

Main Campus General Safety

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Introduction

Clemson believes that the health and safety of students, faculty, and staff are of the greatest importance. Clemson will conduct its operations and construct and maintain its facilities in a manner conducive to the creation of a healthy and safe work environment for all personnel and the surrounding community.

Hazardous Material Emergencies

See the Hazardous Materials Emergency Response Plan.

Indoor Air Quality

The quality of the air in our buildings is a function of the ventilation system serving the area and the contaminants being released into it. Ventilation systems can be upgraded to remove contaminants, but generally only at great expense. For those areas where ventilation systems are suitable and functioning properly, the most logical solution to improving indoor air quality is to reduce or control the release of airborne contaminants. Each Department is expected to have specific regulations which address this problem.

Major sources of airborne contamination are chemical usage, smoking, laboratory procedures, processes producing hazardous or nuisance dust, tight buildings (especially if there is insufficient makeup air), and cooking or food preparation. Specific procedures for the employment of various ventilation devices such as laboratory and kitchen hoods and dust collection devices can reduce the problem significantly.

As of this writing, there is no campus building known to EHS which meets the EPA's definition of a "sick building."

The details of Clemson's Indoor Air Quality management plan are found in the Clemson University IAQ Plan. On the Main Campus, requests for indoor air quality and ventilation evaluations can be directed to EHS, at 656-2583, or by email at ehs@clemson.edu.

Industrial Hygiene

Exposure Prevention and Assessment

Measures to prevent employee exposure to hazardous chemicals include the use of proper engineering controls, work practices, and protective equipment. Supervisors and principal investigators are required to maintain ready access to Material Safety Data Sheets and a complete chemical inventory must be included in their written safety plan. Periodic inspections of the work area for safe work practices and protective equipment use must be conducted. Industrial Hygiene conducts exposure assessment surveys of work areas to review safe work practices, to assess the potential for chemical exposure, and to recommend corrective action. OSHA requirements include air sampling for certain materials and circumstances, described in this section. Requests for surveys, which may include the collection of air or surface samples, can be forwarded to 656-2583.

SUPERVISOR / PRINCIPAL INVESTIGATOR RESPONSIBILITIES

- (1) Assure the properties of hazardous materials are understood by all employees
- (2) Assure MSDS are available and chemical inventories are up-to-date. Assure chemicals which become more hazardous with age are discarded on an appropriate schedule.
- (3) Assure materials requiring exhaust ventilation are used in fume hoods, biological safety cabinets, or other Facilities- installed exhausted enclosures.
- (4) Assure appropriate protective clothing is used.
- (5) Assure appropriate work practices are followed. This includes prevention of ingestion of heavy metals, radioactive materials, or other internal hazards through properly identified work areas and regular cleaning of work surfaces. Proper handling and disposal of sharps (e.g. needles, etc) will reduce the risk of injection.
- (6) Review the Exposure Assessment Criteria section, listed below. Please contact EHS (656-2583) if your work area matches this criteria and if your area has not had an exposure assessment conducted within the past year.
- (7) Contact EHS if questions or concerns arise regarding chemical handling or the effects of toxic or corrosive materials.
- (8) Implement corrective actions recommended by EHS through the work area health assessment program.
- (9) Provide a copy of air sampling results promptly to affected employees.

EHS RESPONSIBILITIES

EHS will notify supervisors and/or principal investigators to coordinate work area health hazard assessments based on a review of Departmental safety plans.

Safety Plan chemical inventories will be reviewed prior to the assessment.

Health hazard assessments will include interaction with Departmental occupants and dissemination of written information.

Conclusions reached during the work area assessment will be used as the basis for recommendations for changes in work practices, engineering controls, protective equipment.

Work area health hazard assessments will also be used to determine whether air sampling is necessary or if medical surveillance of employees is necessary.

Health hazard assessments will be filed EHS, referenced by Department and work location.

A summary of findings will be forwarded to the principal investigator or work area supervisor for corrective action.

EXPOSURE ASSESSMENT CRITERIA

EHS uses the following criteria for prioritizing locations for exposure assessment. Supervisors / principal investigators should contact EHS if the following criteria apply to their work area:

Use of OSHA regulated materials which require air sampling under specific conditions.

Laboratory Scale Use of Chemicals - "Lab Scale" means the laboratory use of containers which are designed to be easily and safely manipulated by one person. OSHA requires air sampling of the materials listed below under "Non-laboratory scale" and for other OSHA regulated substances if there is "reason to believe" that exposure levels for that substance routinely exceed OSHA specified levels. "Reason to believe", as used above, includes the presence of visible emissions, uncontrolled odors, or the perception that adverse health effects have been experienced which are associated with the materials in use. Principal Investigators of lab areas where these materials are in use should contact EHS (656-2583) to determine if a review of the work area and air monitoring is needed.

Non-laboratory scale use of the chemicals listed below typically require an initial assessment of exposure, regardless of whether there is "reason to believe" exposures may be exceeded. Persons involved in "non-laboratory scale" use of these materials should contact Industrial Hygiene for an exposure assessment.

Asbestos - Asbestos containing materials may not be used at Clemson University. Construction and maintenance jobs may involve the disturbance of existing asbestos-containing building materials. This work may only be performed by specially trained personnel. Air sampling requirements are based on type of work performed.

Vinyl Chloride

Inorganic Arsenic

Lead - This covers metallic lead, all inorganic lead compounds, and organic lead soaps. Sampling requirements may also apply to construction/maintenance activities where lead is disturbed.

Cadmium

Benzene

Cotton dust

1,2-dibromo-3-chloropropane

Acrylonitrile

Ethylene oxide

Formaldehyde

Methylenedianiline

1,3-butadiene

The following materials are considered to be cancer causing materials which are specifically regulated by OSHA. Use of these materials is discouraged. Use outside of laboratories or use inside laboratories in greater than “lab scale” quantities (lab scale refers to the use of small containers) is not permitted. Lab use of these materials, where determined necessary by the Principal Investigator, must be conducted in a “designated area” which is specifically marked. Precautions against skin contact with these materials must also be clearly emphasized. Please contact Industrial Hygiene if you use any of these materials.

4-Nitrobiphenyl

alpha-Naphthylamine

Methyl chloromethyl ether

3,3-Dichlorobenzidine (and its salts)

bis-Chloromethyl ether

beta-Naphthylamine

Benzidine

4-Aminodiphenyl

Ethyleneimine

beta-Propiolactone

2-Acetylaminofluorene

4-Dimethylaminoazobenzene

N-Nitrosodimethylamine

Routine use of hazardous materials without the benefit of a fume hood or other exhausted enclosure

This would include operations where exhaust ventilation is not available (e.g. maintenance operations) or operations where exhaust is present, but the material is not used inside of an exhausted enclosure. Use of hazardous materials which can cause chronic health effects and have poor warning properties (e.g. little odor at hazardous concentrations) would also be a priority for an exposure assessment.

When using hazardous materials, regardless of whether they are regulated by OSHA, and warning signs such as odors, visible emissions, or other indication of incomplete capture and exhaust are present. Please contact EHS for any questions or concerns regarding exposure to hazardous materials.

Respiratory Protection

Engineering controls and safe work practices are the primary means to prevent employee over exposure to chemicals. However, when these controls are not feasible or available, then wearing a respirator may be necessary. Employees who wear a respirator must be given prior approval by the EHS. Before a respirator is issued, a workplace assessment is conducted to identify harmful airborne chemicals. If respiratory protection is recommended, the employee will undergo medical approval, training and fit testing. Medical approval, either by physical exam or confidential medical questionnaire, is needed on an annual basis.

Each department that uses respirators, including self-contained breathing apparatus (SCBA), must have a written protocol. The protocol must be incorporated into the safety plan. The department's written program must discuss hazards unique to their work area.

SUPERVISOR'S RESPONSIBILITIES

Notify EHS at 656-2583 if there is a possibility of overexposure to a chemical.

Assure that employees who are required to wear respirators receive annual medical approval. Make certain that the "Medical Surveillance Statement" is reviewed with employee before receiving medical exam.

Assure that a 'Respirator Users Questionnaire' is submitted annually to EHS for employees who are required to wear a respirator.

Assure that new employees receive training and fit-testing.

Assure that all employees who are required to wear a respirator receive annual training and fit-testing.

Assure that employees who are required to wear SCBA receive annual training and have written plans for its use.

Monitor the employee's use of the respirator, including appropriate wear, cleaning and storage of respirator. Refer to 'Guidelines for Respirator Wear' for information on the use and care of respirators, as well as an inventory of respirator equipment including Cartridge and Filter Selection

Assure that respirators are maintained according to manufacturer's recommendations.

ENVIRONMENTAL HEALTH & SAFETY RESPONSIBILITIES

Oversee the Respiratory Protection Program for the University.

Evaluate chemical exposure in the workplace and recommend control measures to reduce exposure.

Select appropriate respirator for the chemical and exposure situation.

Conduct training and fit-testing covering the use and care of respirators. Please refer to 'Guidelines for Respirator Wear' for information on the use and care of respirators.

Maintain the OSHA required Clemson University Respiratory Protection Plan.

Medical Surveillance

The purpose of medical surveillance is for the early identification of conditions, if any, that could present an increased risk of adverse health effects related to the task being performed. Based on the type of work being performed, including consideration of factors such as the duration of the task, the materials being used, and the potential for exposure, medical surveillance is either recommended or required for the job.

