secure scaffolding to a building structure a minimum of every 20 feet. When this is impractical, use outriggers and/or guying.

.05 Protect all open sides of platforms by guardrails, midrails, and toe boards when six feet or more above the ground or floor.

.06 When work is being performed above employees who are working on a scaffold, appropriate PPE and overhead protection must be provided on the scaffold.

.07 Use barricades and warning signs to keep employees from passing beneath

scaffolds.

When employees must work or pass under scaffolds, steps shall be taken to protect those below from the hazard of falling tools or material.

.08 A ladder or equivalent means of safe access shall be provided to the platform. Cross braces shall not be used as a means of access.

.09 Employees must be off a scaffold before moving it.

.10 Prevent materials, tools or debris from accumulating on scaffolds and creating a hazard.

.11 Scaffolds are not used as material hoist towers, or for mounting derricks

144 Solvents

.01 Only approved solvents shall be used. Contact EH&S if you have any questions.

.02 Use the MSDS and/or The Chemical Safety Use Sheet for recommendations, precautions, appropriate protective equipment and safe work practices for each approved solvent.

.03 Use only EH&S approved hand-cleaning products.

145 Stationary Powered Tools

.01 Use appropriate personal protective equipment.

.02 Machine guards shall be properly installed and shall not be removed except for inspection or repairs. Powered tools shall only be operated with the guards in place.

.03 Secure stationary powered tools to prevent movement per manufacturer's recommendation.

.04 Use a mechanical shifter to shift a belt in operation.

.05 Apply the correct belt dressing only after the machine is turned OFF and the belt idle.

.06 Use a brush or other safe method to clean chips away from the machine.

.07 Use clamps to hold work in a drill press.

.08 Remove chuck wrenches from the machine immediately after use. Check machine prior to operation to insure the chuck wrench has been removed and machine is clear and ready for use.

.09 Remote disconnect switches or circuit breakers shall be clearly identified and marked as to their purpose.

.10 Do not attempt to gauge or caliper while the machine is in operation.

GRINDERS

.11 The acceptable clearance from the tool rest to the wheel must not exceed one-eighth of an inch. The distance between the tongue guard and the wheel must not exceed one-fourth of an inch.

.12 Use the manufacturer's recommended wheel speed.

.13 When side grinding, use wheels designed for that purpose.

.14 Work in designated areas. The operator will stand to the side when starting grinding equipment.

.15 Run grinding wheels at operating speeds for at least one minute before work is applied. Dress Wheels as necessary to prevent vibration.

.16 "Ring test" and inspect wheels for chips and cracks before mounting. Wheels shall not be forced onto the spindle.

.17 The work shall not be forced against a cold wheel, but shall be applied gradually until the wheel is warm. The work shall be held firmly against the tool rest.

146 Substations

.01 Only authorized employees or visitors may enter a substation.

.02 Upon entering a substation where other workers are present report to the person in charge in order to exchange information on special system conditions affecting employee safety.

.03 When working in an energized substation, gates are kept closed and latched except where the substation is within or adjacent to power plant or operation

centers.

.04 Substation keys are issued only to authorized persons. Employees are not permitted to loan substation keys to non-employees or other unauthorized individuals.

.05 Danger High Voltage signs are permanently displayed on the fence on all sides of the substation. Damage to fences shall be reported immediately to the supervisor.

.06 When leaving a substation, lock all doors, control houses and outside gates and check to be sure everything is secure and in proper order. Consideration shall be given to eliminating conditions that might attract unauthorized entry.

147 Vehicle Operation

.01 Only properly licensed and authorized persons are permitted to operate motor vehicles and equipment.

.02 Operate vehicles and equipment in accordance with University rules and principles of defensive driving.

.03 Operators will familiarize themselves with and obey all state and local traffic laws and ordinances.

.04 Unauthorized persons are not permitted to ride in University vehicles unless the supervisor grants permission.

.05 Where seat belts and shoulder harnesses when provided.

.06 Employees should ride only in the passenger compartment provided in trucks for their transportation or seated within areas designed for passenger use.

.07 Internal combustion engines will be operated within closed garages or other buildings only when adequate ventilation is provided.

.08 Employees will not operate an unsafe vehicle or equipment. Remove unsafe vehicles or equipment from operation and report it promptly to the person in charge.

