UAB

The University of Alabama at Birmingham®

Environmental Health and Safety

General Safety Program

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The University of Alabama at Birmingham (UAB) General Safety Standards (GSS)

This manual has been prepared for UAB using - as far as is possible - the latest information on international, federal, state, and local legislation. The standard approach is to always use 'best practice' procedures, so the expectations of all regulatory bodies are exceeded.

1.0 Introduction

The UAB-GSS manual has been prepared - again, as far as possible - to make it accessible and useful to all people likely to need reference to health, safety, and welfare issues in their day-to-day, as well as long-term, employment operations. The UAB-GSS manual also attempts in part to educate in, and provide an overview of, occupational safety in the workplace in general. Ideally, all parties will recognize the aim is to achieve a 'no injury' workplace, with the concurrent positive outcome for all stakeholders - whether management, employees, guests, visitors, contractors, and students. The UAB-GSS manual is a ‘living’ document, since it must be monitored and reviewed regularly, and occasionally irregularly due to the result of changed circumstance - whether legislative change or operational change, or in the unfortunate event of an incident occurring that reveals an unforeseen risk that must be considered in the future. Please take the opportunity to participate in the health, safety, and welfare of your workplace. It is your right and responsibility to yourself, your relatives, and your friends - inside and outside the workplace - as well as the wider community.

1.1 Purpose

The following information is provided as a general guideline for activities associated with general safety. Additional information may be obtained by contacting Environmental Health and Safety (EHS) at 205-934-2487 or https://www.uab.edu/ehs/.

1.2 Scope

UAB’s General Safety Standards are derived from federal, state, and local standards, including UAB’s own policies and standard operating guidelines/procedures. These general safety standards involve numerous activities and programs ensuring our campus is a safe place to work, live, and play.

The Department of Environmental Health and Safety (EHS) is responsible for day-to-day accident prevention, inspection, and program safety oversight. These program areas include, but are not limited to, accident prevention, training, education, and risk assessment to properly mitigate hazards. However, everyone on UAB’s campus whether they are faculty, staff, contractor, visitor, or student shares a vital role in campus-wide safety.

1.3 General Safety Rules and Practices

UAB requires all employees to take all necessary precautions to ensure safety. Establishing these rules and reviewing them with new employees will aid in reducing the number of on-the-job incidents.

These safety rules are guidelines and cannot address every situation. Each employee is responsible for staying alert, following the safety rules, and avoiding hazardous situations. Every employee has the right and responsibility to stop work and contact your supervisor if you feel it is unsafe.

Violations of these safety rules may result in disciplinary action, including dismissal.

1. If in doubt about the meaning of safety requirements, ask your immediate supervisor. Ignorance of safety instruction is no excuse.
2. Only perform the job you have been assigned to conduct. If anyone asks you to perform work you are not assigned to do, report it to your supervisor.
3. If you are injured on the job, report the injury immediately to your supervisor, no matter how slight. If the injury is serious, you will be directed to the proper outside medical treatment facility.
4. Use of alcohol or drugs is prohibited and may result in disciplinary action, up to and including termination. It is recommended that all prescription drug use or any conditions that may hinder work performance be reported to your immediate supervisor before work.
5. Know the location of emergency exits in your work area or at the location where you are working.
6. Report to your supervisor immediately any unsafe condition you observe in the workplace(s), including defective equipment and/or tools.
7. Do not use defective equipment or tools. If the proper tool is not available, request assistance from your immediate supervisor/project manager before proceeding.
8. Good housekeeping and proper hygiene practices should always be applied. Always keep work areas neat and clean.
9. Be familiar with the location and contents of Safety Data Sheets (SDS).
10. Absolutely no horseplay is ever permitted.
11. Obey warning tags and signs. They are posted to point out hazards.
12. Do not access elevated locations (rooftops, mezzanines, equipment, containers, etc.) unless a safe means of access exists. Safe access will include use of a secured ladder, stairway, fixed ladder, etc.
13. Wear or use personal protective equipment in any area for which it has been issued.

1.4 Applicable Codes & Standards

UAB utilizes and follows various codes and standards from local, state, federal, and international organizations. Some of these include, but are not limited to:

American National Standards Institute (ANSI).

American Society for Testing and Materials International (ASTM).

Environmental Protection Agency (EPA).

International Building Code (IBC).

International Fire Code (IFC).

International Safety Equipment Association (ISEA).

National Fire Protection Administration (NFPA).

Occupational Safety and Health Administration (OSHA).

The American Society of Mechanical Engineers (ASME).

The National Institute for Occupational Safety and Health (NIOSH).

1.5 Disclaimer

The information provided in this document is not a substitute for training or experience.

The University of Alabama at Birmingham and the authors of these standards assume no liability for any individual's use or reliance upon any material contained or referenced herein. The material contained in this manual may not be the most current.

2.0 General Office Safety

The following guidance is provided to ensure a safe office working environment. It is both the duty and moral responsibility of every employee to promote wellness and prevent the likelihood of accidents in the workplace which may result in property damage, injuries, or loss of life.

2.1 Purpose

All work performed in UAB offices and administrative areas will be conducted using safe work practices. Office and administrative areas will be maintained free of recognized hazards.

2.2 Scope

This guidance applies to all UAB employees and students who occupy or work in office spaces.

2.3 General Guidance

Practice good housekeeping. Keep floors free of items that may present a trip hazard. Keep waste cans off walkways and do not overfill them.

Prevent slipping accidents by cleaning up spills immediately.

Do not participate in horseplay.

Keep tacks and other sharp objects in closed containers.

Use the proper tool for the job at hand (e.g., a staple remover to remove staples).

Comply with all smoking regulations. All buildings on campus are smoke-free.

Be sure to use proper lifting techniques. It is highly recommended to coordinate with personnel skilled in moving to relocate furniture and other heavy objects.

Jewelry, long hair, and clothing must be kept clear of the moving parts of all office machines.

Report any observed pest control problems to Campus Maintenance. Never attempt to apply any pest control chemical yourself.

Contact Environmental Health and Safety (EHS) regarding indoor air quality concerns.

Avoid picking up broken glass with bare hands. Use a broom and dustpan.

Practice proper ergonomics. Note that an ergonomics evaluation and training are available from EHS upon request.

2.4 Fire and Electrical Safety

Know where fire extinguishers are in your work area and how to use them. For training needs, contact EHS.

Power switches must be off, and the cord unplugged when electrical equipment, such as a typewriter, is being cleaned or serviced.

Do not overload electrical outlets. Do not plug a multiple outlet strip - an extension cord with multiple electrical receptacles - into a second multiple outlet strip.

Report immediately any damaged electrical cords, broken switches, loose connections, or bare wires to Campus Maintenance.

Office doors shall be free of obstructions to permit egress in an emergency.

If it is necessary to run a cable or electrical cord across the floor (path of travel), a cable cover must be used to protect the wiring and prevent tripping. Extension cords shall not be used as a permanent power source.

Be familiar with emergency procedures for the office including fire/evacuation, bomb threat, tornado, etc. EHS is available to assist departments with developing site-specific plans, providing training, conducting exercises, and emergency exercise evaluation.

Combustible decorations (e.g., corn stalks, Christmas trees, etc.) are prohibited. Fire and smoke doors **SHALL NOT** be decorated. Decorations shall never be hung from the ceiling as this unnecessarily impairs fire suppression equipment.

Dispose of shipping and packing materials, and other combustibles. Loose debris can cause falls and is a fire hazard.

Candles, lanterns, oil lamps, or any other type of open flame and flame-producing item is prohibited on campus.

Chemicals and flammables shall be labeled and sealed in approved containers. Hazard Communication (HAZCOM) training must be provided for those handling hazardous materials.

2.5 Equipment and Furnishings

Bookcases or file cabinets taller than 72 inches should be secured or anchored, to the wall. Keep bookcase doors closed when not in use.

Avoid overloading the top drawers of filing cabinets to avoid the possible tipping of the cabinet when the drawers are opened.

Open one drawer of the file cabinet at a time to prevent tipping. File cabinets should be placed where their use will not interfere with office traffic patterns.

Keep files and desk drawers closed when not in use.

Guard the sharp edges of furniture to prevent personal injury. Keep desk “pull-out” writing surfaces closed when not in use.

Unplug any office machines that smoke, spark, deliver an electrical shock, appear unsafe or otherwise malfunctioning. Have it inspected by the appropriate repair personnel.

Do not cover air vents or obstruct airflow from registers. Do not place furniture, equipment, or materials in locations that will interfere with air movement around thermostats.

Use care with cutting tools, such as utility knives and other cutting instruments. Guards should be installed on paper cutters during use.

Ensure that glass doors have some type of visible marking to prevent people from walking through, or into, them.

2.6 Fall Prevention

Do not lean too far back in chairs, as this may result in over-balancing and a fall.

Use only safety step stools or ladders for climbing. Do not stand on swivel chairs or use them as step stools.

Report all defects such as loose tiles, broken steps, or loose handrails immediately to Campus Maintenance.

Use a ladder or stepstool. Do not rely on chairs or shelves for support. Use a ladder that is sturdy, with your feet set firmly on the ground.

Wipe up wet spots. Ensure floors are dry, and clear of debris, and clean up spills promptly. Even simple items, such as a loose pencil, could cause a serious falling injury.

Ensure that office lighting is adequate. Ensure that burned out light bulbs are replaced and have additional lighting installed, as necessary.

Secure throw rugs and mats.

3.0 Incident Reporting

Incident reporting is an important practice that promotes safety in the workplace. It not only identifies areas of improvement in an organization but also can prevent accidents from occurring.

3.1 Purpose

Incidents of various magnitudes occur, from property damage in the workplace, to accidents, injuries, or illnesses. It is critical that all personnel are empowered to report incidents that happen using established reporting procedures. When personnel report incidents, they are directly contributing to potentially preventing a future incident from recurring. Reporting allows for UAB to investigate and establish checks, procedures and implement risk controls in response to the incident.

3.2 Scope

These procedures apply to all incidents (injuries/illnesses, environmental releases, and near misses, etc.) that occur with faculty, staff, students, and visitors at UAB.

3.3 Environmental Health and Safety (EHS) Responsibilities

EHS shall review all Workers' Compensation claims by investigating those where hazards are present, where appropriate safety procedures were not followed, and/or where personal protective equipment was not used, defective, or inadequate.

The Risk Management office may forward other claims (property loss, visitor accidents, etc.) and incident reports to EHS for review and investigation.

If the incident resulted in or had the potential to result in a significant injury or property loss it shall be reported to EHS.

If any action is necessary resulting from an investigation conducted by EHS, the findings will be forwarded to the appropriate supervisor and/or department head.

EHS shall also investigate chemical spills/releases and fires.

3.4 Employee Responsibilities

Employees shall report on-the-job incidents/accidents as soon as possible to their immediate supervisor. Reporting is mandatory regardless of severity.

When an incident/accident occurs, the employee’s supervisor or lead employee should investigate the incident/accident. The area where the incident/accident occurred should be viewed and statements should be obtained from any witnesses. Questions regarding how to fill out the incident/accident report should be directed to the Risk Management office.

3.5 Emergency Procedures

Call 911 or the UAB Police and Public Safety Department at 205-934-3535 for the following circumstances: loss of conscious, seizures, difficulty breathing, significant bleeding, potential toxic chemical exposure, burning eyes or throat, or other life-threatening injuries.

3.5 Employee Injury Reporting

Any incident must be reported verbally by the employee to the employee's supervisor and the Director of Human Resources and Faculty Affairs as soon as possible but no later than two calendar days following the incident or following the onset of the illness or disease. Failure to verbally report an incident within two calendar days of occurrence or within two calendar days of the onset of the illness or disease may result in denial of on-the-job injury (OJI) benefits.

All UAB employees who experience an on-the-job injury, other than blood or body fluid exposure, should be evaluated at *The Workplace*, Monday through Friday from 7:00 a.m. to 5:00 p.m. If an incident occurs on the weekend or outside *The Workplace* hours of operation, employees should go to UAB Urgent Care, UAB Highland's Emergency Department, or University Hospital Emergency Department.

Complete an Initial Medical Evaluation Authorization form and send the document with the employee to *The Workplace* if the injury occurs during their operating hours. If outside *The Workplace* hours of operation, send the completed form with the employee to UAB Urgent Care, UAB Highland's Emergency Department, or University Hospital Emergency Department. *The Workplace* if the injury occurs during their operating hours. If outside *The Workplace* hours of operation, send the completed form with the employee to UAB Urgent Care, UAB Highland's Emergency Department, or University Hospital Emergency Department.

Injured employees may use Blazer Express for transportation to and from *The Workplace* for the initial visit. *The Workplace* is located at UAB Hospital-Highlands, 1201 11th Avenue South, Suite 100. Their telephone number is 205-933-5300.

Complete the Employee Incident Report Form as soon as possible. Submit a downloaded PDF copy of the form to HRM-OJI@uab.edu, or print it and deliver it to the OJI Administrator located in the Administration Building, 701 20th Street South, room 215. Their extension is 205-934-5382.

3.6 Needle Sticks and/or Other Exposures

For needle sticks and/or other exposures (including blood, fluid or tissue, biologic agent, chemical agent, radiation, laser, animal), call Employee Health at 205-934-3675 during normal business hours. After normal business hours, on weekends, and holidays, report by calling the Call Center at 205-934-3411 and asking them to page the person on call for the *Needle Stick and Exposure Team*. You will be triaged to care depending on exposure.

3.7 Student/Visitor Injury Reporting

In the event a UAB student/visitor is injured. An immediate assessment should be made to determine the severity of injuries and the proper response required.

If the student/visitor is unresponsive and not breathing contact UAB dispatch immediately at 205-934-3535 or 911 from UAB phone. A qualified person should start Cardiopulmonary Resuscitation (CPR). Attach an Automatic External Defibrillator (AED) if one is available. If severely injured notify UAB dispatch at 205-934-3535 or 911 from UAB phone. Dispatch will then send the appropriate response needed. Be sure to fill out the proper form at the link provided below. Reporting instructions are detailed on the form.

Incident Report Form for Visitors and Students.

If the student/visitor has minor injuries and an emergency response is not needed, then the student should be directed to the Student Health and Wellness Center. Visitors shall be directed to seek medical attention from their provider. It will be up to the student/visitor whether to seek medical attention or not. UAB faculty and staff cannot force a student/visitor to seek medical attention. The form listed above shall be completed and submitted regardless of treatment.

3.8 Near Miss Reporting

A near miss is defined as a narrowly avoided collision or other accident. You may report a near miss incident occurring on UAB's campus to EHS by email to ehssafety@uab.edu. Email should not be used to report events where bodily injury or property damage has occurred, or for events at the University Hospital or UAB Medicine Clinics.

3.9 Report a Safety Concern

Safety at UAB is everyone's responsibility, not just EHS. We depend on you to help us identify opportunities to improve the culture of safety at UAB.

Help us keep UAB a safe and healthy place to work by reporting all safety concerns and incidents that happen that may otherwise go unreported. Call 205-934-2487 or email ehssafety@uab.edu to report a safety concern. Please give us your name, phone number, department, and the details of the concern or incident.

3.10 Property Damage

To report property damage, contact UAB's Office of Risk Management and Insurance.

3.11 Anonymous Reporting

Need to remain anonymous when reporting? All information will be kept confidential. We may ask that you identify yourself in case we have follow-up questions. We would also like to notify you when the problem has been addressed. However, if you are uncomfortable doing so, you can remain anonymous. Call 205-934-2487 and inform the person that answers your call that you would like to remain anonymous.

4.0 Personal Protective Equipment (PPE)

The use of appropriate personal protective safety equipment applies to all employees, students, visitors, and contractors performing tasks or entering areas that require specific PPE.

PPE shall be worn in areas where there is risk of injury or exposure to hazardous substances, or the potential for exposure to hazards exists.

4.1 Purpose

Personal protective equipment, commonly referred to as PPE, is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards.

4.2 Scope

PPE includes devices for hand, foot, eye, face, and head protection, protective clothing, hearing, and respiratory protection. Using PPE requires hazard awareness and training on the part of the user. PPE is not a substitute for engineering and administrative controls, or safe work practices, but should be used in conjunction with these controls.

4.3 PPE Safety Standard Organizations

ASTM International: The *American Society for Testing and Materials International* provides no-cost public access to important standards used in the production and testing of personal protective equipment.

ANSI: The *American National Standard Institute* is a private, non-profit organization that administers and coordinates the United States voluntary standards and conformity assessment system.

ISEA: The *International Safety Equipment Association* engages in the development of ANSI-accredited safety equipment standards, in the United States and around the world.

NIOSH: The *National Institute for Occupational Safety and Health* is a federal agency whose mission is to develop new knowledge in the field of occupational safety and health and to transfer that knowledge into practice.

4.4 Definitions

Safety Data Sheets (SDS): An SDS (formerly known as MSDS) includes information such as the properties of each chemical; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical.

UAB has subscribed to the ChemWatch chemical information database as a tool to help the campus community comply with Hazard Communication and Laboratory Safety Plan requirements.

Thousands of Safety Data Sheets are available in several languages and a variety of formats. The ChemWatch system may be accessed from any computer in the UAB System by visiting: https://jr.chemwatch.net/chemwatch.web/account/autologinbyip.

Personal Protective Equipment (PPE): Includes all equipment designed to provide protection to the wearer from potential hazards to the eyes, face, hands, head, feet, ears, and extremities.

Eye/Face Protection: Equipment designed to provide protection to the face and eyes during exposure to hazards such as flying particles, molten metal or sparks, liquid chemicals, acids or caustic liquids, or potentially injurious light radiation (e.g., lasers, welding).

Head Protection: Equipment designed to provide protection to the head during exposure to potential hazards such as falling objects, striking against low hanging objects, or electrical hazards.