Specific test results and other personal medical information generated by these exams will be kept confidential between the employee and the physician. The physician will determine the scope of the exam, then inform the supervisor of their recommendations based on the exam results. The supervisor will discuss these recommendations, if any, with the employee. The employee can contact the physician who performs the exam with any questions regarding the test results.

According to federal law, employees have the right to request copies of their medical or exposure records at any time. This section pertains to medical surveillance of University employees and students related to the use of chemicals or physical agents (noise, radiation). Medical surveillance, as described in this section, does not include discussion of fitness for duty exams (e.g. Public Safety Officer, Emergency Responder, etc.)

SUPERVISOR'S RESPONSIBILITIES:

Review employee job tasks against the Medical Surveillance Criteria listed below. Contact EHS at 656-2583 if medical surveillance is indicated for an employee. Medical surveillance is determined to be appropriate based on input from the supervisor, EHS, and the medical provider.

Use an approved CU medical provider. Currently, this is either a physician in Redfern or the Occupational Health Nurse in the School of Nursing.

Prior to receiving a medical screening exam, the supervisor must review the following "Medical Surveillance Statement" with the employee:

"Based on the type of work you are performing, including considerations of factors such as the duration of your task, the materials being used, and the potential for exposure, medical surveillance is either recommended or required for this job. The purpose of this medical surveillance is for the early identification of conditions, if any, that could present an increased risk of adverse health effects related to the task you are performing.

Specific test results and other personal medical information generated by those exams will be kept confidential between you and the physician. The physician will determine the scope of the exam, then inform your supervisor of their recommendations based on your exam results. Your supervisor will discuss those recommendations, if any, with you. You can contact the physician who performs your exam with any questions regarding your test results.

According to federal law, you have the right to request copies of your medical or exposure records at any time by contacting your supervisor or Human Resources. Should you have any concerns or questions regarding this procedure, please contact the Human Resources Department.”

The supervisor will discuss the physician's recommendations with the employee. Note: The supervisor will not receive the employee medical exam results. Rather, they will receive a “Health Recommendation Form,” which contains the examining physician's recommendations based on his/her findings.

Assure employees report to the physician on time for the medical exam. Continued work performance is contingent on completion of medical exams. Annual exams not completed within 3 months of the due date will require the employee to stop the task until completion of the exam.

Where department employees are required to receive medical exams/tests based on specific tasks and conditions, ensure that students performing these same tasks under same conditions obtain this medical screening.

Immediately contact Human Resources when an employee requests access to their medical records or exposure records.

Re-examine medical surveillance criteria vs. job task should job duties change.

ENVIRONMENTAL HEALTH AND SAFETY RESPONSIBILITIES

Coordinate medical management program for the University.

Act as CU liaison with the medical provider.

Work in cooperation with medical provider to improve efficiency and effectiveness of medical management program.

Work in cooperation with medical provider to determine tasks where medical surveillance is appropriate. Provide feedback to supervisors on medical surveillance inquiries.

MEDICAL SURVEILLANCE CRITERIA

Clemson Environmental Health and Safety developed these criteria with the assistance from occupational health physicians. The criteria are subject to modification upon periodic review.

OSHA requires medical surveillance for employees who:

Have exposure to noise levels exceeding 85 dBA in an 8 hour time weighted average exposure.

Wear a respirator.

Have exposure to asbestos above the permissible limit or excursion limit for 30 days/year; perform Class 1,2, or 3 asbestos work for 30 days/year.

Use any of the following 13 OSHA regulated human carcinogens as “authorized employees” and those entering “regulated” areas.

4-Nitrobiphenyl
Alpha-Naphthylamine
Methyl Chloromethyl Ether
3,3' Dichlorobenzene (and its salt)
Bis-Chloromethyl Ether
Beta-Naphthylamine
Benzidine
4-Aminodiphenyl
Ethyleneamine
Beta-Propiolactone
2-Acetylamino Fluorine
4- Dimethylaminoazobenzine
N-Nitrosodimethylamine

Use Vinyl Chloride and are exposed above the action level.

Use Inorganic arsenic and are exposed above the action level for at least 30 days/year and based on previous exposure.

Use Metallic Lead, Inorganic Lead, or Organic Lead Soaps and are exposed above the action level for greater than 30 days/year

Use Benzene and are exposed above the action level for greater than 30 days/year and based on additional requirements.

Have "occupational exposure" to Bloodborne Pathogens - refer to Clemson Biological Safety Manual for information.

Are exposed to Cotton Dust and are engaged in yarn manufacturing, slashing and weaving operations, or work in waste houses for textile operations

Use 1,2 - Dibromo-3-Chloropropane, working in a regulated area or may be exposed in an emergency situation

Are exposed to Acrylonitrile above the action level

Are exposed to Ethylene Oxide at or above the action for at least 30 days/year

Are exposed to Formaldehyde greater than the action level or greater than the short term exposure limit.

Are exposed to Methylenedianiline greater than or equal to the action level for 30 days/year.

Are exposed to Cadmium greater than or equal to the action level for 30 days/year.

In addition, employees will need medical surveillance for the following jobs. Note: Medical surveillance may NOT be needed where adequate engineering controls or protective equipment are in use, or when there are no reliable medical tests.

Prepare, mix, or apply organophosphate containing pesticides for greater than 7 days/month (any part of a day constitutes one day) which have a DANGER or CAUTION label. Both baseline exams and follow-up exams are required.

Maintenance operations that creates airborne particles of lead, cadmium, arsenic, or other systemic toxins where local exhaust is not used.

Significant and prolonged use of mercury, chlorinated solvents, heavy metals, or other solids and liquids with chronic toxicity and:

- enclosure and local exhaust ventilation are not available or ineffective or
- prolonged glove contact is necessary and material is capable of rapid absorption through the skin or;
- oral uptake is possible from contaminated surfaces and the material used is a systemic poison.

Use of Class 3b and 4 lasers - ophthalmology exam required prior to use

As specified by department or committee requirements

Note: Various advisory groups or colleges may recommend/require medical exams, biological monitoring, immunizations, or titers based on the nature of the work activity.

EHS personnel will assist supervisors in determining whether medical monitoring is necessary or appropriate for their employees. Call 656-2583 for information.

Hearing conservation

Work areas or job tasks where significant noise exposure exists should be brought to the attention of EHS. Noise exposure includes continuous, intermittent and impulse (less than one second long and greater than one second delay) noises. If sound level measurements indicate that excessive noise exposure exists, relating to OSHA permissible noise levels, investigation of engineering controls or administrative controls (e.g. rotation of employees or limiting time on particular tasks) to reduce exposure is necessary. If such measures do not reduce the noise level sufficiently, employee training, hearing exams, and personal protective equipment (ear plugs or muffs) will be necessary.

SUPERVISOR'S RESPONSIBILITIES

Notify the EHS at 656-2583 if excessive noise is present or suspected in the work environment.

Provide hearing protection devices (ear plugs or muffs), as recommended by EHS, to employees at no cost to the employee, and make certain that devices are worn.

Assure that employees who are required to receive an annual hearing exam receive the exam at no cost to the employee.

Assure that employees complete a Hearing Conservation Program Log if they are participating in the annual hearing exam clinic.

Assure that employees who are using hearing protection devices receive annual training on the use and care of devices.

Maintain any physician reports in a confidential manner

Provide signage at entrances to alert employees that hearing protection is required.

Hearing Conservation Program

Excessive noise levels are often associated with certain tasks such as operating gas powered equipment or working on or near heating, ventilation or air conditioning equipment. When control measures are not feasible or successful to reduce the noise to an acceptable level, OSHA requires that a Hearing Conservation Program (HCP) be implemented in the workplace. Annual employee training and hearing exams (audiograms), and the use of personal protective equipment are components of a HCP. All employees who are participating in the HCP must document their noise exposure yearly on the Hearing Conservation Program Log.

Fetal Risk

The University recognizes that decisions about the welfare of future children must be left to the parents who conceive, bear, support and raise them rather than to employers who hire those parents or institutions which educate them. Areas within the University should pose no threat to occupants, male or female, so that consideration of fetal risk should be, for the most part, unnecessary. There are, however, certain risks associated with higher education and research activities which are unavoidable, possibly not even known. Such risks may extend from possible chemical exposure in laboratories to physical injury inflicted by animals. While the effects of these risks may be acceptable to adult individuals, they may pose serious threats to developing fetuses ranging from potentially crippling to fatal.

Since the fetus is most vulnerable early in its development, it is essential for the student or employee to notify their advisor or supervisor of a pregnancy (or the anticipation of a pregnancy) so that a review of the individual's planned activities for the term of the pregnancy can be conducted to determine if any potentially hazardous exposures are anticipated. EHS will provide hazard information on physical, chemical and biological aspects. All planned activities and related hazard information will be provided in writing to the individual for review by her own personal physician, if she has a physician.

The University recognizes that the decision whether to consult a physician is left to the individual. However, the University strongly recommends that a physician be consulted. This policy is written under the assumption that most individuals will have a physician. If she has no physician, then any decisions as to how to proceed are left to the individual.

After reviewing the potential exposure information and the hazards associated with these exposures, the physician may wish to contact the individual's supervisor or advisor, or EHS for additional information. Based upon the information provided, the physician is expected to discuss the advisability of and make recommendations for participating in the anticipated activities with the patient. If there is a consensus between the doctor and the pregnant individual, that no harm to the fetus is likely to result from these activities, the individual can elect to continue in the activity.