.09 Operate trucks with tool compartment doors closed and tailboards intact (Not hanging loose).

.10 If sufficient personnel are available during backing operations where visibility is obscured; a flagger is used at the rear of the vehicle being backed. The flaggers will position themselves in such a manner as to see the area to the rear of the vehicle and be seen by the operator. The operator obeys the signals given by the

flagman.

.11 Handled any unusual loads in compliance with state and local laws or ordinances.

.12 Balance or distribute the load as equally when loading vehicles.

.13 When loading or unloading, vehicles place vehicle in PARK position and set brakes, or chock the wheels.

.14 Vehicles will be parked at a distance greater than eight feet to any railroad track.

.15 Unless otherwise posted, the speed limit on University property is 20 miles per hour.

.16 Before moving a vehicle where visibility is obscured operators will perform “a walk around”. (Walk around the vehicle it to make sure everything is in the clear.)

.17 Operators must consider overhead clearances.

.18 Employees must not board or get off of a moving vehicle.

.19 Open doors carefully to avoid striking people, objects, or other vehicles. Exercise caution when opening doors on the street side of a vehicle.

.20 Attach and orange warning flag to loads extending four feet or more beyond the body of the vehicle.

.21 Close and lock the safety latch on the pintle hook and use safety chains when attaching trailers.

.22 All trucks hauling poles or pole trailers or any long objects shall be driven with extreme caution because of the overhang.

.23 Use adequate advanced warning to all traffic before attempting to turn with a load that projects over five feet beyond the end of the truck or trailer.

.24 Properly secure equipment and materials carried on or in trailers. Distribute weight evenly.

.25 No one is permitted to ride on a trailer.

.26 “Micro Brakes” on vehicles are secondary braking systems. They are used for that purpose only.

.27 Comply with all applicable DOT regulations when transporting hazardous materials.

.28 Unless the engine is needed to power auxiliary equipment unattended vehicles are

off, the parking brake engaged and all doors locked.

.29 Park or plan routes so as to avoid backing whenever practical.

.30 Keep weights within the Registered GVW (Gross Vehicle Weight).

148 Violence Prevention

.01 Firearms, explosives or other dangerous weapons shall not be carried by anyone in the workplace or in University vehicles.

.02 Harassment or threats are not tolerated.

.03 Report threats or acts of violence on University property immediately to supervisor and/or the University Police. Report such acts off University property immediately to law enforcement, supervisors and C.F. Personnel.

.04 Intimidation, horseplay, scuffling, practical jokes or similar activities are not permitted.

.05 Use a visible means of employee identification when entering University property.

149 Welding, Cutting and Brazing

.01 Only qualified persons are permitted to weld. Prior to welding or cutting, inspect the area for potential fire hazards and permit if necessary.

.02 Provide adequate ventilation during welding operations or use approved respiratoryprotective equipment.

03 Whenever practical, place screens or fire-resistant curtains around welding operations to protect workers nearby.

.04 Properly dispose of welding rod studs.

.05 If the object to be welded or cut cannot readily be moved, all moveable fire hazards in the vicinity must be taken to a safe place or otherwise protected.

.06 Suitable fire extinguishing equipment must be available at the site in a state of readiness for instant use.

.07 Employees exposed to the hazards created by welding, cutting or brazing

operations shall be protected by proper personal protective equipment.

.08 Keep cylinders away from all sources of heat and at least 20 feet from highly combustible materials, or protected by fire-resistant shields.

.09 After welding or cutting is completed mark the hot metal or use other means to warn others.

.10 Follow Campus Facilities Hot Work Program

150 Work Area Protection

.01 Allow motorists and pedestrians time to adjust to upcoming conditions by using as much advance warning as practical. Use signs, and in some cases lights, placed well in advance of the work area to in accordance with approved standards.

.02 Locate ass signs on the side of the roadway and maintain them at right angles to, and facing, oncoming traffic.

.03 Use only approved warning devices. Equip "Workers Ahead" signs with orange flags for better visibility.

.04 Remove signs when the work has been completed. If work is temporarily suspended cover or remove signs.

.05 When the work area is adjacent to, or encroaches upon, a lane of traffic use traffic cones to delineate or to channel traffic away from the work area. The taper must be long enough so vehicles approaching the area have enough distance in which to adjust their speeds and merge to a single lane before the end of the transition.

