DRY SAFETY MANUAL

INDEX

READING ACKNOWLEDGEMENT

I have read and understand the safety requirements outlined in this manual for this laboratory.

Name	Email	Phone Number	Principal Investigator

Revised: 9/18/2013
By: CEE Safety Committee

EMERGENCY CONTACT NUMBERS

Revised 06/2013

Fire

Alert people and activate fire alarm

- Call Knoxville Fire Department at 911
- Evacuate building (do not use elevators)
- Notify building manager and supervisor

Personal Safety: 911
Knoxville Police: 911
Ambulance Service: 911

UT Police: 974-3111

Emergency Safe Line: 656-7233

EH&S website:	web.utk.edu/~ehss	
EH&S	Chuck Payne	974-5084
Biological Safety Officer	Brian Ranger	974-1938
Radiation Safety	Marsha Smith	974-5580
General Campus Information		974-1000

Report Safety Concerns to safety@tennessee.edu

Facilities Services	946-7777
Office of Emergency Management	974-3061
Media Relations	974-2225
Principal Investigator	_____

Structures Lab Policies

This Document outlines the policy regarding safety, safety gear, clothing, requirements, crane operations, hydraulic test, equipment operation, and noise restrictions, for all personnel working or observing activities in the Structures Lab, Materials Lab, Geotechnical Labs, and the loading dock. Certain activities in the Civil Engineering (CE) Shop, Structures, Materials and Geotechnical Labs may be require additional safety and equipment procedures, and the coordinator for these labs should be consulted for that information (CE Shop- Ken Thomas- Larry Roberts; Geotechnical- Nancy Roberts; and Structures – Ken Thomas - Larry Roberts.

The 1st floor and the high-bay area are active with research projects that are associated with the heavy civil construction industry. In order to accomplish the requirements project, a wide range of equipment is utilized to construct and perform experimental tests on various size specimens. This is cause for numerous potential safety hazards. Following the proper safety procedures and wearing proper safety gear and clothing, can reduce the chance of injury caused by improper use of hydraulic test equipment (MTS Equipment), crane operation, power tools, ladders and scaffolding, or contact with hazardous objects.

Revised: 7/25/2013
By: CEE Safety Committee

Structures, Materials and Geotechnical Laboratory Safety

Introduction

The following sections provide general guidelines and requirements for structures, materials and geotechnical laboratory safety with cover the following topics:

- General Laboratory Safety
- Hand Tools
- Power Testing Equipment and Tools

General Laboratory Safety

The hazards associated with laboratory work require special safety considerations. Whether you work in the structures, materials, or geotechnical laboratory, the potential hazards for personal injury are numerous. This section highlights essential safety information for working in a CEE laboratory. Refer to other sections in this manual, including General Safety, Electrical Safety and Fire/Life Safety for more information on handling many laboratory situations.

The following highlights common laboratory hazards.

Personal Protection

There are several measures you must take to protect yourself from laboratory hazards. For example, do **not** wear the following when working around testing equipment:

- Loose fitting clothing
- Neckties
- Jewelry

If you must wear a long sleeved shirt, be sure the sleeves are rolled down and buttoned. Snug fitting clothes and closed toe/closed heel shoes are essential safety equipment in the laboratory.

Make certain that long hair is not loose, but is pulled back away from testing equipment.

Always wear safety glasses with side shields when working with testing equipment. Additional protection using goggles or face shields may be necessary for the following types of work:

- Working with chemicals when there is a likelihood of splash
- Grinding

Wear suitable gloves, preferably leather, when working with the following:

- Scrap metal or wood
- Sharp-edged stock
- Unfinished lumber

Refer to the Personal Protective Equipment section in this manual for more information.

General Job Safety

Before beginning work in a laboratory, be sure you are authorized to perform the work to be done and inspect your testing equipment and tools. If a procedure is potentially hazardous to others in the area, warn fellow workers accordingly. Use warning signs or barriers, as necessary.

Notify your supervisor/professor if you notice any unsafe conditions such as the following:

- Defective tools or equipment
- Improperly guarded testing equipment and machines
- Oil, gas, or other leaks

Inform other employees if you see an unsafe work practice; however, be careful not to distract a person who is working with power tools.

General Safety Guidelines

Follow these guidelines for general laboratory safety:

1. Know the hazards associated with your work. Be sure you are fully educated on the proper use and operation of any testing equipment and/or tool before beginning a job.
2. Always wear appropriate safety gear and protective clothing.
3. Wear nitrile gloves when cleaning with degreasers or ferric chloride (latex gloves do not provide adequate protection.)
4. Ensure that there is adequate ventilation to prevent exposure from vapors of glues, lacquers, paints, and from dust and fumes.
5. Maintain good housekeeping standards.