Should the individual, after consulting with her physician, decide against such participation then the options are as follows:

- In the case of a student, she has the option of sitting out of school for the term of the pregnancy or selecting other activities within her curriculum which are acceptable to her and her physician. No loss of status (within the control of the University) will result from this absence from school.
- For an employee (faculty and staff), the supervisor will provide alternative employment for the term of the pregnancy which minimizes hazards to the fetus and is acceptable to the employee and her physician. No loss of status, or reduction of pay or benefits will be associated with this reassignment. Upon returning to work following maternity leave the individual will be reassigned to her former position (unless unusual medical conditions, supported by her physician exist which might preclude such an assignment). Unusual circumstances will be handled similar to any other work-restricting conditions. Both the individual and her physician must agree that the reassignment will not introduce new conditions which might cause harm to the fetus. If concern exists, it should be brought to the attention of the supervisor so that other, more acceptable arrangements can be made. The physician and the supervisor may communicate, if the patient consents, to assure that reassignments made are acceptable, posing no serious threats to the developing fetus.

If an individual who is pregnant feels that she is not being given the reasonable consideration described above, then the matter should be brought to the attention of:

- In the case of students, Redfern Student Health Center;
- In the case of staff employees, Human Resources; or
- In the case of faculty, the appropriate Department Head or Dean.

Because there is still so much to be learned about effective fetal protection, the University assumes the very conservative position that it is in everyone's best interest to not take chances with human life under these circumstances. The well-being of students, employees and their offspring is the primary motivation which drives this Program. It is hoped that all individuals involved will understand and accept the position the University has taken, fully support the program, and act and respond accordingly.

All Individuals, whether they continue to participate in the original activity or choose an alternative activity will be counseled as to the potential hazards to the fetus. They will be asked to acknowledge that Clemson University has provided the hazard counseling and that they are exercising their responsibility as parents in deciding what is the best course of action for the family and for the fetus. If they refuse to sign such an acknowledgment, the person conducting the counseling will note that fact on the acknowledgment form and have a witness also sign the form acknowledging that the parents were counseled.

Laboratory and Laminar Flow Hood Management Program

A sound Laboratory and Laminar Flow Hood Management Program is an essential part of Clemson University's Safety Program. Laboratory and laminar flow hoods are necessary to prevent harmful exposure of students, faculty and staff to hazardous agents or substances. To insure that the proper hood is selected for a given task, all laboratory and laminar flow hood purchase orders must be reviewed EHS and University Facilities before they can be approved by Purchasing.

After installation of the approved hood, EHS personnel will inspect the equipment and certify the hood's performance. The Laboratory and Laminar Flow Hood Management Program requires that all hoods on campus be certified annually. In addition, all hoods must be recertified whenever they are moved to new locations.

The certification program requires that face velocities meet at least the minimum standard (minimum standards vary depending on the application of the hood). In addition, the program requires that each hood undergo regularly scheduled preventative maintenance. If during normal operation a problem with the hood arises, the user of the hood should notify their University Facilities Zone and EHS of the problem. EHS will assist Facilities to determine if repairs are needed. After any repairs have been made, EHS will recertify the hood. These safety measures are necessary due to the hazardous nature of many of the chemicals, radioactive substances and biological agents used on the Clemson University campus.

Personal Protection Equipment

The primary methods for preventing employee exposure to hazardous materials are engineering and administrative controls. Where these control methods are not appropriate or sufficient to control the hazard, personal protective equipment (PPE) is required.

A work area assessment is required to determine the potential hazards and select the appropriate PPE for adequate protection. Employees must receive training which includes the proper PPE for their job, when this PPE must be worn, how to wear, adjust, maintain, and discard this equipment, and the limitations of the PPE. All training must be documented. A selection of PPE is available at Central Stores.

Each department is responsible for:

Identifying the appropriate PPE based on the hazards of the task/ work area.

Providing and paying for required PPE. Assure appropriate equipment is available

Enforcing the proper use of PPE

Maintaining PPE in a clean and reliable condition (clean, sanitary, replace worn or defective parts)

Training employees (document the training) on the following:

- a) When PPE is needed
- b) What PPE is needed
- c) How to properly put on, adjust, wear, and remove the PPE
- d) Useful life and limitations of the PPE
- e) Proper care, storage, and disposal of the PPE

Types of Personal Protective Equipment

Eye and Face Protection

Faculty, staff, students, contractors, and visitors shall wear the appropriate eye and face protection when involved in activities where there is the potential for eye and face injury from:

Handling of hot solids, liquids, or molten metals

Flying particles from chiseling, milling, sawing, turning, shaping, cutting, etc.

Heat treatment, tempering, or kiln firing of any metal or other materials

Intense light radiation from gas or electric arc welding, glassblowing, torch brazing, oxygen cutting, laser use, etc.

Repair or servicing of any vehicle

Handling of chemicals and gases

Eye protection choices include the following:

SAFETY GLASSES

Ordinary prescription glasses do not provide adequate protection. Eye protection must conform to the American National Standards Institute (ANSI), Standard Z87.1-1989. Look for this stamp on the inside of the safety glass frame. Prescription safety glasses are recommended for employees who must routinely wear safety glasses in lieu of fitting safety glasses over their personal glasses. All safety glasses should have side shields. Whenever protection against splashing is a concern, "Chemical Splash Goggles" must be worn.

GOGGLES

Goggles are intended for use when protection is needed against chemicals or particles. Impact protection goggles which contain perforations on the sides of goggle are not to be used for chemical splash protection, therefore are not recommended. Splash goggles which contain shielded vents at the top of the goggle are appropriate for chemical splash protection, and also provide limited eye impact protection. Goggles only protect the eyes, offering no protection for the face and neck.

FACE SHIELDS

Full-face shields provide the face and throat and partial protection from flying particles and liquid splash. For maximum protection against chemical splash, a full face shield must be used in combination with chemical splash goggles. Face shields are appropriate as secondary protection when implosion (e.g vacuum applications) or explosion hazards are present. Face shields which are contoured to protect the sides of the neck as well as frontal protection are preferred.

EYE PROTECTION FOR INTENSE LIGHT SOURCES

(Welding, gas welding, oxygen cutting, torch brazing, glassblowing, laser use, etc.)

The radiation produced by welding covers a broad range of the spectrum of light. Exposure to ultraviolet light (UV-B) from welding operations can cause “welders flash”, a painful inflammation of the outer layer of the cornea. Arc welding or arc cutting operations, including submerged arc welding, require the use of welding helmets with an appropriate filter lens. Goggles with filter plates or tinted glass are available for glassblowing and other operations where intense light sources are encountered, including but not limited to, gas welding or oxygen cutting operations.

Spectacles with suitable filter lenses may be appropriate for light gas welding operations, torch brazing, or inspection. Users and visitors to Laser use areas (the laser nominal hazard zone) must be protected with suitable laser protection eyewear. Contact the laser manufacturer or the RSO (656-7165) for assistance in selecting laser eyewear.

Hand Protection

Employees shall use hand protection when exposed to hazards including:

- (10) Skin absorption of harmful substances
- (11) Lacerations
- (12) Severe cuts
- (13) Severe abrasions
- (14) Punctures
- (15) Chemical burns
- (16) Thermal burns

Harmful temperature extremes

Wear proper hand protection whenever the potential for contact with chemicals, sharp objects, or very hot or cold materials exists. Select gloves based on the properties of the material in use, the degree of protection needed, and the nature of the work (direct contact necessary, dexterity needed, etc).

Leather gloves may be used for protection against sharp edged objects, such as when picking up broken glassware or inserting glass tubes into stoppers.

When working at temperature extremes, use insulated gloves. Materials such as Nomex and Kevlar may be used briefly up to 1000 F. Do not use gloves containing asbestos. Asbestos is regulated as a carcinogen under OSHA.

When considering chemical gloves, note that glove materials will be permeated (pass through) by chemicals. The permeation rate varies depending on the chemical, glove material, and thickness. Double gloving is recommended when handling highly toxic or carcinogenic materials.

Before each use, inspect the gloves for discoloration, punctures and tears.

Before removal, wash gloves if the glove material is impermeable to water.

Observe any changes in glove color and texture, including hardening or softening, which may be indications of glove degradation.

Body Protection

Employees working around hazard materials or machinery shall not wear loose clothing (e.g. saris, dangling neckties, necklaces) or unrestrained long hair. Loose clothing, jewelry, and unrestrained long hair can become ensnared in moving parts of machinery or contact chemicals. Finger rings can damage gloves and trap chemicals against the skin.

Cotton lab coats (preferable to rayon or polyester coats) should be worn to protect your clothing from becoming soiled and to provide limited protection against minor splashes of chemicals and radioactive materials. Assure that hazardous chemicals, radioactive materials, or toxic dusts are not carried home with you on your street clothes by using lab coats, disposable protective clothing, or work clothes which remain at the workplace. Tyvek coveralls can be used over street clothes for protection against particles and low hazard liquids, but do not provide complete protection against liquids. Lab coats will also not resist liquid penetration, and if splashed with chemicals, should be removed immediately.

Vinyl or rubber aprons and sleeves should be used when dispensing corrosive liquids (e.g. hydrofluoric acid, phenol, etc). Where metal organic liquids or other materials which may self ignite on contact with air are used, Nomex lab coats are recommended, along with face shields. Where contact with hazardous materials with your protective clothing is likely, such as during spill cleanup or pesticide application, polyethylene-coated Tyvek or similar clothing should be used to provide additional protection. The limitations of the protective clothing must always be understood, particularly in situations where contact with the material is likely.

Employees should know the appropriate techniques for removing protective apparel, especially any that has become contaminated. Special procedures may need to be followed for cleaning and/or discarding contaminated apparel.