.06 Make every effort to move traffic around the work area as safely and expeditiously as possible. If there is enough room for two vehicles to pass each other, use cones to divide the space into two lanes. If there is only room for one- way traffic, block off the entire lane.

.07 In a congested area where there is heavy traffic, it may be necessary to designate a member of the crew as flagger. The flagger must wear an orange vest and carry a red flag or approved paddle.

.08 Under extremely heavy traffic conditions, a second flagger or University Police may be required. Each flagger must be able to see the other clearly so as to coordinate their signals.

.09 In a more congested area, where vehicles are parked in designated parking spaces at the curb, place a "Workers Ahead" sign at an appropriate distance to the rear of

the truck. Place a cone and flag immediately behind the truck.

.10 Warning lights. Use steady-burning lights or reflective cone collars on delineators to channel traffic. Use Flashing lights as advance warning and attach it to the very first sign as the motorist approaches the work area.

.11 Use the rotating light on the truck at night as well as daytime when conditions warrant it.

.12 Install work area protection along sidewalks where pedestrians may encroach upon the work area. Added protection is recommended in high-density areas.

151 Compressed Gas Cylinders

.01 Store cylinders in designated areas and secure in an upright position. Keep empty and full cylinders separated. Store oxygen cylinders at least 20 feet from fuel gas cylinders or other combustible material, such as oil and grease, or separate them by an approved firewall.

.02 Cylinders are not to be dropped, struck, rolled in the horizontal position or exposed to temperature extremes.

.03 Use provided caps for valve protection except when regulators are attached to approved carts. Place the cap on the cylinder and hand-tighten. Never insert tools in the cap for the purpose of loosening or tightening the cap. When removing caps make sure that the valve assembly is not unscrewed along with the cap.

.04 Keep oil and grease out of contact with torches, valves, regulators, gauges or fittings of oxygen cylinders.

.05 Never release compressed gas from any cylinder without using a suitable regulator. **See exceptions in Section 2**

.06 Keep sparks or flames away from cylinders or hoses. Signs reading “Danger—No Smoking, Open Flames or Ignition Sources” are required in rooms or at entrances to areas where fuel gas is stored or used.

.07 Secure cylinders in use to a special cart or to a stationary object such as a handrail or column.

.08 Unless secured in a special cart or truck, secure cylinders in the upright position with regulator removed and valve caps in place while being transported.

Safety Operations

200 Aerial Basket Operations

.01 Perform a pre-trip inspection of the vehicle and properly fill out necessary forms.

Visually check aerial baskets at the beginning of each use. Operate and check the controls from the ground before going up.

.02 No one on the ground is permitted to operate the controls to the aerial basket while someone is in the basket, except for emergency purposes or following a direct command from the employee in the aerial basket.

.03 Make sure that brakes are set before setting up aerial basket truck. When parking on an incline, use chocks.

.04 Use outriggers where on vehicles where they are provided. Before operating outriggers, check to see that everyone is in the clear. Place the outriggers firmly on pads or firm footing before operating the boom.

.05 Wear an approved body harness with a shock-absorbing lanyard properly attached to the boom.

.06 Do not climb into or out of the basket while the basket is elevated except in an emergency. Employees shall not belt off to a structure while working in the basket.

.07 Keep the operating control box clear of materials or tools. No objects, except approved storage containers, are allowed to hang on the outside of the basket when working in an energized area.

.08 Put the boom in the cradled position and secure it when moving the vehicle.

.09 Keep within the manufacturer's designated load limits found on the nameplate.

.10 When working on energized equipment, employees shall position themselves below it when practical.

.11 When working on energized equipment, employees shall work on one conductor at a time.

.12 Keep the basket clean, free of debris and covered when not in use.

.13 No tools or equipment shall be rigged to the basket in such a manner as to cause

the basket to become unstable.

201 Compressed Gas Cylinders

.01 Store cylinders in designated areas and secure in an upright position. Keep empty and full cylinders separated. Store oxygen cylinders at least 20 feet from fuel gas cylinders or other combustible material, such as oil and grease, or separate them by an approved firewall.

.02 Cylinders are not to be dropped, struck, rolled in the horizontal position or exposed to temperature extremes.