Hand Protection: Equipment designed to provide protection to the hands during exposures to potential hazards such as sharp objects, abrasive surfaces, temperature extremes and chemical contact. Hand protection is selected based upon the hazard and performance characteristics of the gloves.

Foot Protection: Equipment designed to provide protection to the feet and toes during exposure to situations with the potential for foot injuries such as falling or rolling objects, chemical or liquid exposures, piercing objects through the sole or uppers, and/or where the employee's feet are exposed to electrical hazards.

Hearing Protector/Protection: Equipment designed to provide protection of an individual's hearing during exposure to high noise levels.

Respiratory Protection: Equipment designed to provide protection to the wearer from potential inhalation hazards such as vapors, mists, particulates, and gases.

4.5 PPE Requirements

All personal protective clothing and equipment will be of safe design and construction for the work to be performed and shall be maintained in a sanitary and reliable condition. Only those items of protective clothing and equipment that meet NIOSH, ANSI, and ASTM standards will be procured or accepted for use.

Specific standards regarding the selection and use of PPE are:

- ANSI/ISEA Z87.1-2010, Occupational and Educational Personal Eye and Face Protection Devices.
- ANSI/ISEA Z89.1-2014, American National Standard for Industrial Head Protection.
- ASTM F-2412-2005, Standard Test Methods for Foot Protection, and ASTM F-2413-2005, Standard Specification for Performance Requirements for Protective Footwear.
- Hand Protection selection must be based on the performance characteristics of the glove in relation to the tasks to be performed.

4.6 Environmental Health and Safety (EHS) Responsibilities

The Department of Environmental Health and Safety (EHS) is responsible for the development, implementation, and administration of UAB's PPE requirements. EHS's duties include, but are not limited to:

- Determining the type of PPE necessary based on the hazards involved in the work to be performed.
- Providing safety training and technical assistance to supervisors on the proper use, care, and cleaning of approved PPE.
- Reviewing, updating, and evaluating the overall effectiveness of prescribed PPE.
- Conducting periodic Job Safety Analysis and Risk Assessments to determine PPE requirements, and/or other controls necessary to protect personnel.

4.7 Supervisor Responsibilities

Supervisors have the primary responsibility for implementation of PPE usage in their work area. This involves:

- Identifying hazards prior to the start of any work and seeking assistance from EHS to evaluate and control the hazards when necessary.
- If hazards cannot be eliminated or a substitution is not feasible, then engineering controls that effectively minimize personnel's exposure to hazards shall be utilized.
- Providing the appropriate PPE to assigned personnel, instructing them on its proper usage, and ensuring they are wearing the equipment correctly.
- Effectively supervise personnel to ensure PPE is properly used.
- Notifying EHS when new hazards are introduced and when work processes are added or changed.

4.8 PPE User Responsibilities

The PPE user is responsible for following these requirements:

- Wearing PPE as required.
- Attending required training.
- Caring for, cleaning, storing, and maintaining PPE.
- Informing your supervisor when PPE needs to be replaced.

4.9 PPE Selection

To choose the proper PPE, the individual must be aware of what hazards exist. This involves obtaining information on the types of hazards present, the toxicity of the materials involved, and what other options are available to control exposure.

Information regarding a chemicals specific hazard can be found in its Safety Data Sheet (SDS). The chronic and acute effect of chemicals should also be assessed. The next step would be to implement the control measures necessary to prevent exposure to the operational procedures.

4.9.1 Head Protection

Head injuries are commonly caused by impact from falling or flying objects and falling or walking into hard objects. PPE devices such as hard hats may protect you from objects falling on your head and, in a limited way, from electrical shock or burns. Hard hats should be worn in areas where there is potential for head injuries.

4.9.2 Eye and Face Protection

Eye protection should always be worn where there is potential for injury to the eyes or face from small particles, toxic chemicals, acids or caustic liquids, gases or vapors, bioaerosols, flying objects or particles, large objects, thermal or radiation hazards, and lasers. According to the types of and extent of hazards, different PPE should be worn. PPE for the face and eyes includes devices such as safety glasses, goggles, and face shields. These must always remain clean and free of contaminants. Safety glasses or goggles must always be worn in laboratory areas.

This includes employees, researchers, visitors, contractors, and students. To provide protection, supervisors of such areas shall procure enough goggles or safety glasses which provide the maximum amount of protection possible. If employees wear personal glasses, they shall be provided with a suitable eye protector to wear over them.

4.9.3 Body Protection

Protective clothing, such as lab coats, should be worn when handling hazardous materials. Tyvek suits and sleeves are also available to prevent the contamination of skin and clothing.

4.9.4 Hand Protection

Selecting the proper gloves is particularly important since it is our hands that are often used to handle hazardous materials. These materials usually consist of caustic or toxic chemicals, biological substances, electrical sources, and extremely cold or hot objects that may cause injury to your hands. In addition, traumatic injuries such as cuts, sprains, and punctures may also occur. With the wide range of hazards, there also exists a wide range of gloves that may be used as PPE. The first consideration in the selection of gloves for use against chemicals is to determine, if possible, the exact nature of the substance to be encountered. Read instructions and warnings on chemical container labels and SDS before working with any chemical. Recommended glove types are often listed in the section for personal protective equipment.

4.9.5 Foot Protection

Injuries that may occur when the proper footwear is not worn are chemical and heat burns from spills and splashes of acids and caustics, compression injuries, electrical shocks, and slipping. Wearing the proper footwear is, therefore, especially important when working in areas where physical and chemical hazards are present. Close-toed shoes must always be worn in laboratory areas where chemicals are present.

4.9.6 Hearing Protection

NIOSH established a recommended exposure limit (REL) of 85 A-weighted decibels (dBA) averaged over an eight-hour workday. Workers who are exposed to noise at or above the NIOSH REL are at risk of developing significant hearing loss over their working lifetime.

Hearing protectors shall be provided to all personnel exposed to an 8-hour time-weighted average of 85 dBA or greater. Hearing protectors shall be replaced as necessary.

The Noise Reduction Rating (NRR) of hearing protection devices shall be considered when selecting a device. Most personnel require no more than approximately 10 decibels (dB) of noise reduction to meet the NIOSH REL. Almost any hearing protector, when fit correctly, can provide 10 dB of sound reduction.

4.9.7 Respiratory Protection

Respirators are used to prevent the exposure to air contaminated with harmful dust, fog, fumes, mist, gas, smoke, spray, or vapor. All respirator usage, which includes disposable respirators, air purifying respirators, and air supplied respirators, require annual fit testing and training prior to use.

5.0 Aerial Lifts

An aerial lift is any vehicle-mounted device used to elevate personnel, including:

- Extendable boom platforms.
- Aerial ladders.
- Articulating (jointed) boom platforms.
- Vertical towers.
- Any combination of the above.

Aerial lifts have replaced ladders and scaffolding on many job sites due to their mobility and flexibility. They may be made of metal, fiberglass reinforced plastic, or other materials. They may be powered or manually operated and are considered aerial lifts whether they can rotate around a primarily vertical axis or not.

Supervisors shall assess the worksite to identify all possible hazards to select the appropriate equipment for the task. Personnel who use aerial lifts need to evaluate and implement effective controls that address fall protection, stabilization, and positioning. Only trained personnel are authorized to use aerial lifts, and supervisors shall ensure that those workers show that they can use an aerial lift properly. Safe aerial lift use includes properly maintaining the equipment, following the manufacturer's instructions, adequate and documented operator training, and utilizing the required PPE.

5.1 Purpose

To establish safety protocols for aerial lift usage by UAB personnel.

5.2 Scope

These guidelines apply to all UAB personnel and projects involving aerial lift work activity.

5.3 Aerial Lift Hazards

The following hazards, among others, can lead to personal injury or death:

- Falling from elevated level.
- Objects falling from lifts.
- Tip-overs.
- Ejections from the lift platform.
- Structural failures (collapses).
- Electric shock (electrocutions).
- Entanglement hazards.
- Contact with objects.
- Contact with ceilings and other overhead objects.

5.4 Aerial Lift Operation Requirements

The basic requirements for operating an aerial lift include, but are not limited to:

- Initial training is required to operate aerial lifts. A certified trainer will be responsible for training employees in the correct use and safety precautions for specific equipment.
- Articulated and extensible boom platforms must have both platform (operator controls) and lower controls (on the body of the lift.)
- The operator shall test the controls prior to use to determine that the controls are in safe working condition.
- The operator shall stand firmly on the floor of the basket and shall not sit or climb on the railings or on the edge of the basket or use planks, ladders, or other devices for a higher work position.
- Body harnesses shall be worn with a lanyard attached to the boom. The point of attachment must be the designated loop on the aerial lift's boom or work platform. Personnel cannot attach lanyards to adjacent poles, structures, or equipment while working from an aerial lift.
- An aerial lift shall not be moved when the boom is elevated in a working position with the operator in the basket, except for equipment which is specifically designed for this type of operation.

5.5 Aerial Lift Training

Only trained personnel are authorized to operate aerial lifts. Aerial lift operators shall be trained and knowledgeable of the following:

- When and how to perform inspections.
- The manufacturer's operating instructions.
- Pre-start inspection of the aerial lift.
- Inspection of the work area for dangerous conditions such as uneven surfaces, overhead obstructions, such as power lines, or other hazards.
- Load capacities of the equipment, including the employee and all tools and materials.
- How to safely move the equipment.
- Training on how to prevent falls and use appropriate fall protection PPE.
- Minimum safe approach distances to energized power lines.
- Demonstration of proficiency in aerial lift operation.

5.5.1 Aerial Lift Retraining

Personnel shall be retrained if any of the following conditions occur:

- An incident occurs during aerial lift use.
- Workplace hazards involving an aerial lift are discovered.
- A different type of aerial lift is used.
- When an individual requests retraining.

Supervisors shall ensure personnel who operate an aerial lift improperly are retrained.

5.6 Aerial Lift Pre-Operational Inspection

Prior to using an aerial lift, the operator shall conduct a pre-operational inspection to verify the equipment and its components are in a safe operating condition. Follow the manufacturer’s recommendations and include a check of:

5.6.1 Aerial Lift Vehicle Components Inspection

- Proper fluid levels (oil, hydraulic, fuel, and coolant).
- Fluid leaks.
- Wheels and tires (i.e., proper inflation, wear, operation).
- Battery and charger.
- Lower-level controls.
- Horn, gauges, lights, and backup alarms.
- Steering and brakes.

5.6.2 Aerial Lift Components Inspection

- Operating and emergency controls.
- Personal protective devices.
- Hydraulic, air, pneumatic, fuel, and electrical systems.
- Fiberglass and other insulating components.
- All warning and operational placards.
- All instructional and control markings.
- Mechanical fasteners and locking pins.
- Cable and wiring harnesses.
- Outriggers, stabilizers, and other structures.
- Loose or missing parts.
- Guardrail systems.

Do not operate an aerial lift if any of these components are defective until it is repaired by a qualified person. Remove defective aerial lifts from service (tag out) until repairs are made.

5.6.3 Work Area Inspection

Work areas shall be inspected for hazards and corrective actions taken to eliminate identified hazards prior to and during the operation of an aerial lift. Examples of hazards include, but are not limited to:

- Drop-offs, holes, or unstable surfaces such as loose dirt.
- Inadequate ceiling heights.
- Slopes, ditches, or bumps.
- Debris and floor obstructions.
- Overhead electric power lines and communication cables.
- Other overhead obstructions.
- Other hazardous locations and atmospheres.
- High wind and other severe weather conditions, such as ice.
- The presence of other personnel near or in the work area.

5.7 Aerial Lift Special Precautions

The following precautions are not a comprehensive listing of every hazard that can be present in the work area while using an aerial lift. Personnel should always use their best judgment. However, the listed minimum precautions shall be adhered to.

5.7.1 Fall Protection

- Ensure access gates or openings are closed.
- Stand firmly on the floor of the bucket or lift platform.
- Do not climb on or lean over guardrails or handrails.
- Do not use planks, ladders, or other devices as a working position.
- Use a body harness or a restraining belt with a lanyard attached to the boom or bucket.
- Do not belt-off to adjacent structures or poles while in the bucket.

5.7.2 Traveling & Loading

- Do not exceed load-capacity limits. Take the combined weight of personnel, tools, and materials into account when calculating the load.
- Do not use the aerial lift as a crane or to hoist materials.
- Do not carry objects larger than the platform.
- Do not drive with the lift platform raised (unless the manufacturer's instructions allow this).
- Do not operate lower-level controls unless permission is obtained from the personnel in the lift except in emergencies (e.g., when personnel in the lift are incapacitated).
- Do not exceed vertical or horizontal reach limits.
- Do not operate an aerial lift in high winds above those recommended by the manufacturer.
- Do not override hydraulic, mechanical, or electrical safety devices.

5.7.3 Overhead Protection

- Be aware of overhead clearance and overhead objects, including ceilings.
- Do not position aerial lifts between overhead hazards, if possible.
- Treat all overhead power lines and communication cables as energized and stay at least 10 feet (3 meters) away.
- Ensure that the power utility de-energizes power lines in the vicinity of the work.

Insulated aerial lifts offer protection from electric shock and electrocution by isolating you from electrical ground. However, an insulated aerial lift does not protect you if there is another path to ground, for instance, if you touch another wire. To maintain the effectiveness of the insulating device, do not drill holes in the bucket.

5.7.4 Stability

- Set outriggers on pads or on a level, solid surface if available.
- Set brakes when outriggers are used.
- Use wheel chocks on sloped surfaces when it is safe to do so.
- Set up work area warnings when necessary to warn others such as cones and signage.

6.0 Confined Space Entry

For any assistance and/or procedure assessment, contact The Department of Environmental Health and Safety (EHS), Campus Safety, at 205-934-2487 prior to beginning any work.

6.1 Purpose

To protect personnel from the hazards of entry into permit required confined spaces at the University of Alabama at Birmingham (UAB).

6.2 Scope

To establish requirements, practices, and procedures for permit required confined space entry for all UAB personnel and contractors.

6.3 Entry Supervisor Responsibilities

Shall be responsible for ensuring permits are properly issued and all safety requirements are followed. UAB personnel and contractors shall follow all permit required confined space work procedures and use the appropriate Personal Protective Equipment (PPE).

6.4 Authorized Entrant(s) Responsibilities

Are personnel who are authorized to enter a confined space, whether permit required or non-permit required. Possess adequate knowledge of confined space entry hazards such as signs, symptoms, and consequences of specific exposures. Communicates with the attendant, as necessary, to enable the attendant to monitor entrant status. Alert entrants of the need to evacuate the space.

6.5 Entry Attendant(s) Responsibilities

An individual stationed outside one or more permit-required confined spaces who monitors the authorized entrants and performs all assigned attendant's duties. Thorough knowledge of hazards that may be present during entry, including information of the signs, symptoms, and consequences of specific exposures. Maintain an accurate count of entrants in the permit space. Communicate with entrants to monitor the entrant(s) status. Alert entrants of the need to evacuate the confined space. Summons rescue and other required emergency services when entrants need emergency assistance in evacuating the confined space. Keep unauthorized personnel from entering the confined space. Maintain a safe perimeter free of unauthorized personnel around the confined space ingress and egress area.

6.6 Training

Prior to performing confined space work, all UAB personnel participating in confined space entries (including entry supervisor, entrants, and entry attendants) must receive training. Refresher training will be provided annually and upon request.

6.7 Definitions

Bump Test: A method of verifying instrument accuracy. A bump test verifies calibration by exposing the instrument to a known concentration of test gas. The instrument reading is compared to the actual quantity of gas present (as indicated on the cylinder). If the instrument's response is within an acceptable tolerance range of the actual concentration, then its calibration is verified.

Note: It is recommended that users check with the detection equipment manufacturer for the acceptable tolerance ranges. Instruments should be "zeroed" before the bump test to give a more accurate picture of the bump test results. When performing a bump test, the test gas concentration should be high enough to trigger the instrument alarm.

Calibration: A method designed to adjust the instrument's reading to coincide with a known concentration (generally a certified standard) of test gas. In most cases, a full calibration is only necessary when an instrument fails a bump test or after it has been serviced. The full calibration and bump test should be conducted in a clean fresh air environment.

Confined Space: A space that is large enough and so configured that an employee can bodily enter and perform assigned work yet has limited or restricted means for entry or exit. A confined or enclosed space includes, but is not limited to tanks, vessels, storage bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, and tunnels. Such a space is not designed for continuous employee occupancy.

Entry Permit: A form that authorizes entry to a permit required confined space.

Entry Supervisor: The person responsible for determining whether acceptable entry conditions are present at a permit space where entry is planned, as well as authorizing entry, overseeing entry operations, and terminating entry, as required. Know the hazards that may be faced during entry, including information of the signs or symptoms and consequences of the exposure. Verifies (by checking that the appropriate entries have been made on the permit) that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place, before endorsing the permit and allowing entry to begin. Terminates the entry and cancels the permit. Verifies that rescue services are available and that the means for summoning them are operable. Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations.

Hazardous Atmosphere: An atmosphere that may expose personnel to risks such as death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from one or more of the following causes:

- Flammable gas, vapor or mist equal to or higher than 10 percent of its lower explosive limit (LEL) or lower flammable limit (LFL).
- Airborne combustible dust at a concentration that meets or exceeds its LEL/LFL.
- Atmospheric oxygen concentration equal to or below 19.5 percent or above 23.5 percent.
- Presence of toxic gases (for example, equal to or more than 10 ppm hydrogen sulfide (H2S) measured as an 8-hour time-weighted average.) If the presence of other toxic contaminants is suspected, specific monitoring programs will be developed.
- The atmospheric concentration of any substance for which a dose or a permissible exposure limit (PEL) is published in 29 CFR 1910 Subpart G or in Subpart Z, which could result in employee exposure more than the PEL.
- Any other atmospheric condition that is immediately dangerous to life or health (IDLH).

Immediately Dangerous to Life or Health (IDLH): Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a confined space.