Chemical spills on leather clothing accessories (watchbands, shoes, belts and such) can be especially hazardous because many chemicals can be absorbed in the leather and then held close to the skin for long periods. Such items must be removed promptly and typically be discarded to prevent the possibility of chemical burns.

Foot Protection

Safety toe footwear shall conform to the requirements and specifications of ANSI Z41.1-1991, "Men's Safety-Toe Footwear."

Wear proper shoes, not sandals or open toed shoes, in work areas where chemicals are used or stored. Perforated shoes, sandals or cloth sneakers should not be worn in areas where mechanical work is being done.

Safety shoes are required for protection against injury from heavy falling objects (handling of objects weighing more than fifteen pounds which, if dropped, would likely result in a foot injury), against crushing by rolling objects (warehouse, loading docks, etc), and against laceration or penetration by sharp objects.

Pullovers, worn over regular shoes, are available for protection against certain chemicals. These boots are made of a stretchable rubber compound and are well suited for cleaning up chemical spills.

Respiratory Protection

See the Respiratory Protection section of this manual for more information. Respirators may not be used without prior approval from the Industrial Hygienist in EHS. This assures that respirators are properly selected, users are properly trained, and the appropriate medical exams are conducted according to OSHA regulations.

Hearing Protection

Exposure to noise in excess of OSHA regulated levels requires participation in a hearing conservation program. This program includes training and audiometric exams, among other requirements. Please contact EHS at 656-2583 or ehs@clemsontech.edu if you feel your noise exposure may be excessive. The Hearing Conservation section of this manual for more information.

Head Protection

Helmets designed to protect the head from impact and penetration from falling/flying objects and from limited electric shock and burn shall meet the requirements and specifications established in ANSI Z89.1- 1986, "Requirements for Industrial Head Protection". For more information contact EHS.

Electrical Protection

Specific design and performance, use, and care requirements apply to protective equipment used for isolation against electrical hazards. Persons selecting for purchase, maintaining, and using such equipment (insulating blankets, matting, covers, line hose, gloves, and sleeves made of rubber) must be familiar with these requirements (refer to 29 CFR 1910.137). See the Electrical Safety section of this Health and Safety manual or contact EHS for additional information.

Personal Protective Equipment Central Stores

Personal protective equipment is available at Central Stores. Many items are on display and may be purchased at a discounted price.

Office Safety

Office workers make up a substantial percentage of the University employee population and as such office safety takes on a larger role in the day-to-day workings of office personnel on campus than might be the case in other organizations. Office personnel are faced with many varying types of safety hazards.

Personnel working with Video Display Terminals (VDT's) are prone to backaches and headaches as a consequence of spending many hours in front of their display terminals. Repetitive motion trauma injuries may result from long-term work at improperly adjusted keyboards.

Tripping is a constant hazard faced by office personnel, whether it is from electrical cords, open boxes, or boxes obstructing walkways. Filing cabinets present a risk of injuring personnel by toppling over due to being top heavy, especially when too many upper drawers are open at the same time. Additionally, a tripping hazard exists when lower file drawers are left pulled out. Office personnel face potential safety problems when they hasten to complete tasks. They are then more disposed to tripping and falling down stairs or slipping on floors.

Electrical shock hazards may exist due to improper grounding of equipment, overloading of electrical outlets, or liquids being spilled into electrical devices.

Poor lighting can be the cause of trips and falls in the officer or of personnel bumping into objects. Eye strain and headaches may also be brought about by inadequate lighting in an office environment.

Lack of ergonomic considerations can be a source of discomfort and problems for office personnel when tables, chairs and work stands are set at improper heights or area of an inappropriate design.

Slips, Trips and Falls

Slips, trips and falls are among the most common causes of injury. Nationwide, they are second only to motor vehicles as causes of accidental deaths. These types of accidents occur in many varied types of environments.

Individuals walking across campus are presented with hazards ranging from uneven to cracked pavement, tree root, holes, projecting objects, etc. These hazards can cause falls if the pedestrian is not being observant or it is dark.

The interior of buildings also present numerous opportunities for injury. The problems range from floors that have been waxed but not buffed (which provide a slippery surface to walk on), to floors with wet spots that have not been wiped dry. Stairways may present many hazards, such as poor lighting, loose handrails and stair treads in a cluttered or poor condition. Additionally, trips and falls can occur when aisles are cluttered with boxes or other items. Loose flooring and carpets that are not tacked down properly may present a risk of injury to individuals walking in buildings on campus.

Persons working in or around shop areas should be alert for the problem of oil and grease build up on floors, which present a serious risk of injury due to slipping and falling.

It should be noted that injuries can occur not only from a fall, but over-extension of one or more parts of the body may cause strains if an individual attempts to prevent the fall. Injury from slips, trips and falls can be avoided by learning to recognize the causes and taking preventative actions to prohibit their reoccurrence.

Noise and Hearing Conservation

Continued exposure to noise of sufficient intensity can result in permanent hearing impairment. If an individual must shout to communicate with another close by because of noise, it is likely that the level of this noise is of a sufficient amplitude to cause a temporary or permanent hearing loss (threshold shift). Persons being exposed to noise levels exceeding 85dBA time-weighted-average (TWA) for an eight-hour period should be given periodic audiometric examinations which are conducted by the Clemson Occupational Health Nurse. Should these examinations indicate a loss of hearing, hearing protection must be provide which will reduce the exposure level to below 85dBA. For exposures of 90dBA or greater, controls must be instituted to lower the noise levels to below 90dBA TWA for an eight-hour day. If controls cannot be instituted to accomplish this reduction, hearing protection must be worn which will reduce the exposures to an acceptable level until the noise can be reduced. EHS can provide a noise level assessment, calculate eight-hour exposure levels and make recommendations upon request.

Fire Protection

The major hazards of fires and consequently the need to prevent them are obvious. The major hazards are the loss of life or the injury to employees and others and direct damage due to fires.

Fire Alarm Systems

Automatic and manual fire alarm systems are in most buildings. These systems provide an audible and visual signal to evacuate the building. These systems are also equipped with digital communicators linked to the telecommunications center of Public Safety.

Portable Fire Extinguishers (PFX)

PFX's are installed in virtually all buildings on campus. They shall be located where they are conspicuous, readily accessible and near an exit. The Fire Department, designated users and trained persons are authorized to use portable fire extinguishers in campus buildings. All extinguishers must be located and mounted in accordance with State requirements.

Fixed Fire Suppression Systems

Certain buildings on campus have automatic sprinkler systems installed. The periodic maintenance and required record-keeping of automatic sprinkler systems and standpipes are the responsibility of the department owning or occupying the area protected.

Demonstration and Training Services

Proper training is essential to fire safety and proper emergency response. The Fire Marshall's Office can hold classes, provide training in the use of PFX's, and provide information on any fire safety topic when requested.

Contact the office of Human Resources to find out the dates of regular scheduled PFX training classes. E-mail Emma McKnight, Training Manager, to register for a selected class.

Fire Drills

Fire drills can reduce injuries and deaths due to fires. The Fire Marshall's Office will conduct fire drills in any administrative or academic building at the request of the Building Liaison and with the approval of the appropriate Dean, Director, and Department Head. Fire Protection will conduct fire drills in cooperation with the Department of Housing and Residence Life at least once a semester in every residence hall.

Questions

Direct any questions, concerns or problems related to fire protection and fire safety to the Clemson University Fire Chief (656-3554) or the Clemson University Fire Marshal (656-2323).

Select the Default or the Alternative Program

Described below are the *Default Program* managed by the University and the *Alternative Program* managed by the Department who owns or occupies the area being protected. Each Department shall select one of these two programs.

University Managed Program (Default)

Departments may default to this program. The Fire Marshal and University Facilities Maintenance and Minor Construction are responsible for equipment, maintenance and record keeping.

Emergency Response

All faculty, staff and students must evacuate the area that they are in when a fire alarm sounds.

Anyone discovering a fire shall immediately:

- Activate the building's fire alarm system and leave the building.
- Notify the Department of Public Safety of the fire by calling 911 or 656-2222, or by Blue Light telephone. Facilities remote to the Clemson campus shall notify the Fire Department serving their jurisdiction.

Department Responsibility

It is the responsibility of the Department that owns or occupies the space being protected to schedule portable fire extinguisher training with the Fire Marshal. All persons in the department shall receive training upon initial employment and at least annually thereafter.

The Department shall protect their portable fire extinguishers and advise the Fire Marshal if any extinguishers are improperly mounted, missing, broken or discharged.

Fire Extinguishers

University Facilities Maintenance and Minor Construction is responsible for the following services on portable fire extinguishers at Clemson main campus facilities:

- Conducting monthly inspections
- Conducting periodic maintenance
- Conducting required record- keeping

In addition, the University Fire Marshall will provide the following services:

- Determine the need for fire extinguishers according to State requirements and recommend suitable locations for them.
- Replace any fire extinguisher reported missing, broken, or discharged
- Pay for the maintenance and replacement of fire extinguishers in buildings occupied by non-revenue generating departments.

Department Managed Program (Alternative)

If Departments choose this alternative program, the Department who owns or occupies the space being protected is responsible for the purchase of equipment, maintenance and record keeping.

EMERGENCY RESPONSE

All faculty, staff and students must evacuate the area that they are in when a fire alarm sounds except designated portable fire extinguisher users. In an emergency, the extinguishers may be used by the employees designated to use portable fire extinguishers and any other persons trained in their use.