.03 When opening the cylinder valve, the operator will be in a crouched position behind and below the cylinder valve. The cylinder valve discharge is turned away from the operator and opened slowly. This does not apply when the cylinder is required to be in an inverted position.

.04 Use provided caps for valve protection except when regulators are attached to approved carts. Place the cap on the cylinder and hand-tighten. Never insert tools in the cap for the purpose of loosening or tightening the cap. When removing caps make sure that the valve assembly is not unscrewed along with the cap.

.05 Back off regulators all the way prior to valving the cylinder on. Valves are kept fully open (if empty) or fully closed when not in use. If a special wrench is required, leave it in place on the valve stem for immediate use in case of emergency.

.06 Keep oil and grease out of contact with torches, valves, regulators, gauges or fittings of oxygen cylinders.

.07 Never release compressed gas from any cylinder without using a suitable regulator except to initially clean the valve orifice. The control valve is opened only enough to blow out any foreign particles before connecting the regulator or line to the cylinder.

NOTE: Acetylene and hydrogen cylinders are not to be vented.

.08 Keep sparks or flames away from cylinders or hoses. Signs reading “Danger—No Smoking, Open Flames or Ignition Sources” are required in rooms or at entrances to areas where fuel gas is stored or used.

.09 Oxygen is used for specific purposes only. Do not use it to blow out pipelines, dust clothing, start engines, pressurize tanks, and operate pneumatic tools or paint-spraying devices.

.10 Secure cylinders in use to a special cart or to a stationary object such as a handrail or column.

.11 Unless secured in a special cart or truck, secure cylinders in the upright position with regulator removed and valve caps in place while being transported.

.12 Follow DOT regulations for hazardous materials shipping of all compressed gas cylinders. Papers and cylinders must be legibly marked as to contents (See EH&S Hazardous Materials Website.)

.13 Welding/cutting tanks are prohibited in confined spaces.

.14 Mark vehicles with placards when transporting cylinders.

.15 Use acetylene at pressures less than 15 psi.

.16 Remove regulators and put valve caps in place while cylinders are being transported on elevators.

202 Cranes and Hoists

.01 Only qualified personnel are permitted operate cranes and hoists.

.02 Wear a hard hat when working in the immediate area around a crane.

.03 Make sure that the controls of all cranes are distinctly marked so that their functions cannot be misunderstood.

.04 The operator takes all signals from the designated signal person. Should it be apparent that obeying a signal would result in an injury, the operator will not proceed but will notify the signal person at once. A STOP signal shall be obeyed regardless of who gives the signal.

.05 Mark all lifting equipment, slings and attachments to show load capacity.

.06 Stay within the rated capacity and load limits of the equipment.

.07 Check all clearances before raising or lowering a load.

.08 After the slack is taken up, stand clear of the load before the lift is started, except as required by the job. Use a tag line when moving large, heavy equipment or materials.

.09 Operators will not move loads over the heads of employees. Employees will not work under suspended loads or inside the angle of a winch line.

.10 Suspended work platforms are used unless no other means to access work is available. Refer to Suspended Work Platform Procedures.

.11 The operator shall not leave controls unattended when the load is suspended.

.12 Upon leaving the crane or hoist, the operator opens all necessary switches or controls or apply brakes to prevent movement of the crane or hoist while unattended.

.13 When cranes or hoists are within ten feet of exposed energized overhead lines, the safe approach distances will be constantly checked by a designated observer

.14 When working within ten feet of exposed energized lines or equipment follow all procedures to ground cranes and insulate or isolate lines and equipment.

.15 Exercise extreme caution when working in the vicinity of a mobile crane that is operating near exposed energized equipment.

.16 If the mobile crane accidentally makes contact with energized equipment:

- Do not approach the crane until the contact is broken or the equipment is known to be de-energized.

- If it becomes necessary for the operator to leave the crane, jump clear rather than step down.

.17 Use outriggers to level a mobile crane. To assure stability, re-check outriggers and blocking after the initial strain is taken off and before proceeding with the job.

.18 If an overhead crane or hoist loses power, secure it until the power is restored. Turn the controls to the OFF position and lock out if necessary,

.19 Have an approved fire extinguisher easily accessible to the crane operator.

.20 After the load is removed secure the hook and/or slings.

.21 Visually inspect the hoisting cable each day before it is used.