Lower Explosive Limit (LEL) or Lower Flammable Limit (LFL): The minimum vapor concentration of flammable liquid in air, below which flame propagation does not occur on contact with an ignition source.

Permit Required Confined Space: A confined space that has one or more of the following characteristics:

- Contains or has potential to contain a hazardous atmosphere.
- Contains a material that has the potential for engulfing an entrant.
- It has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
- Contains any additional recognized serious safety or health hazard.

Retrieval System: The equipment (including a retrieval line, full -body harness, lifting device or anchor) used for non-entry rescue of persons from permit required confined spaces.

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

6.8 Confined Space Entry Procedures

All confined spaces shall be evaluated by an entry supervisor prior to authorizing entry to determine if the confined space is permit required, or a non-permit required confined space.

6.8.1 Permit Required Confined Space Entry Procedures

An entry supervisor, entry attendant, and entrant will be designated to participate in each permit required confined space entry. *Note: The entry supervisor is authorized to function as an entry attendant.*

Acquire, inspect, and set up all safety equipment required by the permit, including blowers, full body harness, rescue tripod, and rope or cables.

The entry supervisor will establish appropriate rescue procedures specific to the space entry and will list these procedures on the Confined Space Entry Permit.

All hazardous energy sources will be locked and tagged out. (Refer to UAB-GSS-11 Lockout/Tagout Procedures.)

The confined space atmosphere will be tested to determine whether dangerous air contamination exists and/or if oxygen levels are outside the required range. A direct reading gas monitor will be used. Testing will be performed by the entry supervisor who has successfully completed the gas detector training for the monitor that will be used. The minimum parameters to be monitored are oxygen deficiency or excess, LEL/LFL, H2S and carbon monoxide (CO) concentrations. A written record of the pre-entry test results will be made and kept at the work site for the duration of the job. Personnel that are affected by the confined space will be able to review the testing results.

The entry supervisor will complete and sign the Confined Space Entry Permit prior to space entry. The permit conditions, entry precautions, and rescue procedures will be reviewed with the attendant and entrant(s) prior to entry.

Prior to entry, the attendant will verify that entry conditions are acceptable.

The entrant must wear retrieval equipment during the entire entry operation.

The attendant will continuously monitor the portable gas detector and record the readings every hour, at minimum.

The entry supervisor and attendants shall be always in constant communication with the entrant via radio and/or voice. This must be specified on the permit form.

An immediate evacuation of the space will be ordered if the safety equipment fails or if the space becomes, or has the potential to become, immediately hazardous.

Upon completion of work, the entry supervisor will cancel the permit and ensure that the completed permit is retained in the department’s records. EHS will periodically review the permits while auditing the Confined Space Program.

6.8.2 Ventilating a Confined Space

Set up one or more blowers to provide adequate ventilation for the space. Ventilation must be forced draft discharge of clean air into the space (not exhaust of the space).

Ensure that ventilation air supply is from a clean source. Allow enough time for blowers to clear the space before entering.

After a suitable ventilating period, repeat the testing. Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated.

Ensure that the blowers remain on during the entire entry operation. If the blower fails, the entrant must leave the space immediately.

6.8.3 Monitoring Confined Space Air Quality

Prepare the gas detector. A trained and authorized person, prior to entering a confined space, will prepare the gas detector by ensuring the device is in good working order, and will follow the manufacturer instructions for calibration and maintenance requirements of the equipment.

Conduct a bump test. Breathe into the gas detector probe and look for a decrease in oxygen concentration – the detector should alarm due to the lack of oxygen.

Sample the air quality of the space. This is done by slightly moving the lid (horizontal entry) or by testing the space through a hole in the lid (if available) before completely opening the space (vertical entry.)

Lower the probe slowly into the space, allowing time for the instrument to detect atmospheric changes at different vertical heights within the space (vertical entry.)

Measure in the following order and record the results on the Confined Space Entry Permit: Oxygen, LEL/LFL, H2S, CO.

Lock and tag out all hazardous energy sources. (Refer to GS-100-11.0: Lockout/Tagout (LO/TO).

Test the confined space atmosphere. The confined space atmosphere will be tested to determine whether dangerous air contamination and/or oxygen levels exist. A direct reading gas monitor will be used. Testing will be performed by the entry supervisor who has successfully completed the gas detector training for the monitor to be used. The minimum parameters to be monitored are oxygen deficiency or excess, LEL/LFL, H2S and CO concentrations. A written record of the pre-entry test results will be made and kept at the work site for the duration of the job. Affected employees will be able to review the testing results.

Complete and sign the Confined Space Entry Permit. This will be done by the entry supervisor prior to space entry. The permit conditions, entry precautions, and rescue procedures will be reviewed with the attendant and entrant(s) prior to entry.

Verify that the entry conditions are acceptable. This will be done by the attendant.

Wear retrieval equipment during the entire entry operation. This will be done by the entrant.

Continuously monitor the portable gas detector and record the readings every hour (minimum). This will be done by the attendant.

Ensure ongoing communication. The attendant must be always in constant communication with the entrants via radio and/or voice. This must be specified on the permit form.

Order an immediate evacuation, if needed. An immediate evacuation of the space will be ordered if the safety equipment fails or if the space becomes, or has the potential to become, immediately hazardous.

Cancel the permit. Upon completion of the job, the entry supervisor will cancel the permit and ensure that the completed permit is retained in the department's records.

The gas detector will remain on during the entire entry operation and will be regularly inspected by the attendant. The attendant will also record the gas readings on the record sheet at a minimum of one-hour intervals or after breaks (e.g., lunch, etc.) before re- entering the space.

Entry operations will cease, and entry personnel will be removed if the following concentrations are exceeded any time:

- Oxygen readings less than 19.5% or greater than 23.5%.
- Combustible gas reading equal to or greater than 10% LEL/LFL.
- H2S reading equal to or greater than 10 ppm.
- CO reading greater than 50 ppm.

6.8.4 Emergency Rescue from Permit Required Confined Spaces

Only designated emergency rescue personnel may attempt to conduct a confined space rescue or retrieval. If at any time rescue or retrieval of the confined space entrant is necessary, the attendant or entry supervisor MUST IMMEDIATELY CALL the Birmingham Fire Department by dialing 911 or UAB Emergency Dispatch at 205-934-3535. Additionally, EHS shall be notified at 205-934-2487 immediately after notifying emergency services.

Retrieval equipment is required for all permit required vertical entries. Retrieval equipment shall include the minimum items:

- Rescue harness.
- Rescue tripod.
- Rope or cable.

7.0 Electrical Safety

Electrical safety refers to any type of precaution taken to protect against electric currents. Contact with electricity can cause serious injuries (e.g., electrical shocks, electrical burns, electrocution). If severe enough, electrocution can be fatal.

7.1 Purpose

To ensure that UAB employees understand and comply with the regulatory requirements of electrical standards, and to protect all students, staff, faculty, and visitors on the UAB campus.

7.2 Scope

These guidelines apply to all UAB personnel and projects involving electrical work activity or exposure.

7.3 Environmental Health and Safety (EHS) Responsibilities

EHS shall provide technical assistance in defining hazardous operations, designating safe practices, and selecting proper devices. When necessary, recommend the development of standard operating procedures for electrical equipment and devices in use from the principal supervisor. In coordination with supervisors, review and approve standard operating procedures upon request. Evaluate potential electrical hazards during facility inspections to ensure compliance with existing policy and other safety guidelines. Request support on hardware and equipment testing, tagging out of service equipment, and taking corrective action where necessary. Support employees' training relative to electrical safety. Develop and revise UAB’s electrical safety policy periodically, or when regulatory changes occur.

7.4 Supervisors Responsibilities

Supervisors shall ensure the safety of their personnel and mitigate hazards within their area of responsibility.as necessary. Ensure that all personnel are properly trained, instructed in the safe operation of electrical equipment, and are aware of all hazards associated with the use of these electrical devices. Initiate any necessary administrative action required to enforce safety practices. Review qualified personnel to ensure they are competent in performing their specified duties. Assist in verifying electrical equipment is installed in accordance with applicable codes. Directly observe assigned personnel’s work practices.

7.5 Qualified Personnel Responsibilities

Understand and follow standard operating procedures, regulatory codes, and standards prior to performing electrical work. Use non-conducting or insulated tools and the proper personal protective equipment (PPE) when working with electricity. Never touch wet power tools, electrical cords, or electric equipment. Stay at least 10 feet away from overhead power lines. Never use damaged power tools or electrical cords. Understand and adhere to emergency procedures. Immediately report any work-related injury. Report all potentially hazardous conditions (e.g., faulty equipment, misuse of device) to your supervisor and/or EHS.

7.6 Training Requirements

Electrical safety training is not required for personnel whose job duties do not bring them close enough to expose parts of electrical circuits (50 volts or more to the ground).

Unqualified persons, including personnel who use power tools, perform servicing of equipment and machines, and/or perform maintenance or repair functions on electrical equipment, and who are close enough to exposed parts of electrical circuits (50 volts or more to the ground), require electrical safety training.

Training must be performed before the employee is assigned duties involving work around or on electrical systems.

Retraining will be performed whenever inspections performed by the employee's supervisor, or EHS, indicate that an employee does not have the necessary knowledge or skills to safely work on or around electrical systems. Retraining will also be performed when policies or procedures change and/or new equipment or systems are introduced into the work area.

To be considered a Qualified Person (Qualified Personnel), personnel shall be trained and proficient in the following:

- Can distinguish exposed energized parts from other parts of electrical equipment.
- Determine the nominal voltage of exposed energized parts.
- Know what personal protective equipment to wear and understand flash protection boundaries.
- Approach distances.
- Must be trained in the specific equipment they will work with.
- Medical services and first aid and rescue equipment.
- Lockout/Tagout (LO/TO) procedures.
- Understand the specific hazards associated with electrical energy.
- Understand safety related work practices.
- Be familiar with UAB-GSS-7 Electrical Safety.
- Understand the live work permit system.

7.7 Definitions

Arcing: A type of continuous electric discharge, giving intense light and heat, formed between two electrodes in a gas at low pressure or in open air.

Authorized Lockout/Tagout (LO/TO) Personnel: A person who has completed the required hazardous energy control (LO/TO) training and is authorized to lockout or tagout a specific machine or equipment to perform service or maintenance.

Confined Space: An enclosed space which has limited egress and access and has a potential atmospheric hazard.

Dead Front: Without live parts exposed to a person on the operating side of the equipment.

De-Energized Electrical Work: Electrical work that is performed on equipment that has been previously energized and is now free from any electrical connection.

Disconnecting/Isolating Switch: A device designed to close and/or open an electric circuit.

Energized Electrical Work: Repair, maintenance, troubleshooting, or testing on electrical circuits, components, or systems while energized.

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

Exposed Electrical Parts: Energized parts that can be inadvertently touched or approached nearer than a safe distance by a person. Parts not suitably guarded, isolated, or insulated. (e.g., terminal contacts and lugs, bare wiring).

Ground Fault Circuit Interrupter (GFCI): A device whose function is to interrupt the electric circuit to the load when a fault current to ground exceeds a predetermined value that is less than that is required to operate the over-current protective device of the supply circuit.

Ground: A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

Hazardous Location: An area in which an airborne flammable dust, vapor, or gas may be present and would represent a hazard if a source of ignition were present.

High Voltage: Circuits with a nominal voltage greater than 600 volts.

Interlock: An electrical, mechanical, or key-locked device intended to prevent an undesired sequence of operations.

Isolating Power System: A system comprising of an isolating transformer or its equivalent, a line isolation monitor, and its ungrounded circuit conductors.

Life Safety Equipment: Equipment that provides critical protection for life in the event of an emergency or other serious hazard.

Lockout: The placement of a lock on an energy-isolating device according to procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout/Tagout (LO/TO): A standard that covers the servicing and maintenance of machines and equipment in which the unexpected re-energization of the equipment or release of stored energy could cause injury to employees.

Low Voltage: Circuits with a nominal voltage of less than or equal to 600 volts.

One-Hand Rule: When necessary to work on a “live” circuit, it is best to perform the work with one hand to prevent a deadly hand-to-hand (through the chest) shock current path.

Outlet: A point of the wiring system at which current is taken to supply utilization equipment.

Overcurrent: Any current exceeding the rated current of equipment of the ampacity of a conductor. An overcurrent is the result of an overload, short circuit, arc, or ground fault.

Personal Protective Equipment (PPE): Personnel who work directly with electricity should use the PPE required for the jobs they perform. This equipment may include rubber insulating gloves, hoods, sleeves, matting, blankets, line hose, and industrial protective helmets designed to reduce risks of electric shock.

Qualified Person: One who has received training in, and has demonstrated skills and knowledge in, the construction and operation of electric equipment, installations, and the hazards involved.

Note 1: Personnel may be considered qualified regarding certain equipment, but unqualified regarding other equipment.

Note 2: Personnel undergoing on the job training (OJT) and who, during their OJT phase, have demonstrated an ability to perform their duties safely and proficiently are considered a qualified person for the performance of only those duties only while under the direct supervision of a qualified person.

Remote-Control Circuit: Any electric circuit that controls any other circuit through a relay or an equivalent device.

Service: The conductors and equipment that deliver energy from the electricity supply system to the wiring system of the premises served.

Service Equipment: The necessary equipment, usually consisting of a circuit breaker, or switch and fuses, and their accessories, located near the entrance of supply conductors to the building and intended to constitute the main control and means of cutoff to the supply.

Switching Devices: Devices designed to close and/or open one or more electric circuits. Included in this category are circuit breakers, cutouts, disconnecting (or isolating) switches, disconnecting means, interrupter switches, and oil (filled) cutouts.

Tagout: The placement of a tagout device on an energy-isolating device according to procedure to indicate that the equipment may not be operated until the tagout device is removed.

Voltage: The difference of electrical potential between two points of an electrical or electronic circuit, expressed in volts. It is the measurement of the potential for an electric field to cause an electric current in an electrical conductor.

Voltage, Nominal: An approximate value assigned to a circuit or system for the purpose of conveniently designating its voltage class (as 120/240 volts, 480/277 volts, 600 volts). The actual voltage at which a circuit operates can vary from the nominal with a range that permits satisfactory operation of equipment.

7.8 Installation Requirements

Electrical equipment shall be free from recognized hazards that may cause death, injury, or damage to equipment. Equipment shall be suitable for installation and shall be installed and used in accordance with applicable building codes and standards.

Each disconnecting means (i.e., circuit breaker), shall be clearly labeled to indicate the circuit's function unless it is located and arranged so the purpose is evident. Identification should be specific rather than general and all labels and marking must be durable enough to withstand the environment to which they may be exposed and must include nominal voltage being utilized by the device.

Motors and motor operated equipment with more than one source of power may have multiple disconnects. Where multiple disconnecting means are provided, a permanent warning sign shall be provided on or adjacent to each disconnecting means.

Live parts of electric equipment operating at 50 volts or more must be guarded by use of an approved cabinet or in a room or vault that is accessible to qualified persons only.

Entrances to rooms and other guarded locations that contain exposed live parts operating at 50 volts or more shall be marked with conspicuous warning signs prohibiting unauthorized entry.

7.9 Wiring Design and Protection

New electrical wiring, and the modification, extension, or replacement of existing wiring, and all other electrical related work shall conform to the requirements of the National Electric Code (NEC), also known as NFPA 70, and applicable OSHA regulations.

No grounded conductor shall be attached to any terminal or lead to reverse its designated polarity. The grounding terminal or grounding-type device on a receptacle, cord connector, or attachment plug shall not be used for any purpose other than grounding.

Conductors and equipment shall be protected from overcurrent above their listed current carrying capacity.

All alternating current systems of 50 to 1,000 volts shall be grounded as required by the NEC. The path to the ground from circuits, equipment, and enclosures must be permanent and continuous.

Conductors entering boxes, cabinets or fittings shall be protected from abrasion, and openings through which conductors enter must be effectively closed.

All pull boxes, junction boxes and fittings shall be provided with approved covers. If metal covers are used, they must be grounded. In completed installations, each outlet box must have a cover, faceplate, or fixture canopy. Pull boxes and junction boxes for systems over 600 volts, nominal, must provide complete enclosure, the boxes must be closed by suitable covers securely fastened in place, and the cover must be permanently marked “High Voltage.”

Switchboards and panelboards that have exposed live parts must be in permanently dry locations, and only accessible to qualified personnel. Panelboards must be mounted in cabinets, cutout boxes, or other approved enclosures, and must be dead front unless accessible to qualified persons only. Receptacles installed in damp or wet locations must be suitable for the location.

Cabinets, cutout boxes, fittings, boxes, and panelboard enclosures in damp or wet locations shall be installed to prevent moisture or water from entering and accumulating within the enclosures and shall be mounted so there is at least 6.35-mm (0.25-in.) airspace between the enclosure and the wall or other supporting surface. However, nonmetallic enclosures may be installed without the airspace on a concrete, masonry, tile, or similar surface. The enclosures shall be weatherproof in wet locations.

Screw-base light socket adapters do not maintain ground continuity and may not be used.

Multi-plug receptacle adapters may not maintain ground continuity or may overload circuits and must not be used. If additional receptacles are needed in a work location, additional circuits and/or receptacles must be installed.

Multi-plug power strips with overcurrent protection are acceptable for use with electronic equipment, however, they may not be “daisy-chained” (i.e., two or more power strips plugged into each other in a chain).

Electrical equipment, wiring methods and installations of equipment in hazardous classified locations must be intrinsically safe, approved for the location, or safe for the location.

7.10 Temporary Wiring Requirements

Temporary electrical power and lighting installations 600 volts or less, including flexible cords, cables, extension cords, and distribution panels, may only be used for, and during, renovation, maintenance, repair, or experimental work. Temporary wiring may also be used for decorative lighting for special events and similar purposes for a period not to exceed 90 days.