Anyone discovering a fire shall immediately:

- Activate the building's fire alarm system and leave the building (unless he is a designated portable fire extinguisher user and intends to perform insipient fire fighting).
- Notify the Department of Public Safety of the fire by calling 911 or 656-2222, or by Blue Light telephone. Facilities remote to the Clemson campus shall notify the Fire Department serving their jurisdiction.

DEPARTMENT RESPONSIBILITY

The Department that owns or occupies the space being protected shall designate certain employees to be the primary employees authorized to use the available portable fire extinguishers.

It is the responsibility of the Department to schedule portable fire extinguisher training with the Fire Marshal. Each employee who has been designated by the Department to use fire fighting equipment shall receive training upon initially joining the designated group of employees and at least annually thereafter.

FIRE EXTINGUISHERS

The Department is responsible for the following services on portable fire extinguishers in the space that it owns or occupies:

- Conducting monthly inspection, periodic maintenance, and required record keeping of the Department's PFX's. (Extra units placed in a building that are purchased by discrete programs, such as research projects, should be maintained by the respective project).
- Determining the quantity and the strategic placement of portable fire extinguishers. The distribution plan, as a minimum, must meet State requirements or equal the original placement of extinguishers in the building.
- Replacement of any missing, broken, or discharged PFX's

Purchasing materials

Prior to purchasing materials – particularly chemicals, biologicals, radioactive materials, and heavy floor-mounted equipment – consideration must be given to the appropriateness of the material or equipment:

- (17) Will the equipment fit through the existing doorways?
- (18) Will the floor be able to handle the additional load?

- (19) Is there a material that could be used which is safer or easier to dispose of?
- (20) Do the personnel using the materials have appropriate training?

Consult with University Facilities prior to purchasing and siting floor mounted equipment; consult EHS before purchasing hazardous materials.

Renovations

Renovation of space at Clemson – particularly laboratory or agriculture related storage space – frequently turns up old materials which require special handling. Please make preparations to remove all materials from a space prior to its renovation. Contact EHS for assistance. Additionally, no renovation of Clemson Academic Space may be undertaken without the express permission of the Director of Facilities.

Leaving

When an employee leaves Clemson, he or she shall turn in an inventory of all chemical, biological, or radioactive materials that they have in their possession to their department chair. Once the department has decided what they wish to keep and what they wish to dispose of, they should contact EHS for the removal of hazardous items.

General Shop Safety

On the Clemson University campus there are many woodworking, metal fabricating, and welding shops. Safety is a major concern for people working in these shops.

There are many safety hazards associated with the use of the equipment housed in these facilities by students, staff and faculty.

The primary concern, is that all individuals who use shop equipment require formal training in the proper and safe use of any shop machine with which they might work. This training should then be documented and maintained on file. The unit head is responsible to ensure training is accomplished and documented.

Instruction on the proper use of personal protective equipment is an essential part of all shop safety programs. Eye protection is generally required in all circumstances where powered or impact equipment is used. Where machines or operations present the hazard of flying objects, glare, liquid sprays or splashes, injurious radiation, or a combination of the above, suitable eye/face protection must be worn. Whether the eye protection used is goggles or a face shield depends on the hazard presented by the operation. Persons performing welding operations should always wear eye protection with properly shaded lenses.

Other types of personal protective equipment that may be necessary include respiratory protection, gloves, aprons, long sleeves, etc. as an interim measure until the hazard can be reduced or eliminated by engineering controls. Special clothing and footwear may also be necessary to protect the shop user.

In high noise areas the use of hearing protection, is required. It is the responsibility of the department to provide appropriate personal protection equipment, properly disinfected, in sufficient quantities to adequately protect the user. Portable or mobile equipment operation requires the same considerations as in-place shop equipment.

Preventative and corrective shop maintenance is necessary to keep machines in safe working order. All machines are required to have a regular schedule set up for maintenance checks. Preventative maintenance includes but is not limited to, sharpening cutting edges, lubricating machines, adjusting belts, and ensuring that all machine guards are installed and in proper working order. When gas welding or cutting operations are used, the cylinders and associated equipment must be checked regularly to ensure that safety check valves are installed, cylinders and lines are not damaged, and tanks are properly secured. Shop maintenance also includes good housekeeping practices in the work area. Areas are to be kept free of wood and metal debris, as well as extension cords and other objects which could be trip and fire hazards.

A shop's initial layout has much to do with providing users with a safe work area. The equipment should be properly installed and grounded. In addition, incompatible processes should be separated (such as woodworking, welding operations, and painting operations). All flammable materials and explosive dust generating operations must be kept away from any potential ignition sources. Machines should be spaced in such a way that adequate space is provided between them to accommodate bulky materials.

Environmental Health and Safety is available to assist university personnel when there is a concern with regards to shop safety. EHS can provide inspections to identify safety problems, conduct noise assessments, and make recommendations to correct the problems. Safety seminars can also be provided to educate users on safe shop equipment operation.

Machine Guarding

The hazards posed by an unguarded machine are obvious: in the worst of all cases the machine can do to your body parts what it's doing to the materials it's designed to cut, shape, or form. One of the major goals of OSHA is to guard all machinery and equipment to eliminate hazards created by points of operation, ingoing nip points, rotating points, and flying chips and sparks.

The words "shall be guarded" apply to most machines and equipment the University uses. Some machines require specific guarding methods and all machines are regulated by the general requirements.

All personnel using machinery at the University will adhere to the OSHA regulation 1910.111-.222.

There shall be one or more methods of machine guarding provided to protect the operator and other employees in the machine area from hazards. Examples of guarding methods are:

- Barrier guards

- Two-hand tripping devices
- Electronic safety devices

Types of guards:

- Fixed guard - provides a barrier between a person and the point of operation, power train or other moving parts. These include fences, gates, and protective covers for blades, presses and all moving parts.
- Interlocked guard - when opened or removed disengage the machine's power source. The machine cannot be restarted until the guard is replaced.
- Adjustable guard - provide a barrier that can be adjusted to many different operations, such as varying sizes of stock.
- Self-adjusting guard - barriers that move or self-adjust, according to the size or position of the workplace. The guard returns to its resting position when no material is passing through.

Affix guards to the machine where possible or secure it elsewhere if for any reason attachment to the machine is not possible. The guard shall be such that it does not offer an accident hazard in itself.

Point of operation is the area on a machine where work is actually performed upon the material being processed. The point of operation of machines whose operation exposes an employee to injury shall be guarded. The guarding device shall conform with any appropriate standards. If no specific standard exists then the design and construction of the guard will prevent the operator from having any part of his body in the danger zone during the operating cycle.

The following are some examples of machines requiring point of operation guarding:

- Guillotine cutters
- Shears
- Alligator shears
- Power presses
- Milling machines
- Power saws
- Jointers
- Portable power tools
- Forming rolls and calendars

Revolving drums, barrels, and containers shall be guarded by an enclosure that is interlocked with the drive mechanism so the barrel, drum or container cannot revolve unless the guard enclosure is in place.

When the periphery of the blades of a fan is less than seven feet above the floor or working level, the blades shall be guarded. The guard shall have openings not larger than one-half inch.

Machines designed for a fixed location shall be securely anchored to prevent walking or moving.

Simple Rules to Maximize Worker Safety

1. Always be sure that moving mechanisms are clear of people and objects
2. Be sure that workers are not wearing any jewelry or loose clothing that could get snagged in the machine
3. Keep an eye on overheard moving parts, like pulleys, for potential hazards
4. Check that guards are in place at all points where you could contact moving parts before turning the machine on
5. Be aware of how to turn power on and off if you should have to do so quickly
6. Read the manufacturer's instructions on how to operate the machine safely and correctly
7. Feed material into the machine with push sticks, not your hands
8. Take it easy. Rushing through a job is one of the major causes of accidents
9. Make sure maintenance is performed when required. If you think your equipment might have missed its scheduled maintenance let your supervisor know.
10. Use lockout/tagout procedures when a machine needs repair or maintenance. Turn the machine and the power to the machine off and tag it so that no one tries to use it.

Ladder Safety

A large number of injuries occur each year from the improper use of ladders. The following safe practices address the placement and use of ladders. All Departments must comply with OSHA Standard 1910.25-27 "Portable and Fixed Ladders." All employees must understand the safe ladder use and practice.

Portable Ladder

1. Place the ladder base at a 1:4 ratio from the vertical (horizontal/vertical). For every 4 feet of working length the base of ladder should be 1 foot out from the top support
2. Extend ladder 3 feet above the top support point.
3. Use ladders only in a vertical position. Ladders are not a substitute for a scaffold or a runway between two elevated surfaces.
4. Keep ladder directly off of window panes or sashes.
5. Keep ladders away from front of a door that opens toward the ladder unless the door is locked, blocked, or guarded.

6. Place a portable ladder so both side rails have secure footing. Provide solid footing on soft ground to prevent the ladder from sinking.
7. Place the ladder feet on a substantial and level base not on movable objects.
8. Lean ladder against secured backing.
9. Securely lash or otherwise fasten ladder to prevent slipping when using a ladder for access to high places.
10. Secure bottom and top of ladder to prevent displacement when using ladder for access to a scaffold.
11. Keep ladder away from electrical wiring.
12. One person at a time will be on a ladder.

Inspections

Make periodic ladder inspections for structural integrity. Conduct quarterly inspections as a minimum. Record all inspections made. Remove defective ladders from service when noted during inspection. Tag it with "DANGEROUS - DO NOT USE". Do not use until ladder is repaired. Destroy any ladder that cannot be repaired.