203 Fall Protection

.01 Fall protection is required on all work above six feet unless on an approved work platform, a guardrail system or a safety net system is in place. (Does not apply to step ladders.)

.02 Where the working height is six feet and above, employees must be formally instructed in fall protection procedures before using equipment or setting up a job.

.03 Use only approved personal fall protection equipment.

.04 Inspect safety straps, lanyards, lifelines, and full body harnesses before use each day to determine that the equipment is in safe working condition. Tag and remove from service immediately any defective equipment.

.05 Protect lifelines against being cut or abraded.

.06 Rig personal fall-arrest systems so that an employee is prevented from a free-fall more than six feet or contacting any lower level.

.07 Only one employee is attached to a vertical lifeline or dropline.

.08 Snaphooks must not be connected to loops made in webbing-type lanyards or to each other.

.09 Locate anchorage points for positioning devices and fall-arrest equipment above the full body harness attachment point.

.10 Tag and remove from service immediately, any fall-arrest equipment that has been subjected to stress impacts caused by a free-fall.

Note: Fall protection requirements for work on *ladders*, *scaffolds* or other approved work surfaces are included in those sections.

204 Forklift Operations

Note: Follow CF Forklift Policy.

.01 Only trained and qualified personnel are permitted to operate a forklift. Operation of the forklift is in accordance with manufacturers' safe operating instructions and C.F. Powered Industrial Truck Procedures.

.02 Wear hardhats and safety glasses at all times when operating a forklift in a designated hardhat area or when exposed to overhead hazards. Hardhats are

also worn when using a forklift to lift a load when the top of the load being lifted is higher than cab protection of the forklift.

.03 Complete an equipment checklist examination at the beginning of each shift prior to using the unit. A written copy of the completed checklist is retained on file according to procedures.

.04 Keep all body parts within the confines of the rollover protection structure. Seatbelts are required to be worn when they are part of the rollover protection structure.

.05 When descending an incline, the load is to the rear. When ascending an incline, the load is to the front.

.06 When parked on an incline block or chock wheels.

.07 Avoid sudden stops that might spill the load.

.08 Sound the horn when blind corners are approached.

.09 Do not exceed the allowed levels of carbon monoxide by operating forklifts with gasoline or diesel engines in an enclosed area for prolonged periods of time.

.10 When a forklift is moved, loaded or empty carry forks as low as possible but high enough to clear uneven surfaces (approx. 4”-6”).

.11 Do not raise or lower loads while the forklift is traveling.

.12 Turn on the warning light/s whenever the unit is in operation.

.13 Passengers are not allowed to ride a forklift unless an approved passenger seat is provided. No one shall be permitted to ride the load at any time.

.14 Only an approved platforms are used as worker lifts. The platform must be properly secured to the mast or forks, and guards in place to prevent hands or materials from passing into the mast area.

.15 Use approved fall protection while working in an elevated platform attached to the forklift.

.16 Secure fall protection to the fork-tine carriage and not to the platform or workbasket.

.17 No horseplay

.18 Be aware of overhead clearances

.19 Do not exceed the capacity of the lift truck

205 Lockout/Tagout

Notes: Employees within Generation Transmission and Distribution locations must be familiar with and comply with the clearance and tagging procedures for their facility.

Within transportation operations (vehicle mechanics) employees must be familiar with and comply with the Lockout/Tagout Procedures for their location.

Follow CF Lockout/Tagout Procedures.

.01 Only approved and authorized personnel will apply locks or tags or other energy isolating devices to Campus Facilities equipment, machinery or vehicles. All other affected personnel shall be formally trained in the purpose and application of the procedures.

.02 Approved lockout/tagout, and application devices are the only devices used for controlling energy and tagging purposes, and are used for other purposes.

.03 Tagout devices are constructed and printed so that exposure to weather conditions or wet locations will not cause the tag to deteriorate or cause the tag message to become illegible.

.04 Properly and legibly enter all information required on the tag.

.05 If more than one person is required to lockout or tagout equipment or machinery, each person will place their own personal lockout or tagout device on the energy isolating device.

.06 When an energy-isolating device cannot accept multiple locks or tags use a multiple lockout/tagout device such as a multi-holed hasp.