Ground-fault protection (e.g., ground-fault circuit interrupters or GFCI) must be provided on all temporary wiring circuits, including extension cords, used on construction sites. A GFCI must also be used when extension cords and/or equipment are used in wet, damp, or conductive locations.

All equipment and tools connected by cord and plug must be grounded. Listed or labeled double insulated tools and appliances need not be grounded.

Feeder lines must originate in an approved distribution center, such as a panel board, which is rated for the voltage and current the system is expected to carry.

Branch circuits must originate in an approved power outlet or panel board.

Bare conductors or earth returns shall not be used for the wiring of any temporary circuit.

Receptacles must be of the grounding type. Unless installed in a complete metallic raceway, each branch circuit must contain a separate equipment-grounding conductor, and all receptacles must be electrically connected to the grounding conductor.

Flexible cords and cables must be United Laboratories (UL) listed and suitable for the location and intended use.

Flexible cords and cables shall not run through holes in walls, ceilings, floors, doorways, windows, or similar pinch points unless protected from damage.

Flexible cords and cables shall not be attached to building surfaces, concealed behind building walls, ceilings, floors, or used as a substitute for fixed wiring.

Flexible cords and cables must be protected from accidental damage. Sharp corners and projections are to be avoided.

Temporary wiring shall be inspected before each use. Splicing is prohibited.

7.11 Electrical Closet and Equipment Clearances

In any workspace where there is electric equipment operating at over 600 volts, there must be at least one entrance at least twenty-four inches wide by six feet six inches high to permit escape in the event of an emergency. Any exposed energized conductors operating at any voltage and located near the entrance must be guarded to prevent accidental contact. Any insulated energized conductors operating at over 600 volts and located next to the entrance must also be guarded.

Sufficient access and working space must be provided and maintained around all electric equipment to permit ready and safe operation, and maintenance of the equipment. Working clearances shall not be less than thirty-six inches in all directions from electric equipment. Electrical closets shall not be used for storage, offices, living spaces, etc.

7.12 General Precautions

Two people should always be present during electrical operations, and one of those people should be trained in emergency procedures.

Always have an observer trained in emergency shutdown and first aid. Follow the one hand rule when working on live circuits, if possible.

Treat all exposed wiring and electrical parts as potentially live until it has been checked with a meter.

Make sure the area you are working in is properly illuminated before working on exposed wires. Do not reach into blind areas.

All ladders used near exposed energized sources must have non-conductive side rails and must be clean (free of oil, grease or contamination that would cause it to be conductive).

Never work around a source of electricity when you are wet, it is raining, or your surroundings, tools or clothes are wet. Keep a towel handy for drying your hands and change your clothes if they become wet.

All housekeeping duties should not be performed close to live parts, unless adequate safeguards are provided. Electrically conductive cleaning materials, such as steel wool, should not be used near energized parts.

Where flammable or ignitable materials are present, do not use electric equipment capable of igniting them unless measures are taken to prevent hazardous conditions from developing.

7.13 Emergency Response/Action

In the event of electrocution, immediately dial 911 or UAB Emergency Services at 205-934-3535. Report all incidents to your immediate supervisor and EHS at 205-934-2487.

A person being shocked needs to be disconnected from the source of electrical power. Locate the disconnecting switch/breaker and turn it off. Alternatively, if the disconnecting device cannot be located, the victim can be pried or pulled from the circuit by an insulated object such as a dry wood board, piece of nonmetallic conduit, or rubber electrical cord.

Victims need an immediate medical response: check for breathing and pulse, then apply CPR as necessary to maintain oxygenation. If possible/necessary, locate and utilize an automated external defibrillator (AED) and follow the instructions provided.

If the victim is still conscious after being shocked, they need to be closely monitored and cared for until trained emergency response personnel arrive. There is danger of physiological shock, so keep the victim warm and comfortable.

Shock victims may suffer heart trouble for up to several hours after being shocked. The danger of electric shock does not end after immediate medical attention. Refer to UAB-GSS-3 Incident, Accident, and Injury Reporting for reporting instructions.

8.0 Fall Prevention and Fall Protection

Fall prevention is any system or process you use to keep an accidental fall from being a risk. Fall protection is equipment that you use to minimize an injury in the event of an accidental fall.

8.1 Purpose

To specify practices and training for the safety of personnel while working on elevated surfaces and ladders to minimize/eliminate fall related injuries and fatalities.

8.2 Scope

This guidance applies to all personnel that perform any duties on an elevated work surface where there is a fall hazard of 4 feet or more to a lower level.

8.3 Environmental Health and Safety (EHS) Responsibilities

Provide training, conduct evaluations of elevated work areas, and assist in the selection of the proper equipment for the work to be performed.

8.4 Supervisors Responsibilities

Follow and enforce established fall prevention and fall protection procedures for personnel working at heights.

8.5 Personnel Responsibilities

Personnel who work at heights of four feet or greater shall follow all established fall prevention and fall protection procedures. This includes the use of the personal protective equipment and attending required fall protection and fall prevention training. Additionally, personnel operating aerial lifts, scissor lifts, and other elevated platform equipment shall receive training prior to the use of this equipment.

8.6 Training

Fall Protection training shall be provided for all personnel. Refresher training will be provided periodically to all personnel who use a personal fall arrest system. Training shall be documented, and records shall be maintained, as required.

Employees who use personal fall arresting systems to control fall hazards in their work area shall be knowledgeable of the following:

- The application limits of the equipment.
- The proper hook-up, anchoring and tie-off techniques including determination of elongation and deceleration distance.
- Methods of use, inspection, and storage of equipment.

8.7 Definitions

Aerial lift device: Equipment such as powered platforms, vehicle-mounted elevated and rotating work platforms, extendible boom platforms, aerial ladders, articulating boom platforms, vertical towers, and powered industrial truck platforms.

Anchor point: A secure point of attachment for lifelines, lanyards, or deceleration devices.

Body harness: An interconnected set of straps that may be secured about a person in a manner that distributes the fall arrest forces over at least the thighs, pelvis, waist, chest, and shoulders with a means for attaching the harness to other components of a personal fall arrest system.

Deceleration device: Any mechanism, such as a rope, grabbing device, rip stitch lanyard, specially woven lanyard, or automatic self-retracting lifeline/lanyard, which serves to dissipate energy during a fall arrest, or otherwise limits the energy imposed during fall arrest.

Deceleration distance: The additional vertical distance a falling person travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which a deceleration device begins to operate.

Fixed ladder: A ladder, including an individual rung ladder, which is permanently attached to a structure, building, or equipment.

Guardrail: A barrier at least 42 inches high erected to prevent personnel from falling from working levels more than 30 inches above the floor, ground, or other working areas of a building.

Hole: A void or gap 2 inches or more in its least dimension in a floor, roof, or other walking/working surface.

Ladder: A device typically used to gain access to a different elevation consisting of two or more structural members crossed by rungs, steps, or cleats.

Lanyard: A flexible line of woven fabric or a strap that has a connector at each end for connecting the body harness to a deceleration device, lifeline, or anchor point.

Lifeline: A component consisting of a flexible line for connection to an anchorage at one end to hang vertically or for connection to anchorages at both ends to stretch horizontally. This serves as a means for connecting other components of a personal fall arrest system to the anchorage.

Lower levels: Those areas or surfaces to which an employee can fall. Such areas include, but are not limited to, ground levels, floors, platforms, ramps, runways, excavations, tanks, water, equipment, structures, or portions thereof.

Floor opening: An opening measuring 12 inches or more in its least dimension, in any floor, platform, pavement, or yard through which persons may fall, such as a hatchway, stair or ladder opening, pit, or manhole.

Personal fall arrest system: A system used to arrest a person in a fall from a working level. It consists of an anchorage, connectors, and body harness. It may include a lanyard, deceleration device, lifeline, or suitable combinations of these.

Restraint line: A device, which is attached between the person and an anchorage to prevent the employee from walking or falling off an elevated surface.

Scaffold: Any temporary elevated or suspended platform, and its supporting structures, used for supporting personnel and/or materials.

Self-retracting lifeline/lanyard: A deceleration device containing a drum-wound line which can be slowly extracted from, or retracted into, the drum under minimal tension during normal movement and which, after onset of a fall, automatically locks the drum and arrests the fall.

Standard railing: A vertical barrier erected along exposed edges of a floor opening, wall opening, ramp, platform, or runway to prevent falls.

Toe board: A vertical barrier at floor level erected along exposed edges of a floor opening, wall opening, platform runway, scaffold. or ramp to prevent falls of materials.

Tie-off: A procedure of connecting directly or indirectly to an anchorage point.

Unprotected sides and edges: Any side or edge (except at points of access) of a walking/working surface, (e.g., floor, roof, ramp, or runway) where there is no wall or guardrail system at least 42 inches high.

Walking/working surface: Any surface, whether horizontal or vertical, on which personnel walk or work including, but not limited to, floors, roofs, ramps, bridges, and runways.

Wall opening: A gap or void 30 inches or more high and 18 inches or more wide in a wall or partition, through which personnel may fall to a lower level.

Work area: That portion of a walking/working surface where job duties are being performed.

8.8 Standard Requirements

The requirement for fall protection covers the following equipment/work environment(s):

- **Ladders** – fixed, free standing, temporary, or roll away type.
- **Elevated Personal Platforms** – scaffolding, Baker scaffolds, aerial lifts, scissors lifts, etc.
- **Elevated Surfaces** – roofs (closer than 6 feet from a leading edge), catwalks, skylights, boilers, chillers, etc.
- **Vertical Openings** – ground level entry into excavations, trenches, holes, vaults, vessels, and other confined spaces.

Fall protection is required whenever work is performed in an area 4 feet above its surroundings, and can generally be provided using fall protection systems including:

- **Covers** - Covers are fastened over holes in the working surface to prevent falls.
- **Guardrails** - Standard guardrails consist of a top rail, located 42 inches above the floor, and a mid-rail. Screens and mesh may be used to replace the mid-rail, so long as they extend from the top rail to the floor.
- **Personal Fall Arresting Systems** - Components of a personal fall arrest system includes a body harness, lanyard, lifeline, connector, and a certified anchor point which can support at least 5,000 pounds.
- **Warning Line Systems** - Warning line systems are made up of lines or ropes installed around a work area on a roof. These function as a barrier to prevent those working on the roof from approaching its edges.

8.9 Ladders

Personnel using ladders at a working height of 4 feet or greater shall be knowledgeable of the following:

- How to inspect ladders for visible defects.
- How to use ladders properly.

Personnel who utilize fixed ladders with a working height of 24 feet or greater shall have a fall arrest system attached.

Personnel using a ladder shall maintain three points of contact.

8.10 Personal Fall Arrest Systems

Fall arrest equipment reduces the risk of injuries that may occur when a person falls from one level to another. If engineering controls are not feasible to prevent the fall, fall arrest equipment is required.

Components of a Personal Fall Arrest System include:

- **Body harness** - The harness must comfortably, but snugly, fit the individual. Many body harnesses are designed for "universal fit" to accommodate several individuals. "Universal fit" has limitations; the mid-range “universal fit” may not adequately accommodate individuals that have smaller or larger frames.
- **Shock absorbing lanyards** - Shock absorbing lanyards are required. Static rope and nylon lanyards must be replaced with an appropriate length shock-absorbing lanyard. During fall arrest, the rip stitching of the shock-absorbing lanyard absorbs the shock of the fall drastically reducing forces onto the body and preventing significant injury. Special attention must be given to the stopping distance required by the manufacturer of the lanyard.
- **Locking snap hooks** - Locking snap hooks are required. All connection hardware (e.g. - snap hooks, carabineers) must have a locking mechanism to prevent rolling out from the anchor and sized appropriately to fit with the anchor.
- **Inspection of fall arrest equipment** - The employee will perform a visual inspection of the equipment prior to each use. General Industry standards, UAB, and fall arrest equipment manufacturers require any defective equipment to be immediately removed from service and replaced. Defective equipment must be destroyed to prevent accidental use that could endanger someone's life.

8.10.1 Personal Fall Arrest Systems Inspection

Defects include, but are not limited to, cuts, burns, abrasions, loose threads in stitching, tears, stretching, rust, and mold. Metal or plastic hardware may be damaged or missing.

Reject the equipment for use if any of the following nylon webbing defects are noted:

- Hard shiny spots on the webbing, the nylon appears shriveled, and/or brittle. Any discoloration of the webbing. Loss of elasticity and stitching at connection points that is frayed or unraveling.

When inspecting hardware, look for cracks, pitting, and any distortion in all hardware components such as: buckles, D-rings, snap hooks, carabineers, rivets, and grommets. Pay particular attention to belt buckle grommets due to excessive wear from use; buckles must function properly. Snap hooks must lock and close tightly.

8.10.2 Use of Personal Fall Arrest Systems

- Always use a secure anchor point (must hold 5,000 lb. load).
- Connect to an anchor point at shoulder level or above. Never connect below the D-ring of the body harness.
- Connection to anchor points must prevent a dangerous swing fall hazard or impact with any lower level in the event of a fall.
- Connection to an anchor point must limit the fall to no greater than 4 feet.
- Use chafing pads or anchor slings to prevent cutting connectors (lanyards and lifelines) on sharp edges.
- Do not use knots on connectors (lanyards and lifelines).
- Vertical lifelines must be synthetic (nylon) fiber.
- Rope grab devices used on vertical lifelines must be secured 12 feet up from the terminal end of the vertical lifeline.
- Terminate the end of the vertical lifeline to prevent the rope grab device from slipping off.
- Only one person shall tie off to a vertical lifeline.

8.10.3 Cleaning and Storage of Personal Fall Arrest Systems

Follow the equipment manufacturers' cleaning instructions. Always dry equipment naturally. Use an approved lubricant (light oil or lubricant) to oil snap hooks when dry. Store clean and dry away from direct sunlight and excessive heat.

9.0 Forklift Safety

Forklift safety is the set of procedures utilized for the proper use of forklifts including before and after forklift operations. These forklift safety procedures will minimize the risk of incidents and ensure that the operator and the people within the vicinity are protected.

9.1 Purpose

The purpose of this guide is to inform operators and supervisors of their obligation to follow OSHA, NFPA, and other federal, state, and local regulations pertaining to the use of powered industrial trucks and forklifts at UAB.

9.2 Scope

To establish guidelines for the safe operation, training, and evaluation procedures of powered industrial trucks and forklifts at UAB. As a guide, it is not a substitute for the regulations themselves, but a summary of important considerations.

9.3 Environmental Health and Safety (EHS) Responsibilities

- Shall provide program oversight.
- Review and audit powered industrial truck/forklift safety training, as necessary.
- Provide forklift safety training upon request from the supervisor.
- May audit a department or responsible unit and assign training, as necessary.

9.4 Supervisors Responsibilities

- Identify and designate employees responsible for operating powered industrial trucks/forklifts.
- Ensure that all employees under their direction, who operate a powered industrial truck/forklift are trained and evaluated.
- Maintain records of training and evaluation.
- Ensure that forklifts are repaired when malfunctioning and maintained or taken out of service until such repairs can be made.

9.5 Forklift Operator Responsibilities

- Be trained and evaluated before operating a powered industrial truck/forklift.
- Be evaluated by a competent person every three years.
- Operate and maintain equipment in a safe manner according to regulations and training.
- Report all equipment problems to their supervisor.

9.6 Inspection Procedures

The following section will review pre-operational, battery systems, propane systems, and operational inspections. These procedures are meant as a general guide to performing an inspection of equipment due to having several different manufacturers and models of forklifts that are utilized at UAB. The manufacturer's instructions for inspections of the equipment to be inspected shall take precedence.

9.6.1 Pre-Operational Inspection

A pre-operational inspection can identify potential hazards that may be encountered from a damaged forklift and must be performed by the operator prior to operation. If at any time a forklift is found to need repair, defective, or in any way unsafe, the forklift shall be removed from service until it has been restored to safe operating condition. Always refer to the specific manufacturers provided manual for appropriate inspections guidance. A forklift does not need to be inspected on any day that it is not used.

The pre-operational inspection can include the following, however, refer to the manufacturer's manual for the type of machine you are using:

- Verify that the data plate is present, legible, and represents the configuration in use.
- Verify that all safety and control stickers and labels are present and legible.
- Verify that all safety equipment is present.
- Inspect the mast for broken or cracked weld points and any other obvious damage.
- Ensure roller tracks are greased and that chains are free to travel.
- Forks should be equally spaced and free from cracks along the blade and at the heels.
- Check hydraulic fluid levels.
- Check each hydraulic line and fitting for excessive wear or crimping.
- Check hydraulic lines for breakage in the outer case or sheath.
- Check lift and tilt cylinders for damage or leaking fluid. Fluid leaks are not considered normal and must be repaired.
- Inspect mounting hardware on the cylinders.
- Check tires for excessive wear, splitting or missing tire material.
- Check pneumatic tires for proper pressure indicated on the tire.

9.6.2 Battery System Inspection

Batteries contain acid, so protective gloves, goggles, and long sleeves must be worn when working with batteries. Battery systems should be inspected for:

- Cracks or holes.
- Securely sealed cells.
- Frayed cables.
- Broken insulation. This can occur when a cord rubs against the forklift casing.
- Tight connections.
- Clogged vent caps.

9.6.3 Propane System Inspection

Before replacement, all LP-gas containers should be examined by the operator for the following defects or damage:

- Dents, scrapes, and gouges of the pressure vessel.
- Damage to the various valves and liquid level gauge.
- Debris in the relief valve.
- Damage to or loss of the relief valve cap.
- Indication of leakage at the valves or threaded connections.

9.6.4 Operational Inspection

Once the pre-operational inspection has been completed, mount the forklift safely, put on your seat belt and make any personal adjustments to the seat and steering wheel/mechanism.