Ascending/Descending Ladder

1. Both hands must be used on ladders. Raise/lower needed material by mechanical means.
2. Keep the center of gravity centered as much as possible between the hands and the foot that is in contact with the ladder.
3. Always face the ladder going up or coming down.
4. Never slide down a ladder.
5. Make sure shoe bottoms are not greasy, muddy, or slippery before you climb.
6. Do not climb higher than the third rung from the top on extension or straight ladders or the second tread from the top on step ladders.

Other Practices

1. Make sure step ladder is fully opened and the metal spreader locked before you start to climb ladder.
2. Keep ladders clean and grease free.
3. Do not use ladders during a strong wind except in emergency and only then when tied securely.
4. Do not leave placed ladders unattended.
5. Avoid using metal ladders around energized electrical circuits or equipment.

Fixed Ladders

Fixed ladders cannot be moved. Provide access to specific elevated locations. All fixed ladders over 20 feet in length must have a cage or well.

Other Characteristics

1. Pitch of 75-90 degrees
2. Designed to bear a load of 200 pounds
3. 3/4 inch rung diameter
4. Rungs 16 inches wide
5. Rungs spaced no more than 12 inches apart
6. Hand or side rails extending 3 * feet above the landing
7. Minimum clearance of 2 * feet on the climbing side of ladders with 90 degree pitch and 3 feet for a 75 degree pitch
8. Clear width of 15 inches on each side of the center line of ladder
9. 7 inch clearance in back of ladder to assure adequate footing
10. Painted, if metal or appropriately treated to prevent deterioration if conditions indicate

Projects requiring the installation of fixed ladders must be done under the direction of a professional engineer. OSHA 1910.27 Sub-part D will be followed.

When fixed ladders are used on towers, tanks, or chimneys, use appropriate ladder safety devices. A ladder safety device is an appliance that will arrest the fall of an individual.

Powered Hand Tools

Hand tools and portable tools pervade nearly every type of work setting. Because of their common use hand-tools mishaps account for about 6% of disabling work injuries each year in the U.S. The reason is simple - far too many workers are not sufficiently trained in the proper use and care of the tools they work with.

Any department requiring their employees to use hand or portable tools must comply with the OSHA standard.

OSHA recognized five categories of powered operated hand tools.

1. Electric power operated tools
2. Pneumatic power tools
3. Fuel powered tools
4. Hydraulic power tools
5. Power-actuated tools

Each employer is responsible for the safe condition of tools and equipment used by employees. This includes tools and equipment which may be furnished by employees.

Training will include:

1. How to select the proper tool for the job
2. How to use these tools properly
3. Procedures for inspection of tools
4. Procedures for storage of tools
5. Procedures for repair of faulty tools
6. The importance of planning jobs ahead so that the correct tools are available

General Safe Work Practices

1. Wear safety glasses with side shields or other equivalent eye protection when using hand or portable power tools
2. Use the right tool for the job
3. Inspect tools before use. Do not use damaged tools
4. Know how to use the tool properly
5. Carry tools properly and store them in a safe manner

Flexible Cord and Plug Applications

Flexible cord-and-plug attachment is permitted for limited types of applications on main campus. Listed below are applications where flexible cord-and-plug attachment may and may not be used:

1. Flexible cord-and-plug may be used for (1) portable lamps, (2) for portable appliances and equipment (3) for the connection of stationary equipment to facilitate their frequent interchange, (4) to prevent the transmission of noise or vibration and (5) for snack machines and large domestic appliances such as refrigerators and washers-if they are incidental to the operation. All appliances and equipment must be approved by a national testing lab or local authority and properly grounded. All appliances shall be plugged directly into a proper, structure mounted outlet or plugged into an approved power tap that is plugged directly into a proper, structure mounted outlet.
2. Flexible cord attachment cannot be used as a substitute for the fixed wiring of a structure, cannot be attached to building surfaces, cannot be run through holes or openings, and cannot be concealed behind surfaces of a building.
3. Fixed equipment such as wood working machines, metal working machines, welders, process equipment and testing systems shall not use cord-and-plug attachment if they are installed in an industrial environment such as a maintenance garage, trades shop, industrial lab, processing facility, etc.

Electric Tools

1. All electric power tools shall be effectively grounded except the double insulated and cordless type
2. Electric cords shall be inspected periodically and kept in good condition. Defective cords shall be replaced by factory approved units, only.
3. Electric saw guards should be checked frequently to be sure it operates freely and encloses the teeth completely when it is not cutting

Abrasive Wheels and Tools

1. Power - all grinding machines shall be supplied ample power to maintain the spindle speed at safe levels under normal operating conditions.
2. Guarding -
 - i. Must be equipped with safety guards approved by ANSI for the use, care and protection of abrasive wheels
 - ii. Safety guards shall be strong enough to withstand the effect of a bursting wheel
 - iii. Guards shall be mounted such to maintain proper alignment with the wheel. The guard and its fastenings shall be of sufficient strength to retain fragments of the wheel in case of accidental breakage.
 - iv. The maximum angular exposure of the grinding wheel periphery and sides shall not exceed 180°F.
 - v. All abrasive wheels shall be closely inspected and ring-tested before mounting to ensure that they are free from cracks and defects.

Pneumatic Power Tools

1. Shall be secured to the hose or whip by some positive means to prevent the tools from becoming accidentally disconnected
2. Safety clips or retainers shall be securely installed and maintained on pneumatic impact tools to prevent attachments from being accidentally expelled.
3. All pneumatically driven nailers, staplers, and other similar equipment provided with automatic fastener feed, which operate at more than 100 psi shall have a safety device on the muzzle to prevent the tool from ejecting fasteners, unless the muzzle is in contact with the work surface
4. Compressed air shall not be used for cleaning purposes unless the pressure is reduced to 30 psi at the outlet nozzle
5. The use of hoses for hoisting or lowering tools shall not be permitted

Fuel Powered Tools

1. All fuel powered tools shall be stopped while being refueled, serviced or maintained, and fuel shall be transported, handled, and stored in approved safety cans.

2. Leakage or spillage of flammable or combustible liquids shall be disposed of promptly and safely

Hydraulic Power Tools

1. The fluid used in these power tools shall be fire-resistant and shall retain its operating characteristics at the most extreme temperatures to which it will be exposed
2. The manufacturer's safe operating pressures for hoses, valves, pipes, filters, and other fitting shall not be exceeded

Explosive Actuated Tools

1. The tools shall be tested each day before loading to see that safety devices are in proper working condition.
2. Any tool found not in proper working order or one that has developed a defect during use shall be removed from service immediately and not used until properly repaired.
3. The tool shall be designed so that it cannot be fired unless it is equipped with a standard protective shield or guard.
4. The firing mechanism shall be designed so the tool cannot fire during loading or preparation to fire or if the tool is dropped while loaded.
5. Tools shall not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any employees.
6. Loaded tools shall not be left unattended

Manual Materials Handling (Lifting)

The main consideration for preventing back injury associated with lifting rests primarily with the weights being lifted rather than any particular lifting method. The total accumulated weight should also be considered due to the fact that as fatigue sets in, lifting capability for successive repetitions decreases. Generally, weights in excess of fifty pounds should be handled by two individuals to minimize the possibility of injury. Motions such as twisting, walking and climbing stairs while carrying heavy objects may increase the probability of back injury. Keeping objects close to the body rather than extending them with the arms will help reduce injuries. Heavy objects should not be lifted over the head to be placed on high shelves, etc., without assistance. Questions regarding lifting requirements and recommendations may be referred to EHS.

Construction Safety

Construction safety, as it relates to construction performed by contractual employees, is the responsibility of the primary contractor. These responsibilities are stated in the contract documents and include provisions for adhering to rules, regulations and laws as established by local, state and federal agencies including the Occupational Safety and Health Administration.

Since the consequences of a contractor not following safety regulations can have an effect on Clemson University's property, students, faculty and staff, all efforts are made to ensure that the contractor adheres to safety regulations. On the Clemson campus, these efforts are performed directly by project managers in the Construction Management Section of Facilities. In some situations these efforts are performed by architectural and engineering consultants who report their findings to Construction Management personnel.

On the Clemson Campus, all construction projects are assigned to outside architects. These architects are charged with the responsibility to oversee the entire project, insuring that all relevant safety requirements are met.

Excavation and Trenching

Excavations are any man-made cut, cavity, trench or depression in the earth surface formed by earth removal. (OSHA makes no distinction on the depth of excavation.)

Trenches are narrow excavations made below the surface of the ground. In general, the depth is greater than the width. However, the width of a trench is not greater than 15 feet. An excavation is also considered to be a trench.

Departmental supervisors must ensure their employees follow these procedures:

Prior to Excavation or Trenching

IDENTIFICATION OF BURIED UTILITIES

All underground utilities (public and University) must be clearly marked to identify potentially hazardous situations prior to starting work requiring excavation. The person responsible for oversight must contact "Call before you dig" to identify public utilities.

Contact Clemson University Facilities (656-2186) to identify the location of Clemson utilities.

SURFACE ENCUMBRANCES

Remove, support or safeguard all surface encumbrances located at the site that may create a hazard to employees.

Competent Person

At each excavation site there must be a designated "competent" person whenever employees are digging or in the excavation. A "competent" person means someone capable of identifying existing and predictable hazards in the surroundings, or working conditions that unsanitary, hazardous, or dangerous to employees. The competent person has authorization to take prompt corrective measures to eliminate any unsafe condition. A "competent" person is someone who attends a 4 hour excavation/trenching course and successfully passes the course examination. There must be documentation of the training.