.07 As an alternative, to utilizing a multi-holed hasp to lockout a device, a single lock may be used to lockout the equipment or machinery. Put the single key to that lock in a lockout box or cabinet that can accommodate multiple locks or tags. Secure that cabinet by having each employee use his or her own lock or tag on the cabinet or box. As each person no longer needs to maintain their lockout protection, that person will remove their lock or tag from the multiple lockout device or the lockout box or cabinet, whichever is being used.

.08 To ensure the safe exchange of information and control of hazardous energies, shift changes are coordinated by the authorized employee in charge

.09 In the event work cannot be completed by the end of a shift, and there are no overlapping shifts or direct exchange of information between authorized

employees assuming the work, employees will follow procedures to ensure the equipment or machinery is safe and properly secured, and that all required information is documented.

.10 In the event an employee leaves the facility without removing his/her lock from equipment or machinery on which work must continue, all efforts must be made to contact that employee to return to work and remove the lock or tag.

.11 If an authorized employee who applied the lock or tag device is not available to remove it, and cannot be contacted, the lock or tag may only be removed according to the following procedures as outlined in the Campus Facilities Control of Hazardous Energy Program - LOTO

Lockout/Tagout Procedures

.12 Authorized employees know the type and magnitude of energy sources that the machine or equipment utilizes and understand the hazards and the appropriate means to eliminate the hazard.

.13 If the machine or equipment to be serviced is operating, shut it down using normal shut down procedures.

.14 Operate the disconnect switch, line valve, or other isolation devices so that the equipment is isolated from its energy source(s). Always trace all lines of supply back to their source to assure that there are no added splices, connections or T's that have not been secured. Stored energy in 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 repositioning, blocking, bleeding down, etc.

.15 The authorized employees will lockout and tagout energy isolating devices with assigned individual locks and/or tags.

.16 Any time a lock is used to secure an energy source, it must be accompanied by a tag identifying the person that installed it, the date and time it was installed, and a means by which the employee may be contacted.

.17 At no time will the locking device be removed by anyone other than the person who is identified on the tag unless following specific departmental procedures.

.18 After ensuring that no personnel are exposed, and as a check on having disconnected the proper energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate.

.19 All operating controls should be reset to NEUTRAL or the OFF position after the initial test, if the equipment, machinery, or vehicle being serviced or repaired has stored energy which cannot be realistically removed by

dissipation, bleeding down, or restrained to prevent movement.

.20 The equipment or machine is now locked or tagged out-of-service and maintenance or repairs may begin.

Termination of Lockout/Tagout

.21 After the service and/or maintenance is complete and the equipment is ready to be tested and/or returned to normal operation, it must be inspected for completeness of assembly, the area around the machine or equipment must be checked to ensure that exposures to hazards or risks are minimal, and that all non-essential items have been removed from the operating area.

.22 All equipment guards must be in place and properly adjusted.

.23 All affected employees must be notified of the intention to energize and test the machine or equipment. All non-essential personnel will move to a safe location.

.24 The authorized employee(s) who applied any lock or tag will remove all lockout or tagout devices and operate the energy isolating devices to restore energy to the machine or equipment in the exact reverse order that they were installed.

.25 Do not remove the last lock or tag until all hazards have been considered and corrected as needed.

206 Mowing and Trimming Operations

.01 Gas Powered Lawn Maintenance Tools

.001 Read and follow the manufacturer's routine and preventive maintenance schedule.

.002 Only formally trained employees may operate powered equipment.

.003 When operating the unit grip the specified manufacturer handholds.

.004 Tag damaged tools "Out of Service" to prevent accidental start up or use.

.005 Tag and remove from service tools that have parts that are loose, worn, cracked or otherwise visibly damaged.

.006 Turn the engine "Off" and allow it to cool:

- Before adding fuel.
- When not in use
- Before performing maintenance on it.
- Before covering or storing it.

.007 Turn the power switch of the engine to “Off” and disconnect the spark plug wire from the spark plug before cleaning, inspecting, adjusting or repairing cutting blades or other rotating parts.

.008 Smoking is prohibited

- While servicing, or using a hand held gasoline tool (hedge cutter, trimmer, etc.)
- While refueling any equipment.

.009 By-pass switches and all other safety device provided by the manufacturer or added for employee safety will be kept in working condition.

.02 Mowing

.001 Visually inspect the area to be mowed; remove or mow around hazards such as tree stumps, roots, rocks, branches sprinklers, hoses, electrical cords, light fixtures, pipes, etc.