- Start the engine and verify that all controls operate as they should, including lift, tilt, and shift controls, lights, horns, backup alarms, etc.
- The steering wheel/mechanism should have appropriate free play.
- Move forward and brake, ensuring travelling and stopping operates as it should.
- Check the floor for evidence of fluid leaks. Again, fluid leaks are not normal and must be fixed.
- Once operational aspects are verified, you may begin work.

10.0 Crane and Hoist Safety

This program applies to cranes and hoists that are attached to any building, research facility or equipment owned or operated by UAB and to all UAB faculty, staff, students, supplemental labor, and subcontractor personnel who use such devices.

10.1 Purpose

Many types of cranes, hoists, and rigging devices are used at UAB for lifting and moving materials. UAB's program is to maintain a safe workplace for faculty, staff, and students; therefore, it cannot be overemphasized that only qualified and licensed individuals shall operate these devices.

This program has been established to:

- Ensure the safe use of cranes, hoists, and slings.
- Ensure that departments understand and comply with safety standards related to cranes and hoists.
- Assign responsibilities to personnel which are necessary for successful implementation of this program.

10.2 Scope

This program applies to all employees at UAB and covers cranes and hoists except for mobile cranes, engine hoists, and winches.

10.3 Definitions

Crane: A machine for lifting or lowering a load, and moving it horizontally, in which the hoisting mechanism is an integral part of the machine. It may be driven manually or by power and may be a fixed or a mobile machine, but does not include stackers, hoist trolleys, lift trucks, power shovels, backhoes, or excavators.

Hoist: An apparatus for raising or lowering a load but does not include a car or platform riding in guides or horizontal motion.

Qualified Person/Operator: A person designated by the department who, by reason of training and/or experience, has demonstrated the ability to safely perform all assigned duties. Persons may be deemed "qualified" to operate all or only specific cranes and hoists within a department by their supervisor.

Rigging: Collectively referred to as "below the hook devices" are also called "lift gear." May be any device used to carry, position, and secure a load while it is being hoisted or craned.

10.4 Environmental Health and Safety (EHS) Responsibilities

- Interpret crane and hoist safety regulations, rules, and standards.
- Oversee the development, revision, and implementation of UAB-GSS-10.0 Crane and Hoist Safety.
- Assist in the investigation of incidents/accidents related to cranes and hoists.

10.5 Supervisors/Principal Investigators Responsibilities

- Ensure personnel (including students) under their supervision receive the required training and are certified and licensed to operate cranes and hoists in their area.
- Provide training for crane and hoist operators. This training shall be documented and conducted by a designated instructor who is a licensed and qualified crane and hoist operator.
- Ensure that hoisting equipment is inspected and tested monthly by a qualified person, and that rigging equipment is inspected annually by a qualified person.
- Ensure personnel are provided with and use the appropriate personnel protective equipment.
- Take prompt corrective action when unsafe conditions or practices are observed.

10.6 Operators Responsibilities

- Lockout/Tagout (LO/TO) any equipment that is defective.
- Operate hoisting equipment safely.
- Conduct functional tests prior to using the equipment.
- Ensure the appropriate personal protective equipment is worn.
- Select and use the appropriate rigging equipment.
- Possess a valid operator’s license and have it on their person while operating cranes and/or hoists.
- Participate in the medical certification program, as required.
- Conduct periodic and special load tests of cranes and hoists.
- Maintain written records of inspections and tests. Maintain all manuals for cranes and hoists in a central file for reference.
- Attending all required training.
- Immediately report any unsafe conditions or concerns to their supervisor/principal investigator.
- Inspect and load test cranes and hoists following modification or extensive repairs.

10.7 Operators Minimum Requirements

Only licensed personnel shall operate a crane or hoist.

To be qualified as a crane and hoist operator, the candidate shall have received direct training from a licensed, qualified crane and hoist operator designated by the candidate's supervisor. Crane and hoist operators must renew their license every three years.

The operator is responsible for scheduling any non-destructive test and inspection for crane and hoist hooks at the time of the periodic load test, and testing and inspecting before use new replacement hooks and other hooks suspected of having been overloaded. The evaluation, inspection, and testing may include, but are not limited to visual, dye penetrant, and magnetic particle techniques referenced in ASME B30.10 (Hooks, Inspection and Testing).

Cranes and hoists shall have the following performed and verified prior to use: pre-operational, monthly, and annual inspections.

Any unsafe condition noted during an inspection shall be corrected before the equipment is used.

Operators shall comply with the manufacturer's specifications and limitations applicable to the operation of the equipment.

Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a qualified engineer competent in this field and such determinations will be appropriately documented and recorded.

Operators shall follow safe work practices when operating cranes, hoists, and associated equipment (i.e., slings).

10.8 Inspection Requirements

All tests and inspections shall be conducted in accordance with the manufacturer's recommendations:

- If any unsafe conditions exist, the equipment shall be removed from service.
- To remove a crane and hoist from service it shall be LO/TO to prevent use.
- A unit which has been idle for a period of one month or more shall be given a monthly inspection before placing in service.
- Prior to use, all new, altered, modified, or repaired cranes and hoists shall have testing performed by the installation company or a qualified third-party.
- Load tests shall not be more than 125% of the rated load unless otherwise recommended by the manufacturer.

10.8.1 Monthly Inspections

All in-service cranes and hoists shall be inspected monthly, and the results documented. Defective cranes and hoists shall be LO/TO until all defects are corrected.

10.8.2 Annual Inspections

The department that owns the equipment shall schedule and supervise the annual preventive maintenance (PM), and annual inspections of all cranes and hoists. The annual PM and inspection shall be performed by a qualified third-party company, approved by the manufacturer.

10.9 General Safety Rules

Operators shall comply with the following rules while operating cranes and hoists:

- Do not engage in any practice that will divert your attention while operating the crane.
- Respond to signals only from the person who is directing the lift, or any appointed signal person. Always obey a stop signal, no matter who gives it.
- Do not move a load over people. People shall not be placed in jeopardy by being under a suspended load. Also, do not work under a suspended load unless the load is supported by blocks, jacks, or a solid footing that will safely support the entire weight. The operator shall remain at the controls, or LO/TO the main electrical disconnect switch.
- Ensure that the rated load capacity of a crane, hoist, or any sling or fitting is not exceeded. Know the weight of the object being lifted. Use a dynamometer or load cell to determine the weight if it is unknown.
- Ensure all controls are in the OFF position before closing the main line disconnect switch.
- Avoid side pulls. These can cause the hoist rope to slip out of the drum groove, damaging the rope or destabilizing the crane or hoist.
- To prevent shock loading, avoid sudden stops or starts. Shock loading can occur when a suspended load is accelerated or decelerated and can overload the crane or hoist. When completing an upward or downward motion, ease the load slowly to a stop.

10.10 Overloading

Cranes and hoists shall not be loaded beyond their rated capacity for normal operations. Any crane or hoist suspected of having been overloaded shall be removed from service by LO/TO the main disconnect switch. Additionally, overloaded cranes shall be inspected, repaired, load tested, and approved for use before being returned to service.

10.11 Hand Signals

Signals to the operator shall be in accordance with the standard hand signals unless voice communications equipment (telephone, radio, or equivalent) is used. Signals shall be discernible or always audible. Some operations may require additional or modified basic signals. For all such cases, these signals shall be agreed upon and thoroughly understood by both the person giving the signals and the operator and shall not conflict with the standard signals.

10.12 Pre-Operational Inspection

Prior to operation, operators shall perform the following steps before making lifts with any crane or hoist:

- Test the upper-limit switch. Slowly raise the unloaded hook block until the limit switch trips.
- Visually inspect the hook, load lines, trolley, and bridge as much as possible from the operator's station; in most instances, this will be the floor of the building.
- If provided, test the lower-limit switch.
- Test all direction and speed controls for both bridge and trolley travel.
- Test all bridge and trolley limit switches, where provided, if operation will bring the equipment near the limit switches.
- Test the pendant emergency stop.
- Test the hoist brake to verify there is no drift without a load.
- If provided, test the bridge movement alarm.
- LO/TO to repair any crane or hoist that fails any of the above tests.

10.13 Rigging Inspection

Only select rigging equipment that is in good condition. All rigging equipment shall be inspected annually. Defective equipment shall be removed from service and destroyed to prevent inadvertent use. The load capacity limits shall be stamped or affixed to all rigging components. Reject any rigging equipment with a minimum of one of the following discrepancies:

- Nylon slings with abnormal wear, torn stitching, broken or cut fibers, discoloration, or deterioration.
- Wire-rope slings with kinking, crushing, bird-caging, or other distortions. Evidence of heat damage, cracks, deformation, or worn end attachments. Six randomly broken wires in a single rope lay or three broken wires in one strand of rope.
- Hooks opened more than 15% at the throat. Hooks twisted sideways more than 10 degrees from the plane.
- Chain slings with racked, bent, or elongated links or components. Cracked hooks, shackles, eye bolts, turnbuckles, or other components that are damaged/deformed.

10.14 Rigging a Load

- Determine the weight of the load. Do not guess.
- Determine the proper size and weight capacity for slings and components.
- Do not use manila rope for rigging.
- Ensure that shackle pins and shouldered eye bolts are installed in accordance with the manufacturer's recommendations.
- Ensure ordinary (shoulder less) eye bolts are threaded at least 1.5 times the bolt diameter.
- Use safety hoist rings (swivel eyes) as a preferred substitute for eye bolts when possible.
- Pad sharp edges to protect slings. Remember that machinery foundations or angle-iron edges may not feel sharp to the touch but could cut into rigging when under several tons of load. Wood, tire rubber, or other pliable materials may be suitable for padding.
- Do not use slings, eye bolts, shackles, or hooks that have been cut, welded, or brazed.
- Install wire-rope clips with the base only on the live end and the U-bolt only on the dead end. Follow the manufacturer's recommendations for the spacing for each specific wire size.
- Determine the center of gravity and balance the load before moving it.
- Initially lift the load only a few inches to test the rigging and balance.

10.15 Moving a Load

- Center the hook over the load to keep the cables from slipping out of the drum grooves and overlapping, and to prevent the load from swinging when it is lifted. Inspect the drum to verify that the cable is in the groove.
- Use a tag line when loads must traverse long distances or must otherwise be controlled.
- Manila rope may be used for tag lines.
- Plan and check the travel path to avoid personnel and obstructions.
- Lift the load only high enough to clear the tallest obstruction in the travel path.
- Start and stop slowly.
- Land the load when the move is finished. Choose a safe landing area.
- Never leave suspended loads unattended. In an emergency where the crane or hoist has become inoperative, if a load must be left suspended, barricade and post signs in the surrounding area, under the load, and on all four sides. LO/TO the crane and hoists main electrical disconnect switch.

10.16 Parking a Crane or Hoist

- Remove all slings and accessories from the hook. Return the rigging device to the designated storage racks.
- Raise the hook at least 7 feet above the floor.
- Store the pendant away from aisles and work areas and/or raise it to a minimum of 7 feet above the floor.
- Place the emergency stop switch in the OFF position.

11.0 Lockout/Tagout (LO/TO)

Lockout/Tagout (LO/TO) is the de-energizing and securing of equipment, machinery, or processes so hazardous energy is not re-introduced during servicing or repair. This includes closing electrical circuits and valves, neutralizing extreme temperatures, securing moving parts and more.

11.1 Purpose

To establish practices and procedures to safeguard personnel from the release of hazardous energy. This includes the unexpected activation of mechanical equipment, electrical equipment, and/or other power sources during inspection, maintenance, and related activities.

11.2 Scope

The LO/TO standard applies to all personnel performing servicing or maintenance on machines or equipment. These personnel are exposed to the unexpected energization, startup, or release of hazardous energy.

The term "unexpected" also covers situations in which the servicing or maintenance is performed during ongoing normal production operations if:

- Any personnel that are required to remove or bypass machine guards or other safety devices.
- Personnel that are required to place any part of their body into a point of operation or into a machine or equipment where work is completed or into any hazardous area associated with the machine or equipment’s operation.

11.3 Environmental Health and Safety (EHS) Responsibilities

- Ensure the overall effectiveness of the procedures and practices detailed in this program.
- Ensure that all personnel follow this program when performing LO/TO.
- Provide the necessary support to enable effective implementation of this program and its related activities.

11.4 Definitions

Lockout: The use of appropriate locking devices to safely prevent equipment from being energized while work is in progress.

Tagout: The use of a tag to identify equipment that cannot readily be locked out of service to notify personnel that the machinery/equipment has been taken out of service and must not be reactivated while work is in progress.

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

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

Authorized Personnel: Any properly trained person who has the authority and responsibility to perform the lockout/tagout assignments.

11.5 LO/TO System Procedure

- Notify affected personnel when the LO/TO of a system will be utilized and the reason it is necessary. The authorized personnel shall know the type and magnitude of energy that the machine or equipment utilizes and shall understand the associated hazards.
- If the machine or equipment is operating, shut it down by the normal procedure.
- Operate the switch, valve, or other energy isolating device(s) so that the equipment is isolated from its energy source(s). Stored energy (such as that in springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, must be dissipated or restrained by methods such as repositioning, blocking, or bleeding down.
- LO/TO the energy isolating devices with assigned individual lock(s) and tag(s).
- After ensuring that no personnel are exposed to potential hazards, and as a check on having disconnected the energy sources, operate the push button or other normal operating controls to verify the machinery/equipment will not operate.

  CAUTION: Return operating control(s) to neutral or off position after the test.
- The machinery/equipment is now in LO/TO status.

11.6 Restoring Machinery/Equipment to Operation

- After servicing is complete and the machinery/equipment is ready for normal operations, check the area around the equipment to ensure personnel are not exposed to potential hazards.
- After all tools are removed from the machinery/equipment, guards have been reinstalled, and personnel are clear of potential hazards, remove all LO/TO devices. Operate energy isolating devices to restore energy to the machinery/equipment.

11.7 Multiple Locks

In the preceding steps, if more than one individual is required to LO/TO machinery or equipment, each individual shall place their personal LO/TO device on the energy isolating device(s). When an energy isolating device cannot accept multiple locks or tags, a multiple LO/TO device, such as a hasp, may be used. If a lockout is used, a single lock may be used to lockout the machine or equipment with the key being placed in a lockout box or cabinet that allows the use of multiple locks to secure it. Each employee will then use their own lock to secure the box or cabinet. As each person no longer needs to maintain their lockout protection, that person will remove their lock from the box or cabinet.

11.8 Temporary Removal of LO/TO Devices

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

- Remove non-essential items and ensure that equipment components are operationally intact.
- Notify affected personnel that LO/TO devices have been removed and ensure that all personnel have been safely positioned or removed from the area.
- Have personnel who applied the LO/TO devices remove them.
- Energize and proceed with testing or positioning.
- De-energize all systems and reapply energy control measures in accordance with the LO/TO System Procedure (UAB-GSS-11.5).

11.9 Maintenance of Machinery/Equipment

Where maintenance, repairing, cleaning, servicing, adjusting, or setting up operations cannot be accomplished with the energy source disconnected, such operations may only be performed under the following conditions:

- The operating station (e.g., external control panel) where the machine may be activated shall be continuously under the control of a qualified operator/person.
- All participants must have a clear view of the operator or in mutually clear communication.
- All participants must be beyond the reach of machine/equipment elements that may move rapidly and present a hazard.
- Where machine/equipment configuration or size requires that the operator leave the control station to install tools, and where there are machine/equipment elements that may move rapidly, if activated, such elements must be separately locked out.
- During repair procedures when mechanical components are being adjusted or replaced, the machine/equipment shall be de-energized or disconnected from its power source.

11.10 LO/TO Removal by Supervisor

A system shall be in place that addresses device removal if the authorized employee who applied the LO/TO device is unavailable to remove it. The person's direct supervisor may only remove the authorized person's LO/TO device(s), after necessity has been established. The procedure shall include the following:

- The person's direct supervisor shall investigate the circumstances and verify that the authorized person that applied the device is not at the facility.
- All reasonable efforts shall be made to contact the authorized person to inform them that their LO/TO device will be removed.
- The authorized person's direct supervisor is certain that removal of the LO/TO device will not endanger employees.
- The authorized persons direct supervisor will complete a *Removal of LO/TO Form*.
- Prior to resuming work, the authorized person shall be notified that their LO/TO device was removed in their absence.

11.11 LO/TO Inspections

An authorized person shall perform inspections of the energy control procedures annually. The inspections must review LO/TO procedures and correct any discrepancies noted.

12.0 Scaffolding

UAB personnel must follow general industry standards when working with scaffolds. All scaffolds must be inspected daily by a qualified person before any work begins.

12.1 Fixed Scaffolds

The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks shall not be used to support scaffolds or planks.

Scaffolds and their components shall be capable of supporting, without failure, at least four times the maximum intended load.

Scaffolds shall be maintained in safe condition. Scaffolds shall not be altered or moved horizontally while they are in use or occupied.

Any scaffold damaged or weakened from any cause shall be immediately repaired and shall not be used until repairs have been completed.

Scaffolds shall not be loaded in excess of the working load for which they are intended.

Guardrails not less than 2x4 inches or the equivalent and not less than 36 inches or more than forty-two inches high, with a mid-rail, when required, of 1x4-inch lumber or equivalent, and toe-boards shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toe-boards shall be a minimum of four inches in height.

12.2 Mobile Scaffolds

All scaffold work levels 10 feet or higher above the ground or floor shall have a standard (4-inch nominal) toe board.

All work levels 10 feet or higher above the ground or floor shall have a guardrail of 2x4- inch nominal or the equivalent installed no less than 36 inches or more than forty-two inches high, with a mid- rail, when required, of 1x4-inch nominal lumber or equivalent.

A climbing ladder or stairway shall be provided for proper access and egress and shall be affixed or built into the scaffold and so located that its use will not tend to tip the scaffold. A landing platform shall be provided at intervals not to exceed twelve feet. Never climb a ladder with tools or materials; instead, attach to the body in an appropriate support or pull up with a rope.

Employees shall not work on scaffolds during storms or high winds.