Excavation

MATERIALS AND EQUIPMENT

Trench shoring and trench jacks shall be on the site before any excavation begins when the expected depth will exceed four feet or where unstable soil is expected. In addition, a radio equipped truck or portable radio shall be on the site at all times when work is in progress.

PROTECTION OF EMPLOYEES

No one shall enter excavations of four feet or more in depth without having shoring in place or the banks cut back to a safe angle. (Refer to OSHA Standard 1926.652) No one shall enter an excavation of less than four feet without shoring or proper angle of repose unless authorized by a competent person.

Excavations less than four feet in depth may not require this degree of protection if examination of the ground by a competent person provides no indication of a potential cave in. Store excavated material at least two feet from the excavation edge. Workers must wear hard hats at the site when work is in progress. Provide a stairway, ladder, ramp or other safe means of egress in trench excavations that are 4 feet or more in depth.

The travel distance to the ladder must be no more than 25 feet of lateral travel for employees. The ladder must extend three feet above the edge of the trench.

INSPECTIONS

A competent person must make daily inspections of excavations, the adjacent areas, and protective systems for evidence of possible cave-ins, indications of protective systems failure, hazardous atmospheres, or other hazardous conditions.

The competent person must conduct an inspection:

- Prior to the start of work and as needed throughout the shift

- After every rainstorm or other hazard increasing occurrence

- As dictated by the activity taking place in the trench

- When fissures, tension cracks, sloughing, under cutting, water seepage, bulging at the bottom or other similar circumstances occur

- When there is any change in the size, location or placement of the soil pile

- When there is any indication of change or movement in adjacent structures

- Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmosphere, or other hazardous conditions, remove exposed employees from the hazardous area until safety measures are in place.

BARRICADES AND WARNINGS

The danger excavation work presents and the high student population on campus requires us to take special measures to protect the public. Simple barricades are not enough protection in high traffic areas near sidewalks, and roadways subject to pedestrian traffic. In high traffic areas, place snow fencing around the excavation to provide maximum protection. An additional precaution is to use barricades with flashing lights whenever possible on pedestrian walkways and roadways.

Provide employees exposed to public vehicular traffic with warning vests or other suitable garments marked with reflector or high-visibility material. The supervisor must contact the Clemson Public Safety and apprise them of the excavation and ensure that they check periodically for vandalism or any other unusual activity.

COMPETENT PERSON TRAINING

To become a competent person, a person needs specialized training. This training is available through EHS. Determination of competency requires participant to pass the course final examination.

Hoist and Crane Safety

The inspection procedure for hoists and cranes in regular service is in two general classifications based on the inspection intervals performed. The intervals are dependent on the nature of the critical components of the crane/hoist and the degree of their exposure to wear, deterioration or malfunction.

The two general classifications are “frequent” and “periodic.” Listed below are definitions and elements of both.

Most causes of chain failure can be detected before failure occurs if there is a proper inspection procedure. A good inspection plans for two inspections: one daily by personnel using the chain, the other biannually.

The former helps to detect those links and hooks that are visibly unsafe because of overloading, faulty rigging or other unsafe practices.

1. Frequent inspection - Daily to monthly intervals

Inspect the following items for defects at intervals are defined with each section:

- ⇒ All functional operating mechanisms for maladjustment interfering with proper operation on a daily basis.
- ⇒ Deterioration or leakage in lines, tanks, valves, drain pumps, and other parts of air or hydraulic systems on a daily basis.
- ⇒ Hooks with deformation or cracks. Visual inspection daily. Perform monthly inspection with a certification record which includes the date of inspection, the signature of the person who performed the inspection and the serial number, or other identifier of the hook inspected. For hooks with cracks or having more than 15 percent in excess of normal throat opening or more than 10<< twist from the plan of the unbent hook shall be discarded.

⇒ Hoist chains, including end connections, for excessive wear, twist, distorted links interfering with proper function, or stretched beyond manufacturer's recommendations. Visually inspect hoist on a daily basis. Monthly inspect with a certification record that includes the date of inspection, the signature of the person who performed the inspection and an identifier of the chain inspected

2. Periodic inspection - 1-12 month intervals

Inspect for the following:

- a) Deformed, cracked, or corroded members
- b) Loose bolts or rivets
- c) Cracked or worn sheaves and drums
- d) Worn, cracked or distorted parts such as pins, bearings, shafts, gears, rollers, locking and clamping devices
- e) Excessive wear on brake system parts, linings, pawls, and ratches
- f) Load, wind, and other indicators over the full range, for any significant inaccuracies
- g) Gasoline, diesel, electric, or other power plants for improper performance or noncompliance with applicable safety requirements.
- h) Excessive wear of chain drive sprockets and excessive chain stretch.
- i) Electrical apparatus for signs of pitting or any deterioration of controller contractors. Limit switches and push-button stations.

3. Cranes not in regular use:

- a) If crane is idle for 1 month or more but less than 6 months, perform all the inspections listed above for frequent inspections.
- b) If idle for a period over 6 months will need a complete inspection as listed above for frequent and periodic inspection
- c) Prior to initial use all new and altered cranes shall have the following testing:
 - Hoisting and lowering
 - Trolley travel
 - Bridge travel
 - Limit switches, locking and safety devices
- d) The trip setting of hoist limit switches shall be determined by tests with an empty hook traveling in increasing speeds up to the maximum speed. The actuating mechanism of the limit switch shall be located so that it will trip the switch in sufficient time to prevent contact of the hook or hook block with any part of the trolley.

- e) Test loads shall not be more than 125% of the rated load unless otherwise recommended by the manufacturer. The test reports shall be placed on file where readily available.

4. Rope Inspection

A thorough inspection of all ropes shall be made at least once a month and a certification record will include the date of inspection, the signature of the person who performed the inspection and an identifier for the ropes inspected. The logs will be readily available. Any deterioration shall be carefully observed and determination made as to whether further use of the rope would constitute a safety hazard.

Heat Stress

The likelihood of a heat-related illness, heat stress, is generally low on this campus when compared to industries such as foundries, etc. in which extremely hot working environments are common. However, heat stress can occur anywhere under adverse heat conditions. Situations which might present cause for concern include athletic activities, strenuous outdoor physical activities and indoor working conditions in non-air-conditioned spaces. Protective clothing, required by the activity, also requires consideration of heat conditions.

Normally, our employees and students who are exposed to seasonal temperature variations become accustomed to the higher temperatures gradually as the weather warms up. This natural acclimatization enables these individuals to perform physical activities under hot conditions with minimal adverse effects. Unseasonably high temperatures of heat waves, however, may stress individuals who might otherwise be able to handle the hotter temperatures under normal conditions. Likewise, persons who are not used to performing physical activities under high heat conditions may suffer ill effects from the heat if not introduced into these activities gradually. It is important, therefore, that supervisors and instructors be trained in the recognition of potential heat stress conditions, the symptoms and proper first aid treatment for heat-related illnesses. Failure to provide immediate, proper treatment to a heat stress illness may result in the death of the stricken individual. A discussion of heat-related illnesses, their first aid treatment and steps to avoid heat stress is provided below.

Acute Heat Disorders (Illnesses)

HEAT RASH

A reddening of the skin caused by a buildup of sweat in the skin due to clogged sweat pores. Generally, this condition is caused by poor personal hygiene and can be alleviated by washing the affected areas regularly and the application of drying lotions to the skin.

TRANSIENT HEAT FATIGUE

Marked by impaired mental or physical performance, possible nausea and a fatigued feeling. Although there is no treatment indicated for this condition, the discomfort and physiologic strain can be reduced by acclimatization (discussed below) and training to increase skill levels for the tasks being performed.

HEAT SYNCOPE (FAINTING)

Fainting caused by insufficient blood flow to the head. Prolonged standing in heat causes blood to pool in the lower extremities. This pooling, along with the increased circulation of blood in the skin due to vasodilation, causes a reduction in venous return to the heart. Insufficient blood is pumped through the circulatory system and the brain does not receive adequate oxygen. By fainting, the head is brought lower, to the level of the feet, and circulation to the brain is restored. Persons who have fainted respond well to lying down in a cool area (shade, air conditioning, etc.).

Recovery is normally prompt and complete. Preventative measures include acclimatization and intermittent activity to aid in the circulation of the blood in the lower portions of the body.

HEAT CRAMPS

Cramping of voluntary (skeletal) and involuntary (abdominal) muscles. Caused by the loss of salt (electrolytes) due to heavy sweating and by drinking of large volumes of water without replacing these salts, this condition is treated by administering salted liquids by mouth (or in extreme cases, intravenously). Several days may be required for complete recovery. Prevention consists mainly of salting foods to taste at meals. Salt tablets are no longer recommended due to the hazards of hypertension (high blood pressure). Electrolytic beverages such as Gatorade and Sqwincher replaces needed salts as well as fluids.

HEAT EXHAUSTION

Fatigue, nausea and dizziness are all symptoms of heat exhaustion. The individual is usually moist and clammy with a pale appearance. This condition is brought on by the depletion of the body's fluid content by sweating, accompanied by strenuous activity to the point that blood circulation is adversely affected.