.002 The kill switch on a mower must be maintained in working order at all times.

.003 Direct the grass discharge away from bystanders.

.004 When dumping or removing clogged grass from equipment turn the power off.

.005 Mowing slopes of greater than 3:1 require special consideration. Steep slopes must be evaluated prior to cutting to determine safest way to mow them. Only well-trained, experienced operators determined by management will mow slopes.

.006 Keep the mower in gear when going down slopes.

.007 Place discharge chutes in “down” position when mowing.

.03 Edging

.001 Start an edger with the blade off of the ground.

.002 Operate the edger at full blade speed.

.003 When edging along roads, stay as close to the curb as possible.

.04 Line Trimming/Weed Eater/Brush cutter

.001 Before refueling the trimmer, remove it from the harness, place it on the ground and allow it to cool.

.05 Backpack Blowers

.001 Do not use the blower to clean you.

.002 Do not direct the blower toward bystanders.

207 Scaffolding

Notes: Refer to CF Safety Policies for specific requirements.

See CF Safety Infolibrary for scaffold procedure and daily checklists.

.01 Formally trained persons will design and erect Scaffolds.

.02 The scaffold must be inspected by a competent person prior to each work shift and after any incident which could alter the scaffold's safety.

.03 Maintain scaffold components maintained in good repair and inspected before erection. Any broken, bent, altered or otherwise structurally unsound frame or support members shall not be used. All scaffolds and their supports must be capable of supporting the load they are designed to carry with a safety factor of four.

.04 When scaffolds must be erected on soft or filled ground, sufficient sills or underpinnings will be used to insure stability.

.05 The legs or uprights of scaffolding shall be plumb and securely and rigidly braced to form a stable work platform. Braces shall not be forced to make them fit.

.06 Adjusting screws, rather than blocking, shall be used to compensate for uneven ground.

.07 Secure scaffolding to a building structure whenever possible. When this is impractical, use outriggers and/or guying.

.08 Protect all open sides of platforms by guardrails, midrails, and toe boards when six feet or more above the ground or floor.

.09 When work is being performed above employees who are working on a scaffold, appropriate PPE and overhead protection must be provided on the scaffold.

.10 Use barricades and warning signs to keep employees from passing beneath scaffolds. When employees must work or pass under scaffolds, steps shall be taken to protect those below from the hazard of falling tools or material.

.11 A ladder or equivalent means of safe access shall be provided to the platform. Cross braces shall not be used as a means of access.

.12 Use only “scaffold grade” lumber for platform planking. Lay planks solid. Planks must be secured. At least six inches but less than 18 inches of planking is required to extend beyond end supports.

.13 Employees must be off a scaffold before moving it.

.14 Prevent materials, tools or debris from accumulating on scaffolds and creating a hazard.

.15 Work from the platform of a scaffold. Do not use ladders or makeshift devices to gain added height from the platform.

.16 Lock castor brakes on rolling scaffolds before employees climb them. Check that castors are pinned into the frames.

.17 Do not use ladders in the horizontal position for use as scaffolding.

.18 Scaffolds are not used as material hoist towers, or for mounting derricks.

208 Welding, Cutting and Brazing

.01 Only qualified and trained persons on CF procedure are permitted to weld, cut, or braze. Prior to welding or cutting, inspect the area for potential fire hazards and permit if necessary.

.02 Welding, cutting, or brazing outside of designated areas must have a permit filled and on site. See CF Safety Forms on webpage.

.03 Inspect oxygen and fuel gas hoses before use. Remove hoses that leak or show burned or worn areas from service.

.04 Provide adequate ventilation during welding operations or use approved respiratory protective equipment.

.05 Whenever practical, place screens or fire-resistant curtains around welding operations to protect workers nearby.

.06 Any arc welding machine that gets wet internally must be thoroughly dried and tested by a qualified person before being used.

.07 Welding cables shall be inspected periodically for damage and loss of insulation. Remove any cables in need of repair from service immediately.

.08 Uncoil welding cable before use. Firmly attach the ground lead to the work. Check all ground connections to be sure that they are mechanically strong and electrically adequate for the required current.

.09 Join ground and electrode cables using connectors specifically designed for the purpose.