Employees shall not work on scaffolds which are covered with ice or snow, unless all ice or snow is removed, and planking sanded/scuffed to prevent slipping.

Tools, materials, and debris shall not be allowed to accumulate in quantities to cause a hazard.

13.0 Emergency Eye Wash Stations/Drench Showers

Equipment that falls under this standard includes drench showers, eyewash, eye/face wash, portable eyewash, and combination eyewash & drench shower units. Where the eyes or body of any person may be exposed to injurious hazardous materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.

13.1 Purpose

To establish guidelines and procedures for the proper use, installation, and functioning of emergency eye wash stations, drench showers, and all other associated equipment.

13.2 Scope

This standard applies to all emergency eye wash stations, drench showers, and all other associated equipment used on UAB's campus.

13.3 Environmental Health and Safety (EHS) Responsibilities

Inspect emergency eye wash stations, drench showers, and associated equipment for proper documentation of inspections. Additionally, EHS shall visually inspect the equipment to ensure it is compliant with this standard.

Advise on the design and installation requirements of emergency eye wash stations, drench showers, and associated equipment to ensure they conform to established standards.

13.4 Training

All personnel who may be exposed to hazardous, particulate, or corrosive materials shall be instructed on the proper operation of eyewash & drench shower equipment. In addition, all employees must be made aware of the locations of flushing stations. Furthermore, personnel shall read the Safety Data Sheet (SDS) prior to using any form of hazardous material. Certain chemicals are reactive to water so the application of first aid will be determined by the SDS.

13.5 Identification

Eyewash and drench shower stations must be installed in a well-lit area and identified with a highly visible safety sign.

13.6 Equipment Location

All flushing equipment must be located in areas that are accessible within 10 seconds (roughly 55 feet). Keep in mind that an injured worker may need additional time to reach the flushing stations, as the severity of the injury could vary. In the presence of highly corrosive chemicals, consideration should be given to installing the flushing equipment much closer to the hazard. Be cautious of electrical supply panels that may be within splashing distance such as charging stations for forklifts and other battery-operated machinery.

13.7 Simultaneous Operation

Units which combine a drench shower and eye/eye face wash unit must accommodate simultaneous use. Therefore, both the drench shower and eye wash unit must be fully operable at the same time to properly flush the skin, eyes, and face.

13.8 Design

Emergency showers shall be designed, manufactured, and installed in such a manner that, once activated, they can be used without requiring the use of the operator's hands.

Eyewashes and eye/face washes shall be arranged such that the flushing fluid flow pattern is not less than 33 inches and no greater than fifty-three inches from the surface on which the user stands and 6 inches minimum from the wall or nearest obstruction.

A single step up into an enclosure where the equipment can be accessed is not considered to be an obstruction. Additionally, installers should allow for adequate overhead clearance to accommodate the presence of cabinets over a counter or faucet-mounted emergency eyewash so as not to create an additional hazard that could be encountered when using the device.

13.9 Obstructions

Drench showers and eyewash stations must be located on the same level as the hazard and the path of travel shall be free from obstructions. If your facility contains a hazardous area that is located on a different level, floor, or platform than your current flushing stations, you must install equipment on every level that contains a hazard. Items such as trash cans, pallet jacks, boxes, raw materials, or any other stored items must not block access to the flushing stations. Also, a door is considered an obstruction. If the hazard is non-corrosive, one door can be present only if it opens in the same direction of travel as the person requiring the use of the flushing station.

13.10 Supply Lines

All water supply lines must be provided to meet the ANSI minimum flow requirements at 30-90 PSI. The recommended incoming pipe sizes (IPS) are as follows:

1/2" (1.27 cm) IPS for eyewash stations and eye/face wash stations

1" (2.54 cm) IPS for drench showers

1-1/4" (3.175 cm) IPS for combination eyewash drench showers

13.11 Shut-Off Valves

If shut-off valves are installed on the supply line for maintenance purposes, provisions must be in place to prevent unauthorized shut-off. Lockout/Tagout (LO/TO) devices are the preferred method to secure shut-off valves.

13.12 Water Temperature & Tepid Water

ANSI defines tepid water as "a flushing fluid temperature conducive to promoting a minimum 15-minute irrigation period. A suitable range is 16-38°C (60-100°F)".

Medical professionals recommend that tepid flushing fluids be used to treat chemically injured eyes and body tissue. Temperatures that exceed 100°F can enhance chemical interaction with the eyes and skin. Additionally, flushing fluid temperatures below 60°F can cause hypothermic shock. ANSI standard states that while cooler flushing fluids may provide immediate relief after chemical contact, "prolonged exposure to cold fluids affect the ability to maintain adequate body temperature and can result in the premature cessation of first aid treatment."

Tepid water can be delivered to eyewash and shower flushing stations by many different means. The most common method is by installing Thermostatic Mixing Valves (TMV's) or Water Tempering Valves. These valves blend hot and cold water to provide a comfortable flushing fluid within the temperature range as defined by ANSI. Access to hot water is a necessary component and can be achieved through traditional water heaters, on-demand water heaters (tankless water heaters), and recirculating systems. It is important to note that standard water mixing valves should not be used for the purpose of providing tepid water to emergency eyewash stations and drench showers. Mixing valves designed specifically for eyewash related products include a hot water shut-off to prevent accidental scalding, and a cold-water bypass to ensure the delivery of flushing fluids in the event the hot water supply fails.

During the winter months, eyewash stations and drench shower units that are exposed to freezing temperatures must be protected. ANSI states that "Where the possibility of freezing conditions exists, equipment shall be protected from freezing or freeze-protected equipment shall be installed". Freeze protection valves are a cost-effective way to prevent water from freezing in supply pipes and within the flushing stations. Additionally, heat trace units, heater jackets, and freeze protected eyewash equipment can be used to prevent the freezing of slushing stations.

For locations where the ambient water temperature may exceed 100°F, anti-scald valves should be used to purge potentially scalding water from the supply lines. This may include outdoor locations that are exposed to direct sunlight, or indoor locations that may be exposed to extreme temperatures from machinery or manufacturing processes.

13.13 Maintenance & Testing

Proper maintenance and weekly testing are necessary to ensure that emergency drench showers and eyewash stations are functioning safely and properly. Weekly testing helps clear the supply lines of sediment and bacteria build-up that is caused by stagnant water. The ANSI standard states that plumbed flushing equipment "shall be activated weekly for a period long enough to verify operation and ensure that flushing fluid is available".

Portable and self-contained equipment must be visually checked to determine if flushing fluid needs to be changed or supplemented.

13.13.1 Weekly Testing

It is required to activate the emergency equipment weekly to verify operation and to ensure there is a flushing fluid supply and clear the supply line of any sediment build-up that could prevent the flushing fluid from being delivered due to stagnant water.

The duration of the weekly activation depends on the amount of water contained in the unit itself and all sections of pipework that are not a part of a constant circulation system, also known as the “dead leg” portions. The goal of the weekly activation is to flush out the stagnant water in the dead leg completely.

Weekly activation is not required for systems that are directly supplied by a circulating water system and no stagnant water is present within the line provided to the spray head.

13.13.2 Annual Testing

All emergency eyewashes, eye/face washes, showers and combination units are required to be fully inspected annually to ensure conformance with the installation standards for that type of equipment. The following are some of the requirements that need to be met for the annual test:

1. The equipment must be assembled and installed in accordance with the manufacturer’s instructions, including flushing fluid delivery requirement.
2. Equipment must be accessible within 10 seconds, located on the same level as the potential hazard, and must be free of obstructions that may inhibit immediate use.
3. Must be identified with well-lit, highly visible signage.
4. Equipment must be connected to a supply of flushing fluid that can produce the required flush time of a full 15 minutes.
5. Where the possibility of freezing conditions exists, equipment must be protected from freezing or freeze-protected equipment must be installed.
6. Must deliver tepid flushing fluid for the full 15-minute drench period.
7. Equipment must go from “off” to “on” in 1 second or less.
8. Must provide a controlled flow of flushing fluid at a velocity low enough to be non-injurious to the user.

13.14 Personal Wash Units/Bottled Eye Wash

Bottled eyewash or other personal wash units such as single head drench hoses are considered supplemental equipment only. These types of flushing units do not meet ANSI's requirements for eyewash and/or drench shower stations and should not be used as an alternative to a 15-minute flushing station.

A personal wash unit may be kept in the immediate vicinity of employees working in a potentially hazardous area. The main purpose of these units is to supply immediate flushing. With this accomplished, the injured individual should then proceed to a plumbed or self-contained eyewash and flush the eyes for the required 15-minute period.

13.15 Performance & Installation Requirements

For detailed information please refer to the equipment manufacturer’s specifications.

13.15.1 Eye Wash Stations

- The minimum flow for plumbed and portable Eyewash units is .4 GPM at 30 PSI.
- Units must be capable of delivering a minimum of 15 minutes of flushing fluid.
- Eyewash units shall be capable of being activated in 1 second or less.
- Stay open ball valves must be used to accommodate for hands-free rinsing.
- Flushing fluid must be provided to both eyes simultaneously.
- Dust caps or dust covers must be installed to protect the unit from contamination.
- Spray heads must be positioned between 33" and 45" from the floor.
- Spray heads must be positioned at least 6" from the wall or nearest obstruction.

13.15.2 Eye/Face Wash Stations

- Minimum flow for plumbed and portable Eyewash units is 3 GPM at 30 PSI.
- Units must be capable of delivering a minimum of 15 minutes of flushing fluid.
- Eyewash units shall be capable of being activated in 1 second or less.
- Stay open ball valves must be used to accommodate for hands-free rinsing.
- Flushing fluid must be provided to both eyes simultaneously.
- Dust caps or dust covers must be installed to protect the unit from contamination.
- Spray heads must be positioned between 33" and 45" from the floor.
- Spray heads must be positioned at least 6" from the wall or nearest obstruction.

13.15.3 Drench Showers

- Minimum flow for drench showers is 20 GPM at 30 PSI.
- Units must be capable of delivering a minimum of 15 minutes of flushing fluid.
- Drench showers shall be capable of being activated in 1 second or less.
- Stay open ball valves must be used to accommodate for hands-free rinsing.
- Drench showers pull-rod must be installed no more than 69" from the floor.
- Drench shower spray head must be positioned between 82"-96" from the floor.
- The spray-pattern must be 20" in diameter at 60" above the floor.
- The center of the spray pattern must be at least 16" away from any obstruction.
- Combination units must meet both criteria for drench showers & eyewash.

14.0 Three-Dimensional (3D) Printer Procedures

These procedures have been developed to increase awareness and minimize risks associated with 3D printers, and to ensure the user and personnel within the vicinity are protected.

14.1 Purpose

These procedures establish minimum requirements necessary to allow for the safe use of 3D printers at UAB. Furthermore, these procedures were created in response to the increased use of 3D printers by faculty, staff, and students at UAB.

Studies have indicated that 3D printers can generate potentially harmful concentrations of ultrafine particles (UFPs), volatile organic compounds (VOCs), and several other health hazards during the printing process or subsequent treatment steps used to finish the product. Production processes and materials vary greatly between 3D printing applications, each having its own unique set of health and safety hazards. The safety guidelines detailed in these procedures have been developed with the most current health and safety information available.

14.2 Scope

These procedures apply to all students, staff, faculty, and visitors who conduct 3D printing on UAB's campus.

14.3 Definition

3D printing is a process that builds a three-dimensional object from a computer-aided design model by successively adding material layer by layer called additive manufacturing.

14.4 Environmental Health and Safety (EHS) Responsibilities

- EHS shall review and have final approval of all 3D printer purchases.
- EHS will consider the type of printer, the type of print media to be used, the proposed location of the printer, and the printer(s) arrangement before approval is granted.
- EHS may require the modification of the proposed printer location by adding or modifying exhaust ventilation prior to granting purchasing approval. Any modification of these systems shall be the financial responsibility of the requesting department.
- EHS has the authority to immediately halt and/or revoke approval of any printing operations if it deems the operation to be unsafe.

14.5 Deans, Directors, Principal Investigators (PI) Responsibilities

- Deans, directors, PI's, and printing managers shall enforce these procedures, including compliance with its training requirements, and maintaining records of training.
- Shall provide the required personal protective equipment (PPE), training on the use of PPE, and enforce its correct use.
- Develop adequate operating procedure for the equipment while following the manufacturers recommendations/requirements.
- Ensure the equipment is used properly and only by trained and authorized personnel.

14.6 Purchasing Department Responsibilities

- Whenever possible, printers certified to the ANSI/CAN/UL 2904 Standard, which tests and certifies printers for low emission rates, should be purchased.
- All safety related components such as enclosures and filters shall be included on the initial purchase of the 3D printer.
- Submit all 3D printer purchase requests for review by EHS.
- Ensure printers are not ordered until final approval from EHS is received.

14.7 Training Requirements

Each department, school, etc. is responsible for ensuring their personnel receive the required annual hazard communication (HAZCOM) training. This requirement applies to all users working directly with, and in the area where a 3D printer and its associated media/components are being used. Additionally, the training shall cover all hazardous materials used in the 3D printing process. HAZCOM training is available from EHS upon request.

Completion of the training must be documented in writing, or electronically, and the records shall be maintained by the department in which the 3D printers are being utilized.

14.8 Types of 3D Printers

Fused Deposition Modeling (FDM) also known as Fused Filament Fabrication (FFF), is the most used 3D printing technology, due to its ease of use and lack of reliance on harsh chemicals. FDM uses a thick string of raw material, commonly referred to as filament. The filament is a constant width of either 1.75 mm or 2.85 mm and is typically a thermoplastic that is delivered on a spool.

Stereolithography (SLA) is an additive manufacturing process that belongs to the vat photopolymerization family. Also known as resin 3D printing, there are three main 3D printing technologies associated with vat polymerization: SLA, DLP and LCD. The three technologies all use a light source to cure a photopolymer resin but with the following differences:

- Stereolithography (SLA) uses ultraviolet (UV) lasers as a light source to selectively cure a polymer resin.
- Digital light processing (DLP) uses a digital projector as a UV light source to cure a layer of resin.
- Liquid crystal display (LCD) uses an LCD display module for projecting specific light patterns.

SLA is one of the most widely used vat photopolymerization technologies. It creates objects by selectively curing a polymer resin, layer by layer, using a UV laser beam. The materials used in SLA are photosensitive thermoset polymers that are in liquid form.

Selective Laser Sintering (SLS) is the third major printing method, which uses a powdered raw material, typically a polymer. The powder is stored in a container, where a recoating blade distributes a thin layer of material onto the build area. A high-powered laser fuses the small particles of material together to form a single horizontal layer of computer-aided drafting (CAD) data.

Polyjet 3D printing works very similarly to normal inkjet printing. The process consists of placing droplets of a photopolymer onto the build plate. A UV light then passes over this layer and solidifies it. The process repeats until the part is complete. Polyjet is highly accurate and very fast.

Direct Metal Laser Sintering (DMLS) is a process used to manufacture metal parts. The process works by placing down a thin layer of powdered metal. A high-power laser then traces out the cross-section of the part and sinters the metal powder together. After each layer is complete, another layer of powder is deposited, and the process is repeated. It must be noted that sintering is not the same as melting. The metal powder is only fused on the surface.

Electron Beam Melting (EBM) is one of the more advanced 3D printing techniques that use an electron beam to fuse metal particles. The process works by depositing a thin layer of metal powder. An electron beam then traces out the cross-section. The beam can be split to melt multiple areas at once, significantly improving production speed. This high-energy beam melts the particles together creating a homogeneous microstructure that results in high-strength parts. The build chamber must be kept under a vacuum for the beam to work correctly.

Multi Jet Fusion (MJF) is a unique 3D printing machine. MJF works by placing a layer of plastic onto the build plate. Then a heating head moves across the powder to preheat it. Finally, an inkjet-type printing array moves over the powder and selectively places fusing and detailing agents onto the powder. The heating elements then fuse the layer. This technology allows for multi-color and multi-material components.

14.9 Feedstock

The most common type of feedstock used in 3D printers are acrylonitrile butadiene styrene (ABS) and polylactic acid (PLA). ABS is comprised of thin strands, or filaments used to form thermoplastics. Using a computer-generated image, a 3D printer heats and melts the feed material, adding layers of filament on top of one another to form a 3D replica of the image. Like most plastics, PLA has the potential to be toxic if inhaled and/or absorbed into the skin or eyes as a vapor or liquid during manufacturing processes. ABS feedstock poses a greater health and safety risk than PLA feedstock.

Other printing feedstock may include metallic powders, which are used to fabricate tools and machinery parts. Please review product Safety Data Sheets (SDSs) for material specific safety information before using any material in a 3D printer.

14.10 3D Printing Hazards

3D printing materials can vary widely, with options that include plastics, powders, resins, metals, and carbon fiber. When these materials are heated during the manufacturing process the materials break down. Personnel operating a 3D printer, or in the vicinity of 3D printer operations, may be exposed to inhalation hazards in the form of very small particles (ultrafine particles/nanoparticles) and gases (chemical vapors).

14.10.1 Ultrafine Particles/Nanoparticles (UFPs)

UFPs are aerosols which have an aerodynamic diameter of 0.1 micron or less and are one of the byproducts emitted during the 3D printing process. UFPs are of concern because they are exceedingly small, have irregular surface areas, and negatively affect the skin, lungs, nerves, and brain tissues. UFPs are small enough to pass through the lung tissue into the blood stream, circulating like oxygen molecules. Elevated UFP levels have been linked to adverse health effects including cardiopulmonary mortality, strokes, and asthma. The 3D printer manufacturers recommended enclosures and filters designed for their printer shall be installed prior to and during operation to reduce the potential for exposing users to these airborne particulates.