This dehydration along with the competition for blood between the skin, for cooling, and the muscles, for oxygen, results in a circulatory strain which can be compared to shock. Treatment consists of moving the individual to a cooler location, having him/her lie down and drink large volumes of liquids. After a period of rest and the intake of adequate fluids, the individual will appear to have recovered; however, return to activities in hot conditions should be accomplished gradually, under close supervision, as the individual may be more susceptible to heat stress as a result of the occurrence of heat exhaustion. Prevention consists of drinking adequate amounts of suitable liquids regularly over the period of heat exposure, beyond that called for by the thirst mechanism, and gradually becoming acclimated to the heat.

HEAT STROKE

Heat stroke is a very serious medical emergency. The human body experiencing heat stroke has lost the ability to thermoregulate (maintain proper temperature) due to a fatigue and shut down of the sweating mechanism. Body core temperature rises rapidly to life threatening levels. The victim slips into a coma and may die. Symptoms include hot, dry skin which may be red, mottled or cyanotic (bluish). Rectal temperatures of 104°F are common at the onset of the symptoms. Victims are confused, lose consciousness, convulse, become comatose and die if proper treatment is not rapidly administered. Predisposing conditions which may lead to heat stroke include:

- Sustained exertion in the heat when not acclimatized;
- Poor physical condition and obesity;
- Recent alcohol intake;
- Dehydration;
- Individual susceptibility; and
- Chronic cardiovascular disease.

Treatment consists of a rapid cooling of the body by immersion in chilled water with massage, wrapping the victim in wet sheets and vigorously fanning, or wiping the individual down with alcohol. It is important to avoid over-cooling and treat for shock if necessary. Call for medical assistance immediately. Heat stroke can be avoided by proper screening of individuals regarding their health and physical fitness prior to allowing them to participate in strenuous activities in the heat. Gradually acclimatize over a period of five to seven days (see acclimatization information, below). During particularly severe heat conditions, all participants in strenuous activities should be watched by someone trained in recognizing heat stress illnesses and their proper treatment.

ACCLIMATIZATION

Individuals expecting to engage in strenuous activities or work in the heat who are not used to doing so can reduce the likelihood of suffering an acute heat disorder by first undergoing an acclimatization program. In this procedure, the task is restricted to one hundred minutes per day of performing the task in the heat.

This reduced exposure is done daily for seven continuous days (for physically fit individuals, five days may be adequate if the task is not overly strenuous). The benefits derived include an earlier onset of sweating, lower task heart rate and a less elevated body core temperature. Vacations, illnesses (especially if heat related or involving a fever), excessive or regular alcohol use, poor physical condition and obesity negatively affect the body's ability to acclimatize to heat. Supervisory personnel should be aware of these factors and pay particular attention to individuals fitting the above categories if heat is going to impact on their activities.

DETERMINATION OF HEAT STRESS CONDITIONS

The Industrial Hygienist in Environmental Health and Safety can assess heat conditions to determine if they present a hazard. Recommended Heat-Stress Alert Limits (RAL's) for non-acclimatized individuals and Recommended Heat-Stress Exposure Limits (REL's) for acclimatized individuals can be determined based on the anticipated task load and the wet bulb globe temperature (WBGT) reading for the conditions. Ceiling limits for exposures and what percentage of each hour an individual can perform the task based on the ambient conditions and work can then be determined. These figures are based on the assumptions that individuals are young, lightly clothed and in good physical condition. For older persons, those in poor physical condition or more heavily clothed, these limits must be reduced accordingly. Any time the REL/RAL is exceeded, supervisors or instructors must be alert to symptoms of heat stress in their participants. EHS can make recommendations as to activity-rest cycles.

In our area the climate is such that much of the Summer may qualify as being a heat wave. The formal definition of a heat wave is any day that the maximum temperature exceeds 95°F and is 9°F higher than the preceding day's high temperature. Areas suspected of being heat stress area should be evaluated to determine if the RAL/REL is being exceeded due to ambient conditions. These evaluations can be performed by EHS upon request. It should be noted that humidity plays an important role in determining the WBGT used in assessing whether the RAL/REL has been exceeded and is, therefore, an additional consideration for persons in charge of activities.

Fall Protection

OSHA regulations require employers to provide their employees with fall protection when an employee works 6 feet or higher above a floor and there are unprotected sides or edges. Examples of work situations requiring fall protection are: roofs, excavations, holes, hoist area, ramps, runways and other walkways.

Departments must ensure employees have proper training and equipment plus ensure their employees use the fall arrest equipment provided. There are several methods available to meet the standard based on the work situation. Using guardrail, fall arrest systems, a monitor, safety net or warning line system are acceptable methods to achieve compliance. The elements cited are highlights from the standard. You can get more complete criteria by calling Environmental Health & Safety (656-2583).

1. Guard Rails

- Able to withstand a force of 200 lbs.

- Are 42" +/-3" above walking/working level

- Have mid-rails or mesh

- Has a top rail of 1/4" diameter

2. Fall Arrests

Have connector that are corrosion resistant; all edges are smooth

Have D-rings and snap hooks tested to a minimum tensile load of 3,600 lbs. without cracking or breaking

Have D-rings and snap hooks with a minimum tensile strength of 5,000 lbs.

Snap hooks sized to be compatible with the member to which they are connected

Snap hooks shall not be engaged

- Directly to webbing, rope or wire rope
- To a D-ring to which another snap hood or other connector is attached
- To a horizontal lifeline

Lanyards and vertical lifelines shall have a minimum breaking strength of 5,000 lbs.

Lifelines shall be protected against being cut or abraded

Self-retracting lifelines and lanyards which automatically limit free fall distance to 2 feet or less shall be capable of sustaining a minimum tensile load of 3,000 lbs.

Anchorage for personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 lbs. per employee attached.

Personal fall arrest shall be inspected prior to each use for wear, damage and other deterioration, and defective components shall be removed from service

NOTE: Anchorage is the means of attaching the lifeline to some structure holding the system securely. The lifeline is a rope, cable, or shaft held securely by the anchorage, and on which the fall arrester slides. The fall arrester moves freely up or down on the lifeline as long as there is not load on the arrester. As soon as there is a load on the arrester, the arrester locks onto the lifeline and prevents any downward motion.

3. Safety Monitor

Designate a competent person:

Competent person must recognize fall hazards

Must warn employees of fall hazard or when an employee is acting unsafely

Must be on the same working surface and have visual contact and be within vocal communication

Must not have any other responsibilities while on the job

4. Safety Net

Be no more than 30' below level of work

Be dropped tested with a 400 lb. bag

Have mesh opening not to exceed 36" nor be longer than 6" on any side

Have a border rope for webbing with a minimum breaking point of 5,000 lbs.

5. Warning System

Made of rope, wire, or chain

Place around all sides of roof work area

Place not less than 6' from edge

Training

The employer shall train each employee who might be exposed to fall hazards. The program shall help employees recognize the hazards of falling and the procedure to follow to minimize these hazards.

1. The employer shall assure each employee has training by a competent person qualified in the following areas:

The nature of fall hazards in the work area

The correct procedures of erecting, maintaining, disassembling and inspecting the fall protection systems used.

2. The Department shall document the training.

Hazard Communication

See the Hazard Communication Manual

Radioactive Materials

See the Radiation Safety Manual

Chemical Hygiene

See the Chemical Hygiene Manual

Biosafety

See the Biological Safety Manual

Pesticide Exposure Prevention

The University will comply with the EPA Worker Protection Standard (WPS) 40 CFR Part 170 in all aspects. This standard addresses training, personal protective equipment, safety procedures, and medical monitoring to reduce or eliminate exposure to pesticides. The WPS covers pesticides that are used in the production of agricultural plants on farms, forests, nurseries, and greenhouses. The WPS addresses procedures that are necessary for responding to exposure-related emergencies. Exposure to certain pesticides may lead to serious illness.

In order to prevent exposure, safe work practices, training and personal protective equipment are necessary. The use of certain pesticides, including organophosphate chemicals, require medical monitoring.

Employees whose use of a pesticide is not covered under the Worker Protection Standard will be required to meet conditions as specified in OSHA's Hazard Communication Standard and Personal Protective Equipment Standard. Please contact EHS for questions regarding the WPS.

Departments have the following responsibility:

- Make certain that employees are adequately trained.

- Assure that the necessary personal protective equipment is available for use during application, equipment cleaning, or spill cleanups for each pesticide in use..

- Assure that employees and students receive required medical surveillance as described below. Note: (This is at the student's expense and they can choose their own physician. Employees must use approved Clemson medical provider.

- When possible, choose a pesticide with the lowest toxicity rating (e.g. a pesticide with a 'Caution' label rather than a 'Danger' label).

- Make efforts to limit the exposure time of employees who apply, mix or handle designated pesticides to less than 7 days in any 30 day period.

- Where necessary, maintain pesticide application schedule and post for the required time period.

- Adhere to other areas of the WPS, including REIs - Restricted Entry Intervals, oral warnings, pesticide application notification and posted safety information.

- Follow WPS requirements in the event of a pesticide poisoning or exposure, which includes provisions for transportation to a medical facility and providing medical personnel with information on the pesticide and circumstances of the injury/exposure.

Medical Surveillance is required for the following chemicals and conditions of use:

- Employees who handle organophosphate or carbamate pesticides for more than 7 days per month and have a "Danger" or "Warning," (Category one and two) label.

- Baselines and follow-up exams are required for employees who work with designated pesticides. Employees who work with these compounds less often or use closed mixing and loading systems may require less frequent testing. Baseline values are verified every two years. Follow-up exams will be upon direction of the physician.

Underground Storage Tanks

See the Underground Storage Tank Manual.

Air

See the Clemson University Title V permit documentation.

Storm Water

See the Storm Water Plan for the facility in question.