.10 A welder will not weld with cables coiled around or placed on his or her body. Repair splices are not permitted within ten feet of the welder.

.11 Electrode holders, when not in use, are placed so that they cannot make electrical contact with persons, conductive objects, fuel or compressed gas tanks. Remove electrodes from holders when not in use.

.12 Welding rod studs must be properly disposed of.

.13 If the object to be welded or cut cannot readily be moved, all moveable fire hazards in the vicinity must be taken to a safe place or otherwise protected.

.14 Suitable fire extinguishing equipment must be available at the site in a state of readiness for instant use.

.15 No welding or cutting shall be performed on used equipment, pipes, drums,

barrels, tanks, or other containers until they have been cleaned so thoroughly as to make certain that there are no flammable materials present or substances that might produce flammable or toxic vapors.

.16 Employees exposed to the hazards created by welding, cutting or brazing operations shall be protected by proper personal protective equipment.

.17 Mechanical ventilation is required for the following materials: fluorine compounds, zinc, lead, chlorinated hydrocarbons, beryllium, cadmium, mercury, cleaning compounds, galvanized materials and stainless steel are particularly hazardous and have specific control requirements. Refer to MSDS for specific health requirements for these hazardous materials.

.18 Under no conditions shall acetylene be generated, piped or utilized at a pressure in excess of 15 psig (or 30 Pisa) or no more than one quarter turn of the spindle.

.19 Legibly mark compressed gas cylinders identifying the gas content, with either the chemical or trade name of the gas.

.20 Keep cylinders away from all sources of heat and at least 20 feet from highly combustible materials, or protected by fire-resistant shields.

.21 Except when cylinders are in use or connected for use. Keep valve protection caps in place at all times, hand-tighten only.

.22 Separate oxygen cylinders in storage from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 20 feet or by a non-combustible barrier at least 5 feet high having a fire-resistance rating of at least one- half hour.

.23 Keep Cylinders, valves, couplings, regulators, hoses and other equipment free from oily or greasy substances.

.24 Before attaching a regulator to a cylinder, stand to one side and open the valve slightly for an instant, then close it. This “cracking” of the cylinder valve will clean the valve of dust or dirt.

.25 Before a regulator is removed from a cylinder valve, close the valve shall release the gas from the regulator.

.26 Open acetylene cylinder valves less than one and one-half turns of the spindle. This allows ready closing of the valve in an emergency situation.

.27 Always use the proper hoses. Fuel gas hose is usually red (sometimes black) and has a left-hand treaded nut for connecting to the torch. Oxygen hose is green and has a right-hand threaded nut for connecting to the torch.

.28 Pressure-reducing regulators are used only for the gas and pressures for which they are intended.

.29 Gauges on oxygen regulators shall be marked Use No Oil.

.30 Place welding cable, hoses, and other equipment so that they are clear of passageways, stairways and ladders unless properly guarded.

.31 Matches, lighters, or hot work shall not be used to light a torch. A friction striker or other approved device shall be used.

.32 After welding or cutting is completed mark the hot metal or use other means to warn others.

.33 When welding or cutting in an area where flammable or combustible materials are present a obtain Hot Work Permit.

209 Powder Actuated Tools (.22 & .32 Caliber Shots)

.01 Only trained employees who are qualified will use powder actuated tools.

.02 Carry and transport explosive charges in approved containers.

.03 Operators and assistants using these tools must wear eye protection (safety goggles and/or face shield) and a hard hat.

.04 Maintain tools in good condition and service in accordance with manufacturer's guidelines.

.05 This equipment is used only upon approved materials. Operators must know the construction and composition of materials the tool is being used upon.

.06 Ensure that the protective shield is properly attached to the tool Prior to use.

.07 Inspect the tool to be sure that it is clean, moving parts operate freely and the bore is free from obstructions. Clear the bore before using. A charge shall not be fired to clear the bore.

.08 Tag and remove any defective tool immediately.

.09 Powder actuated tools shall not be used in an explosive or flammable atmosphere.

.10 Load tool just prior to the intended firing. Unload tool immediately when work is suspended.

.11 Use only cartridges with an explosive charge adequate for the job and with proper penetration.

.12 Tools and cartridges shall not be left unattended.

.13 Keep tool held perpendicular to the work surface.

.14 Tools, loaded or unloaded, shall not be pointed at any person.