14.10.2 Chemical Vapors

Toxic vapors and vapors with highly volatile organic compounds (VOCs) are generated when certain thermoplastic filaments are heated during the printing process. Therefore, additional ventilation may be required for certain models of 3D printers. To reduce the risk of exposure to these vapors the following must be assessed prior to purchasing and installing a 3D printer:

- The building and room where the 3D printer will be located.
- Placement of the 3D printer in the space.
- Selection of printing feedstock.
- Ventilation of the room where the 3D printer will be located.
- Other uses of the area where a 3D printer is located.
- Personnel transiting through and in the vicinity of the 3D printer area.

Additional consideration should be given in purchasing a 3D printer with a built-in emissions filtration system.

14.10.3 Corrosive Baths

Support material can be removed by placing prints in a heated corrosive bath containing sodium hydroxide or other caustic chemicals. Exposure to these chemicals can cause serious chemical burns, scarring, and vision damage.

14.10.4 Vapor Baths

ABS objects can be smoothed or “polished” by placing them in a closed vessel filled with a small quantity of acetone or other organic solvent, which vaporizes and reacts with the ABS plastic. These solvents are usually flammable and can cause symptoms when inhaled such as headache, nausea, and respiratory tract irritation.

14.10.5 Biological Material

Printers using biological material can produce aerosols which may be inhaled or deposited onto nearby surfaces.

14.10.6 Heat

Components such as UV lamps, motors, heat beds, and print heads become hot during operation and can cause burns when touched.

14.10.7 Flammability

Fine metal powders such as aluminum, steel, and titanium can spontaneously combust under normal atmospheric conditions (known as pyrophoricity). Organic solvents like acetone used in vapor polishing can combust when exposed to a heat source. Chemicals used in bed preparation such as hairspray are flammable.

14.10.8 Inert Gas

3D printers sometimes use inert gases such as nitrogen or argon to create a noncombustible atmosphere in the printing chamber. Some aerosol jet printers use an inert gas as part of the aerosolization and deposition process. If inert gas is introduced into the surrounding atmosphere, it can displace oxygen and present an asphyxiation hazard.

14.10.9 Electric Shock

Unguarded electrical components and damaged power cords can result in electric shock.

14.10.10 Mechanical Hazards

Hands and fingers can get pinched by moving printer components while in operation. CNC post-processing of metal parts present mechanical and noise hazards.

14.10.11 Ultraviolet (UV) Light/Lasers

Eye exposure to the UV lights used in SLA printers can cause temporary or permanent vision loss. Directed Energy Deposition and Powder Bed Fusion printers often use powerful Class 4 lasers which can cause permanent eye injury from direct or reflected light.

14.11 Operating Guidelines

The following guidelines have been developed with the most current health and safety information available regarding 3D printers and their associated equipment. Additionally, these guidelines are the minimum requirements for operation, always follow the manufacturers recommendations.

14.11.1 General Safety Provisions

- **Biological Hazards** – 3D printing with biological material may require additional approvals and specialized equipment (e.g., biosafety cabinets), particularly if infectious or toxic aerosols are generated in the process. Proper printer disinfection procedures may also need to be developed.
- **Chemical Safety** - All chemicals used in the processes should be stored properly and follow all UAB lab safety guidelines.
- **Corrosive Baths** – Some 3D printers require the use of corrosive baths to remove the extra material surrounding each 3D printed item. The use of corrosive baths must be reviewed and approved by EHS to ensure proper ventilation, procedures, training, emergency equipment and personal protective equipment are provided.
- **Electrical** - Contact to energized parts can lead to injury or even death. All parts should be UL approved or other equivalent third party inspected. Before each use, inspect the 3D printer for any damaged wiring and safeguards. Do not use printers if problems are found. All printers must be installed according to the manufacturer's requirements in addition to the NFPA 70 National Electric Code.
- **Emissions** – Nanoparticles and chemical vapors may be emitted. Proper ventilation is needed and maintain a safe distance from the printer to minimize the inhalation of emitted particles.
- **Hot Surfaces** - Operators must be protected from hot surfaces associated with the printers. Such surfaces must be guarded, and labeling must warn users of the hazards.
- **Jams** - Turn off the printer if the printer nozzle jams and allow the printer to ventilate before removing the cover.
- **Personal Hygiene** - Eating, drinking, applying cosmetics, chewing gum, or handling contact lenses in rooms that contain 3D printing operations shall be prohibited. Users must wash their hands thoroughly after working with 3D printers.
- **Physical Security** - Access to 3D printers should be secured and limited to only those trained and authorized approved UAB students or personnel.
- **Prohibited Use** - 3D printers shall only be used for making approved items. The creation of weapons or other harmful/illegal objects is strictly forbidden. Particular attention should be given to ensure patent laws are not being broken.
- **Safety Data Sheet (SDS)** must be obtained and kept by the department for all print media and for any other chemical product used in the printing process. All applicable SDSs must be readily accessible for review in the event of an emergency.
- **Ultraviolet (UV) light** poses a radiation hazard that can cause damage to vision and skin. If UV light is used in the curing process, the proper personal protective equipment and/or shielding shall be utilized.

14.11.2 Ventilation

Proper ventilation is required for 3D printer installations and must be pre-approved by EHS. Ventilation requirements may be based on, but not limited to, equipment manufacturer specifications and anticipated usage.

3D printers using PLA media exclusively may be set-up in a workspace having at least 4 to 6 air changes per hour (ventilation may or may not be required). Requests for the placement of PLA printers in any space shall be reviewed by EHS before proceeding.

3D printers are not permitted in a space designated as an office.

3D printers using ABS media, including printers designed and set-up to use both PLA and ABS, may only be used in work areas having a dedicated exhaust system or one pass air and at least six air changes per hour. It is recommended that printers using ABS media be used within a fume hood whenever possible.

3D printers using other types of media, including but not limited to, thermoplastics, photopolymers, nylon, high impact polystyrene, high density polyethylene, powdered metals, biological media, or other uncommon medias shall be reviewed by EHS on a case-by-case basis with specific precautions required based on the hazards unique to the printing process in question.

14.11.3 Engineering Controls

Particle emissions are the focus, especially when multiple printers are running simultaneously. Another consideration is toxic vapors that can be generated by heating plastics. Engineering controls should be considered first to assist with minimizing hazards. These may include the following:

- 3D printers shall ONLY be used in properly ventilated areas.
- Choose low-emitting printers and feed materials/filament when possible.
- Purchase and use the manufacturers supplied controls, such as an interlocked enclosure. (Enclosures appear to be more effective in controlling emissions than a generic machine cover).
- Safety interlock switches shall be enabled, and their proper function verified prior to and throughout the printing operation.

14.11.4 Personal Protective Equipment (PPE)

- Follow all PPE requirements found in the Safety Data Sheet (SDS) for the media being used as well as the manufacturers PPE requirements for the printer. PPE items required may include, but are not limited to nitrile gloves, respirators with organic vapor cartridges, sealed goggles, etc.
- Eye protection is required during any activity where airborne projectiles may be present (e.g., removing rough edges of a printed item).
- A universal spill kit shall be provided by the department and maintained in the printing area.

14.12 Three-Dimensional (3D) Printer Authorization Request

Requesting Department: _____

Requestor Name: _____

Requestor Phone Number: _____

Requestor Email: _____

Building and Room Number: _____

EHS Representative	Approved	Disapproved*
Campus Safety		
Radiation Safety		
Industrial Hygiene		
Chemical Safety		
Environmental Mgmt.		

**In the event an EHS representative deems there is cause for disapproval, contact the requestor for possible corrective actions prior to signing.*

_____ _____

EHS 3D Printer Coordinator (Print / Sign) Approval Date

Notes: _____

_____

_____

_____

_____

_____

_____

Upon approval, a copy of this authorization request shall be posted in the 3D printing area.

15.0 Heat Illness Prevention Plan

The following Heat illness Prevention Plan was prepared using guidelines provided by the Occupational Safety and Health Administration (OSHA), National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH). This heat illness prevention plan is provided as a resource and not designed to address all work site scenarios and heat stress hazards. It is designed to reduce the development of heat-related illnesses in healthy, physically fit workers. It is not designed to meet state, local or other regulatory requirements on heat stress. It is not designed to protect workers with medical conditions or preexisting conditions that put them at risk of heat stress. It is recommended that employers medically screen workers prior to work in hot environments, especially when physical exertion is required. It is recommended that employers seek further information on heat stress and prevention using OSHA provided resources and applicable regulations, available both online and via area offices.

15.1 Purpose

This heat illness prevention plan was developed to provide supervisors and workers with the training and tools to help protect them from heat-related exposures and illnesses.

15.2 Scope

Each work site and job task can be unique and contain a number of heat stress hazards that must be addressed prior to the beginning of and during work activities.

Supervisors and workers are responsible for assessing these hazards and taking necessary corrective actions to reduce heat related illnesses.

15.3 Definitions

Both OSHA and NIOSH provide the following definitions, in their various publications on heat stress and heat stress prevention.

Acclimatization: The physiological changes that occur in response to a succession of days of exposure to environmental heat stress and reduce the strain caused by the heat stress of the environment; and enable a person to work with greater effectiveness and with less chance of heat injury.

Body Heat Balance: Steady-state equilibrium between body heat production and heat loss to the environment.

Body Heat Balance Equation: Mathematical expression of relation between heat gain and heat loss, expressed as $S = (M – W) \pm C \pm R \pm K – E$.

Body Heat Storage (S): The change in heat content (either + or −) of the body.

clo: A unit expression of the insulation value of clothing, 1 clo = 5.55 $kcal \cdot m^{2} \cdot h^{-1} \cdot °C^{-1}$. A clo of 1 is equal to the insulation required to keep a sedentary person comfortable at 21°C (~70°F). It is also sometimes expressed as 1 clo = 0.155 $m^{2} \cdot °C \cdot W^{-1}$.

Conductive Heat Transfer (K): The net heat exchange involving the direct transfer of heat via direct contact between two mediums (solid, liquid, or gas) that have a temperature differential.

Convective Heat Transfer (C): The net heat exchange by convection between an individual and the environment.

Evaporative Heat Transfer (E): Rate of heat loss by evaporation of water from the skin or gain from condensation of water on the skin, expressed as $kcal \cdot h^{-1}$, $W \cdot m^{-2}$, or W.

Heat Cramp: A heat-related illness characterized by spastic contractions of the voluntary muscles (mainly arms, hands, legs, and feet), usually associated with restricted salt intake and profuse sweating without significant body dehydration.

Heat Exhaustion: A heat-related illness characterized by elevation of core body temperature above 38°C (100.4°F) and abnormal performance of one or more organ systems, without injury to the central nervous system. Heat exhaustion may signal impending heat stroke.

Heat Strain: The physiological response to the heat load (external or internal) experienced by a person, in which the body attempts to increase heat loss to the environment in order to maintain a stable body temperature.

Heat Stress: The net heat load to which a worker is exposed from the combined contributions of metabolic heat, environmental factors, and clothing worn which results in an increase in heat storage in the body.

Heat Stroke: An acute medical emergency caused by exposure to heat from an excessive rise in body temperature [above 41.1°C (106°F] and failure of the temperature-regulating mechanism. Injury occurs to the central nervous system characterized by a sudden and sustained loss of consciousness preceded by vertigo, nausea, headache, cerebral dysfunction, bizarre behavior, and excessive body temperature.

Heat Syncope: Collapse and/or loss of consciousness during heat exposure without an increase in body temperature or cessation of sweating, similar to vasovagal fainting except that it is heat induced.

Heat Tolerance: The physiological ability to endure heat and regulate body temperature at an average or better rate than others, often affected by the individual's level of acclimatization and physical conditioning.

Humidity, Relative (RH): The ratio of the water vapor present in the ambient air to the water vapor present in saturated air at the same temperature and pressure.

Hyperpyrexia: A body core temperature exceeding 40°C (104°F).

Hyperthermia: A condition where the core temperature of an individual is higher than 37.2°C (99°F). Hyperthermia can be classified as mild (37.2–38.5°C; 99–101.3°F), moderate (i.e., heat exhaustion [38.5–39.5°C; 101.3–103.1°F]), profound (>39.5°C; 103.1°F), or profound clinical hyperthermia (i.e., heat stroke [>40.5°C; 104.9°F]), and death can occur without treatment (>45°C; 113°F).

Metabolism (M): Transformation of chemical energy into free energy that is used to perform work and produce heat.

Pressure, Atmospheric (Pa): Pressure exerted by the weight of the air, which averages 760 mmHg at sea level and decreases with altitude.

Pressure, Water Vapor (Pa): The pressure exerted by the water vapor in the air.

Qualified Health Care Professional: An individual qualified by education, training, and licensure/regulation and/or facility privileges (when applicable) who performs a professional service within his or her scope of practice in an allied health care discipline, and independently reports that professional service.

Radiant Heat Exchange (R): The net rate of heat exchange by radiation between two radiant surfaces of different temperatures.

Recommended Alert Limit (RAL): The NIOSH-recommended heat stress alert limits for unacclimatized workers.

Recommended Exposure Limit (REL): The NIOSH-recommended heat stress exposure limits for acclimatized workers.

Rhabdomyolysis: A medical condition associated with heat stress and prolonged physical exertion, resulting in the rapid breakdown of muscle and the rupture and necrosis of the affected muscles.

Sweating, Thermal: Response of the sweat glands to thermal stimuli.

Temperature, Ambient (t_a): The temperature of the air surrounding a body. Also called air temperature or dry bulb temperature.

Temperature, Core Body (t_{cr}): Temperature of the tissues and organs of the body. Also called Core Temperature.

Temperature, Dewpoint (t_{dp}): The temperature at which the water vapor in the air first starts to condense.

Temperature, Globe (t_g): The temperature inside a blackened, hollow, thin copper globe measured by a thermometer whose sensing element is in the center of the sphere.

Temperature, Natural Wet Bulb (t_{nwb}): The wet bulb temperature under conditions of the prevailing air movement.

Temperature, Oral (t_{or}): Temperature measured by placing the sensing element under the tongue for 3 to 5 minutes.

Temperature, Psychrometric Wet Bulb (t_{wb}): The lowest temperature to which the ambient air can be cooled by evaporation of water from the wet temperature-sensing element with forced air movement.

Temperature, Rectal (t_{re}): Temperature measured 10 centimeters (cm) into the rectal canal.

Temperature, Skin (t_{sk}): Temperature measured by placing the sensing element on the skin.

Temperature, Tympanic (t_{ty}): True tympanic temperature is measured by placing the sensing element directly onto the tympanic membrane and recording the temperature. Estimates of tympanic temperature are usually obtained by placing a device into the ear canal close to the tympanic membrane.

Temperature Regulation: The maintenance of body temperature within a restricted range under conditions of positive heat loads (environmental and metabolic) by physiologic and behavioral mechanisms.

Thermal Insulation, Clothing: The insulation value of a clothing ensemble.

Wet Bulb Globe Temperature (WBGT): This is an environmental temperature arrived at by measuring dry air temperature, humidity, and radiant energy (i.e., usually direct sunlight being absorbed by clothing), used to calculate a thermal load on the person.

Work: Physical efforts performed using energy from the metabolic rate of the body.

15.4 UAB Policy

UAB is dedicated to protecting employees from on-the-job illnesses and injuries. All employees have the responsibility to work safely on the job. The purpose of this plan is to supplement our existing safety and health program and to ensure employees recognize heat stress hazards and act appropriately to address those hazards. The general approach addresses five (5) key areas of heat illness prevention, as outlined below.

15.4.1 Heat Illness Prevention Plan Main Elements

Control	Description
1. Train supervisors and workers	Train supervisors and workers on heat illness prevention strategies, as well as to recognize and report the signs and symptoms of heat related illnesses.
2. Monitor weather and workplace conditions	Monitor weather workplace conditions and take preventative measures to protect workers when the temperatures exceed 70°F (21°C).
3. Conduct a heat hazard assessment when temperatures exceed 70°F	Determine an effective wet-bulb globe temperature (WBGT-Effective) and use established recommended alert limits (non-acclimatized workers) and exposure limits (acclimatized workers) to determine the level of risk to heat stress.
4. Implement heat illness prevention strategies	Implement appropriate heat illness prevention strategies based on established risk levels for heat stress.
5. Plan for heat related medical emergencies	Ensure adequate supervision, first aid and medical services are readily available in the event a worker suffers from a heat illness.

15.4.2 Employee Responsibilities

Each employee will be trained in heat illness prevention and will strictly adhere to the recommended practices, except when doing so would expose him/her to a greater hazard. If, in the employee's opinion, this is the case, the employee is to notify their supervisor of their concern and have the concern addressed before proceeding.

15.4.3 Employer Responsibilities

On the job, it is the responsibility of Campus Safety to implement this Heat Illness Prevention Plan. Continual observational safety checks of work operations and the enforcement of the safety policy and procedures shall be regularly enforced. The supervisor is responsible for correcting any unsafe practices or conditions immediately.

It is the responsibility of the employer to ensure that all employees understand and adhere to the policies and procedures of this plan. It is also the responsibility of the employee to bring to management's attention any unsafe or hazardous conditions or practices that may cause injury to either themselves or any other employees.

15.5 Employee Training

To ensure workers are prepared to work safely under hot conditions, all employees and supervisors who may be exposed to heat stress and heat related illnesses will receive training on the following:

15.5.1 Five Elements of Heat Illness Prevention

1. Training.
2. Monitoring.
3. Hazard Assessment.
4. Heat Illness Prevention Strategies.
5. Emergency Preparedness.

15.5.2 Risk Factors for Heat Related Illnesses (HRIs)

Environmental:

- Temperature.
- Humidity.
- Air movement.
- Radiant heat (e.g., sun exposure).

Work Related:

- Physical exertion.
- Clothing.

Personal Risk Factors:

- Age.
- Physical fitness.
- Acclimatization.
- Medical conditions.
- Medications.
- Alcohol and/or drug use.
- Caffeine.

15.5.3 How the Body Handles Heat

- Increased heart rate.
- Increased blood circulation to skin.
- Evaporative cooling from sweating.

15.5.4 Acclimatization

Reduces risks of dehydration and salt loss. Sweating and evaporative cooling becomes more efficient. Salt loss becomes more efficient. Core body temperature maintained more efficiently. Reduces strain on the heart. Blood circulation to skin becomes more efficient. Recovery heart rate improves. The human body needs to acclimate to hot environments, typically 10-14 days.

- Gradually increase exposure to hot environment over 7-14 days.
- Avoid prolonged exertion during hottest times of day.
- Schedule heavy exertion for cooler parts of day.

Acclimatized workers will need 2-3 days of re-acclimatization if they stop working under heat stress conditions more than a week.

15.5.5 Hydration

One cup (8 ounces) of cool water or an electrolyte replacement fluid every 15-20 minutes; four cups of water every hour. Increased water intake may be needed to account for increased physical exertion and/or sweating. However, too much water intake can be dangerous and lead to headache, nausea, vomiting and/or mental confusion. Physiological monitoring may be necessary under extreme conditions If sweat is not trapped within clothing, then we can monitor body weight, which should not drop below 1.5% of starting body weight. Urine color is another indicator of potential dehydration.

- Normal urine should be a pale yellow.
- Use a urine color chart to help determine if you are properly hydrated. Some diets, medications and illnesses may affect results.

15.5.6 Rest Breaks

Prolonged physical exertion and muscle activity increases the body's core temperature and reduces the body's ability to cool itself. Short rest breaks are necessary to allow blood to flow to the skin to be cooled.

Rest breaks slow down the buildup of heat in the body from prolonged muscle activity.

Rest breaks are also important for the heart and allow your heart rate to recover from sustained heat stress and physical exertion.

Rest breaks in the shade help will cooling, especially if there is air movement with cool air.

15.6 Heat-Related Illnesses (HRIs)

The following information needs to be covered in training on heat-related illnesses, including cause, preventative measures, signs and symptoms, first aid treatment and reporting requirements. *Report all HRIs to supervisor and Campus Safety.*

15.6.1 Heat Rash

Cause:

Irritation of skin due to excessive sweating.

Preventative measures:

Wear loose fitting clothing that allows sweat to dissipate. Wear freshly laundered clothing each day. Avoid working in sweat-soaked clothing for prolonged periods (e.g., change at breaks as needed). Wash sweat-soaked areas with mild soap and water and dry thoroughly at breaks and after your shift ends.

Signs and symptoms:

Itchy and painful clusters of red blisters. Common to the neck, chest, groin, armpits and creases of the elbows and knees.

First aid treatment:

Move person to a cool location. Have person take a cool shower. Thoroughly dry the skin following shower. Continue to ensure skin is cleaned and dried frequently, especially before and after shifts. Seek medical treatment if rash persists for more than two days or if rash becomes infected.

15.6.2 Heat Cramps

Cause:

Depletion of salt and water in body due to excessive sweating. This is a precursor to more serious heat exhaustion and/or heat stroke.

Preventative measures:

Acclimatization to heat helps reduce salt and water loss. Drink adequate amounts of water throughout the day. Salt your foods to taste.

Signs and symptoms:

Muscle cramps, spasms and/or pain. Common to major muscles used for work (e.g., arms, legs, abdominal, and back muscles).

First aid treatment:

Move person to a cool location. Provide person with an electrolyte replacement fluid to replace lost salt and water. Seek medical treatment if cramps persist or other heat illness symptoms develop (e.g., elevated body temperature, elevated heart rate, headache, dizziness, etc.).

15.6.3 Heat Syncope

Cause:

Prolonged standing or sudden rising from a sitting or resting (supine) position; dehydration can be a contributing factor.

Preventative measures:

Acclimatization to heat helps reduce dehydration. Drink adequate amounts of water throughout the day. Break up long periods of standing with small rest breaks. Rise slowly from sitting or resting positions.

Signs and symptoms:

Light-headedness or dizziness, fainting.

First aid treatment:

If he/she is only slightly dizzy and able to move, have two people assist and carefully move to a cool location and have the person lay down on back with feet elevated above heart level; provide small amounts of water.

If the dizziness persists, request immediate first aid and/or medical attention.

If he/she fainted, then secure the area, elevate his/her feet above heart level and request immediate first aid and/or medical attention; do not allow him/her to get up quickly or walk about.

15.6.4 Heat Exhaustion

Cause:

The body's inability to cool itself, often due to a combination of several factors (e.g., high temperatures, humidity, physical exertion, dehydration, clothing that blocks sweat evaporation and/or alcohol use). This is a serious condition that can lead to a life-threatening heat stroke.

Preventative measures:

Acclimatization to heat helps reduce dehydration. Drink adequate amounts of water throughout the day. Take small rest breaks in shade to allow body to recover from heavy physical exertion and heat exposure. Protect skin against sunburn, which reduces the body's ability to cool itself. If possible, perform heavier physical labor towards cooler part of the day (e.g., early morning or evening).

Signs and symptoms:

Elevated core body temperature of 100.4 to 102.2°F (38 to 39°C); oral temperature 99.6 to 101.4°F. Weak, but rapid pulse (elevated heart rate). Cool, moist skin (person may appear pale with clammy skin). Excessive sweating. Headache and possible irritability. Fatigue or weakness. Dizziness and/or feeling faint. Nausea and/or vomiting. Decreased urine output.

First aid treatment:

Seek immediate medical care (call 911 or 934-3535 on campus).

Immediately help the person cool off. Move to a cool location. Remove or loosen unnecessary clothing. Have them drink small amounts of cool water. Spray skin with cool water and fan rapidly to increase evaporation and cooling. Monitor body temperature and continue cooling efforts until body temperature returns to a normal temperature below 99°F (37°C). Implement additional heat stroke treatments if body temperature does not decrease below 100°F (37.8°C) after 30 minutes or increases above 102°F (38.9°C).

15.6.5 Heat Stroke

Cause:

Body is unable to cool itself and regulate core body temperature. This is a serious and life-threatening condition that requires immediate medical attention (call 911 or 934-3535 on campus).

Preventable measures:

Same as for heat exhaustion.

Signs and symptoms:

Elevated core body temperature above 104°F (40°C); oral temperature above 103.2°F. Hot, dry skin or heavy sweating. Mental confusion, agitation and/or irrational behavior. Clumsiness. Slurred speech. Fainting or a loss of consciousness. Seizures or convulsions.

First aid treatment:

Call 911 or 934-3535 on campus and seek immediate medical attention for the victim; do not wait as their life depends on getting immediate medical care.

Provide immediate and aggressive cooling to their body. Elevate feet above heart level. Remove or loosen unnecessary clothing. Pack ice in groin and armpit areas. Soak skin with cool water and fan rapidly and vigorously to increase cooling of skin. As an alternative, immerse them in a tub of cool water or spray body with large amounts of cool water.

Do not give person fluids to drink, especially if unconscious.

Monitor body temperature and continue cooling efforts until body temperature returns to a normal temperature below 99°F (37°C). Administer CPR as needed, if blood circulation or breathing stops, until emergency medical services arrive.

15.6.6 Rhabdomyolysis

Cause:

Sometimes caused by a combination of heat stress and prolonged physical exertion, muscle starts to break down and die, releasing proteins and electrolytes into the bloodstream. This is a potentially life-threatening condition affecting the kidneys that requires immediate medical attention.

Preventative measures:

Same as for heat exhaustion and heat stroke. Avoid overexertion, such as lifting objects heavier than you can comfortably lift or straining muscles to a point where they can no longer function properly. Those with diabetes, thyroid conditions or muscular dystrophy are at greater risk. Those with a viral infection, such as flu, HIV or herpes, are at greater risk. Use of alcohol and illegal drugs, such as heroin, cocaine and amphetamines can increase the risk. Some medications, such as such as antipsychotics or statins, can increase the risk.

Signs and symptoms:

Muscle cramps, pain and/or loss of range. Joint pain and/or stiffness. Swelling of muscles. Weakness and a decreased ability to perform physical exertion for even a small amount of time. Dark urine (similar to tea or cola in color).

If kidney damage and/or failure occurs the following life-threatening indicators may be observed:

- Shortness of breath.
- Irregular heartbeat.
- Swelling in the legs and feet.
- Seizures.
- Coma.

First aid treatment:

Seek immediate medical care for the victim (IV fluids and treatments to combat toxic proteins in blood are needed to prevent kidney failure).

15.7 Heat Illness Prevention Strategies

Engineering Controls

Reduce physical exertion and physical demands of work through use of powered tools and equipment, especially for tasks involving heavy lifting.

Reduce radiant heat loading from the sun or other sources of radiant heat (e.g., furnaces, combustion engines and compressors, hot surfaces, heated transfer lines, windows receiving intense sun, etc.). One effective method is to place line-of-sight, reflective barriers between the heat source and workers. Another method is to insulate hot surfaces, such as furnaces.

If air temperatures are below 95°F, then increase air speed across skin of workers using fans or air movers, to increase evaporative cooling from skin.

If air temperatures are above 95°F, then reduce air speed across skin of workers, to reduce convective heat transfer from air to skin.

If humidity is below 50%, then evaporative coolers and portable fans with water mist systems can be used to effectively cool the air by about 10 to 20°F.

Decrease humidity to below 50% to increase evaporative cooling from sweating.

Administrative Controls

Adjust work schedule to ensure workers are acclimated to work in hot conditions.

Schedule work or work requiring heavy physical exertion during the coolest parts of the day.

Modify the work-rest schedule to shorten heat exposure periods by including frequent rest breaks. Shorter, more frequent breaks are more effective than longer, less frequent rest breaks.

Encourage adequate water intake at frequent intervals to prevent dehydration (e.g., one 8-ounce cup of cool water or an electrolyte replacement fluid every 15 to 20 minutes).

The supervisor or foreman is responsible for making sure drinking water is provided, within the following guidelines:

- Ensure that water containers are clean and sanitary prior to filling.
- Ensure water containers are filled at a sanitary location.
- Provide sufficient disposable cups and a place for disposing cups.
- Ensure workers do not share cups and dispose of used cups.
- Prohibit workers from opening the cooler top to fill cups and instead have workers use the provided spigot.

Pure and cool potable water must be made available to workers at no additional cost.

- Do not use water from irrigation, sprinklers or firefighting systems.
- Do not use water from a garden hose, as it may contain contaminants from the hose and/or bacteria and other microbes.
- Water quantities need to be sufficient and at least 1 quart per worker per hour for the entire shift.
- Locate water containers as close as practicable at all times.
- Encourage workers to frequently drink water and not wait until thirsty.

Provide a shaded and/or air-conditioned space nearby for rest and water breaks.

Train workers on the recognition of the signs and symptoms of heat-induced illness and on heat illness prevention strategies.

Alert workers to extreme heat events or heat stress conditions and provide a short review of the heat illness prevention strategies for the day.

Work in pairs (buddy system) and monitor each other for signs and symptoms of heat stress or illness.

Avoid caffeine and alcohol before and during working in a hot environment.

Report illnesses or medical conditions that may put them at risk of heat stress (e.g., diarrhea, fever, infection, etc.).

Medically screen for work in hot environments.

Personal Protective Equipment (PPE) Controls

Provide clothing designed to keep the body cool, such as air, cooled fluid or ice-cooled conditioned clothing.

Provide reflective clothing to reduce radiant heat loading from the sun or hot surfaces radiating heat.

If air temperatures are below 95°F and worker is protected from radiant heat, then decrease clothing coverage or layers (when feasible) to increase evaporative cooling from skin.

Caution: Do not remove clothing designed to protect workers from chemical, mechanical or other hazards without conducting a proper evaluation to address those hazards.

If air temperatures are above 95°F, then increase clothing coverage to reduce air speed across skin of workers, which can help reduce convective heat transfer from air to skin.

15.8 Heat Hazard Assessment

When weather or workplace conditions will exceed 70°F (21°C), a heat hazard assessment must be conducted to take into account for environmental and work factors associated with heat stress and heat-related illnesses. Temperature, humidity, wind speed and solar irradiance are environmental factors that must be taken into account.

Work factors include metabolic work rate (physical exertion) and clothing. These factors are all accounted for using an effective wet-bulb globe temperature (WBGT-Effective).

Use of a heat index, which only takes into account temperature and humidity, is not recommended. The heat index does not take into account wind speed, radiant heat, clothing and metabolic heat from physical exertion, which are all factors that can contribute to heat stress and heat-related illnesses.

Instead, a WBGT-Effective and threshold limits established by NIOSH are used to assess risk and recommend effective heat stress controls. Further details and an example on this method are available in the OSHA Technical Manual, Section III, Chapter 4 on Heat Stress (www.osha.gov) and the NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments (www.cdc.gov/niosh).

Contact Campus Safety for a heat hazard assessment at 934-2487.

16.0 Industrial Hygiene Program

The Industrial Hygiene program at the University of Alabama at Birmingham (UAB) is governed by federal, state, and local, standards including university policies and University Standard Operating guidelines. UAB follows the National Institute for Occupational Safety &Health (NIOSH) and the U.S. Department of Labor Occupational Safety and Health Administration (OSHA), which provides guidelines and is the federal authority responsible for enforcing Industrial Hygiene standards.

The UAB Industrial Hygiene Program serves UAB Campus, UAB Hospitals, and all UAB Research Facilities. UAB is committed to providing a safe environment for building occupants, students, visitors, patients, and personnel.

16.1 Requirements

The basis for the Industrial Hygiene Program at UAB is provided for by UAB University policies and procedures.

16.2 Purpose

The UAB Industrial Hygiene Program focuses on identification, evaluation, and control of hazards exposures in the workplace. The UAB Industrial Hygiene Program concentrates on maintaining worker exposures below permissible levels, and to reduce or eliminate exposures when possible. UAB Environmental Health & Safety (EH&S) offers Industrial Hygiene investigations by providing technical expertise, regulatory consultation, and Industrial Hygiene sampling/baseline monitoring. Additional information may be obtained by contacting Environmental Health & Safety at 205-934-2487.

16.3 Scope

The UAB Industrial Hygiene program serves all of the UAB Campus, UAB Hospitals, and facilities, Research Facilities, and UAB Administration and Auxiliary Buildings through a variety of programs and services.

16.4 Hospital Waste Anesthetic Gas Monitoring Program

UAB Industrial Hygiene provides regular and emergency monitoring of Waste Anesthetic Gases to all UAB Hospitals, clinics, and research programs. Consultations with UAB Hospital and clinical staff and recommendations are also provided by the IH program.

16.5 Respirator Protection Program

OSHA standard 1910.134 regulates respirator use and requires the use of respirators when individuals could possibly be exposed to hazardous materials at or above the threshold limit. Respirators shall be used only when there are no other practical means of keeping exposures below acceptable levels.

The UAB Industrial Hygiene program will assist in evaluating the actual hazard potential and determining what protections for workers are required. If respirators are recommended, the IH program, working in conjunction with UAB Occupational Health, will be responsible for determining proper respirators for the task and providing initial and annual fit testing for employees using respirators.

16.6 Asbestos Safety Program

UAB Industrial Hygiene offers services for identifying asbestos-containing materials, prior to construction or maintenance activities that may disturb asbestos. UAB Campus Safety also offers Asbestos Awareness Training for employees who may come into contact with Asbestos-containing materials (ACMs) as part of their job (e.g., maintenance workers, Building Services employees, etc.). UAB IH also provides respiratory protection Fit Testing for employees who may come into contact with ACMs.

Damaged asbestos-containing material should be reported to UAB Industrial Hygiene or UAB Campus Safety. UAB IH is available to sample materials that may contain asbestos and to perform exposure assessments in areas that may contain ACMs.

16.7 Hazard Assessment & Chemical Monitoring

UAB Industrial Hygiene program evaluates work environments with potential hazards (chemical, mechanical, noise, etc.) to determine the severity of the hazard and the proper protective measures that need to be taken. The evaluation of contaminant levels is an integral part of the hazard assessment. The UAB Industrial Hygiene program can assist departments by performing chemical monitoring or by providing guidance in securing monitoring services. Direct reading instruments and analytical methods may be used in monitoring. Departments may request hazard assessments and chemical monitoring from the Industrial Hygiene program by contacting UAB Campus Safety or UAB Industrial Hygiene directly.

16.8 Air Quality Assessment

The quality of the air inside a building is affected by a variety of comfort, physical, chemical and biological factors. Factors influencing the indoor air quality of a room or building include:

Comfort issues (temperature, humidity, "stuffiness").

Supply of fresh air to the building.

Accumulation of particulate, biological or chemical contaminants originating from within or outside the building.

In the event of an unexpected and/or unusual odor in a work area, identify the source of the odor as soon as possible. Begin by asking other building occupants about work or activities that may be going on that could be the cause. If the source cannot be identified, or if the odors are extreme or are causing acute reactions to building occupants, contact UAB EHS at 205-934-2487. EHS staff will respond and will help to identify the source and recommend actions.

16.9 Planning, Design, & Construction Consulting

UAB Industrial Hygiene consults on air quality issues and planning during renovations of existing structures and new construction for UAB Campus, UAB Hospitals and other UAB facilities.

Record of Reviews and Changes

Date	Comments	Name
12FEB2024	Initial development.	C.M. Ham, Sr.
24APR2024	(REV1) Added 14.0 Three-Dimensional (3D) Printer Procedures.	C.M. Ham, Sr.
24APR2024	Reformatted Appendix A, B, and C.	C.M. Ham, Sr.
09AUG2024	(REV2) Added 15.0 Heat Illness Prevention Plan.	C.M. Ham, Sr.
10FEB2025	Updated cover page with revised UAB logo.	C.M. Ham, Sr.
14JAN2026	(REV3) Added 16.0 Industrial Hygiene Program.	C.M. Ham, Sr.
14JAN2026	Deleted Appendix.	C.M. Ham, Sr.