    - Keep the work area free from slipping/tripping hazards (oil, cords, debris, etc.)
    - Clean all spills immediately.
    - It is recommended that electrical cords pull down from an overhead pulley rather than lying on the floor.
    - Leave tool and testing equipment guards in place.
    - Make sure all tools and testing equipment are properly grounded and that cords are in good condition.

Hand Tools

Hand tools are non-powered tools. They include axes, wrenches, hammers, chisels, screw drivers, and other hand-operated mechanisms. Even though hand tool injuries tend to be less severe than power tool injuries, hand tool injuries are more common. Because people take everyday hand tools for granted, simple precautions for safety are easily forgotten.

Structures, Materials and Geotechnical Laboratory Safety

The most common hand tool accidents are caused by the following:

- Failure to use the right tool
- Failure to use a tool correctly
- Failure to keep edged tools sharp
- Failure to replace or repair a defective tool
- Failure to safely store tools

***IMPORTANT*:** Use the right tool for the job to complete a job safely, quickly, and efficiently.

Follow these guidelines for general hand tool safety:

1. Wear safety glasses whenever you hammer or cut, especially when working with surfaces that chip or splinter.
2. Do not use a screwdriver as a chisel. The tool can slip and cause a deep puncture wound.
3. Do not use a chisel as a screwdriver. The tip of the chisel may break and cause an injury.
4. Do not use a knife as a screwdriver. The blade can snap and cause an injury.
5. Never carry a screwdriver or chisel in your pocket. If you fall, the tool could cause a serious injury. Instead, use a tool belt.
6. Replace loose, splintered, or cracked handles. Loose hammer, axe, or maul heads can fly off defective handles.
7. Use the proper wrench to tighten or loosen nuts. Pliers can chew the corners off a nut.
8. When using a chisel, always chip or cut away from yourself.
9. Do not use a wrench if the jaws are sprung.
10. Do not use impact tools, such as chisels, wedges, or drift punches if their heads are mushroom shaped. The heads may shatter upon impact.
11. Direct saw blades, knives, and other tools away from aisle areas and other employees.
12. Keep knives and scissors sharp. Dull tools are more dangerous than sharp tools.
13. Iron and steel hand tools may cause sparks, which are hazardous around flammable substances. Use spark-resistant tools made from brass, plastic, aluminum, or wood when working around flammable hazards.

Improper tool storage is responsible for laboratory accidents. Follow these guidelines to ensure proper tool storage:

1. Have a specific place for each tool.
2. Do not place unguarded cutting tools in a drawer. Many hand injuries are caused by rummaging through drawers that contain a jumbled assortment of sharp-edged tools.
3. Store knives or chisels in their scabbards.
4. Hang saws with the blades away from someone's reach.
5. Provide sturdy hooks to hang tools on.
6. Store heavy tools, such as axes and sledges, with the heavy end down.

Revised: 8/21/2013
By: CEE Safety Committee

Power Testing Equipment and Tools

Power tools can be extremely dangerous if they are used improperly. Each year, thousands of people are injured or killed by power tool accidents. Common accidents associated with power tools include abrasions, cuts, lacerations, amputations, burns, electrocution, and broken bones. These accidents are often caused by the following:

- Touching the cutting, drilling, or grinding components
- Getting caught in moving parts
- Suffering electrical shock due to improper grounding, equipment defects, or operator misuse
- Being struck by particles that normally eject during operation
- Falling in the work area
- Being struck by falling tools

When working around power tools, you must wear personal protective equipment and avoid wearing loose clothing or jewelry that could catch in moving machinery. In addition to general laboratory guidelines, follow these guidelines for working with power tools:

1. Use the correct tool for the job. Do not use a tool or an attachment for something it was not designed to do.
2. Select the correct bit, blade, cutter, or grinder wheel for the material at hand. This precaution will reduce the chance for an accident and improve the quality of your work.
3. Keep all guards in place. Cover exposed belts, pulleys, gears, and shafts that could cause injury.
4. Always operate tools at the correct speed for the job at hand. Working too slowly can cause an accident just as easily as working too fast.
5. Watch your work when operating power tools. Stop working if something distracts you.
6. Do not rely on strength to perform an operation. The correct tool, blade, and method should not require excessive force. If undue force is necessary, you may be using the wrong tool or have a dull blade.
7. Before clearing jams or blockages on power tools, disconnect from power source. Do not use your hand to clear jams or blockages, use an appropriate tool.
8. Never reach over equipment while it is running.
9. Never disable or tamper with safety releases or other automatic switches.
10. When the chance for operator injury is great, use a push stick to move material through a machine.
11. Disconnect power tools before performing maintenance or changing components.
12. Keep a firm grip on portable power tools. These tools tend to "get away" from operators and can be difficult to control.
13. Never leave chuck key in chuck.
14. Keep bystanders away from moving machinery.
15. Do not operate power tools when you are sick, fatigued, or taking strong medication.
16. When possible, secure work pieces with a clamp or vise to free the hands and minimize the chance of injury. Use a jig for pieces that are unstable or do not lie flat.

Guards

Moving machine parts must be safeguarded to protect operators from serious injury. Belts, gears, shafts, pulleys, fly wheels, chains, and other moving parts must be guarded if there is a chance they could contact an individual.

As mentioned before, the hazards associated with moving machinery can be deadly. Hazardous areas that must be guarded include the following:

1. Point of operation. Area where the machine either cuts, bends, molds, or forms the material.
2. Pinch/nip point. Area where moving machine parts can trap, pinch, or crush body parts (e.g., roller feeds, intermeshing gears, etc.)
3. Sharp edges.

There are three types of barrier guards that protect people from moving machinery. They consist of the following:

- Fixed guards
- Interlocked guards
- Adjustable guards

A fixed guard is a permanent machine part that completely encases potential hazards. Fixed guards provide maximum operator protection.

Interlock guards are connected to a machine's power source. If the guard is opened or removed, the machine automatically disengages. Interlocking guards are often preferable because they provide adequate protection to the operator, but they also allow easy machine maintenance. This is ideal for problems such as jams.

Self-adjusting guards change their position to allow materials to pass through the moving components of a power tool. These guards accommodate various types of materials, but they provide less protection to the operator.

***IMPORTANT*:** Guards must be in place. If a guard is removed to perform maintenance or repairs, follow lockout/tagout procedures. Replace the guard after repairs are completed. Do not disable or move machine guards for any reason. If you notice that a guard is missing or damaged, contact your supervisor and have the guard replaced or repaired before beginning work.

***NOTE*:** Hand-held power tools typically have less guarding in place than stationary power tools. Use extreme caution when working with hand-held power tools and always wear a face shield.

Structures, Materials and Geotechnical Laboratory Safety

Laboratory Specific Safety Guidelines

In addition to the safety suggestions for general laboratory usage, there are specific safety requirements for structures, materials and geotechnical laboratories. The following sections cover safety guidelines for specific laboratory operations.

For instance, a structural testing laboratory includes a variety of testing arrangements, all of which contain possibilities for accidents. The variety of potential tests and test set-ups makes the definition of specific rules of behavior at best difficult and at worst impossible. In order to measure what the researcher wants to measure, a certain amount of creative rigging is sometimes—often times—called for, rigging that is important to get the job done but too variable to have a rule book that says "Follow this set of rules, and everything will be alright." There are, however, certain categories of accidents and logical guidelines that fit a large percentage of test operations, as noted in the paragraphs below.

The first ingredient in safe operation of test equipment in a testing laboratory is simply knowledge. Before a faculty researcher or GRA or undergraduate worker uses any piece of equipment, be it an MTS controller or overhead crane, he/she should have some reasonable level of knowledge of how that piece of equipment operates and what the potential misuses are. But after all the guidelines are written, there is no substitute for three key ingredients in assuring safety: awareness, caution, and common sense. None of these ingredients are quantifiable, but no set of rules, however detailed, can assure safety unless the three ingredients are present. This concept of awareness, caution, and common sense should be emphasized by every research investigator to every student worker—and then reviewed from time-to-time. The stakes are high; serious injury is always one slip away; and when it happens, remorse doesn't make the injury go away.

Categories of Potential Accidents

As previously mentioned, the hazards associated with a testing laboratory can be deadly. Categories of hazards that must be guarded against include the following:

- Release of strain energy
- Projecting elements
- Falling objects
- Falls
- Burns

Adequate knowledge of how to use the equipment is an obvious first step. Then, the three safety criteria of awareness, caution, and common sense are always important and are indispensable qualities of safe behavior in testing laboratories.

Release of Strain Energy

In a typical test in a structures testing laboratory, large forces which produce significant deformations are applied until the structural test specimen being loaded fails. Considerable strain energy has been generated in the specimen and in the test apparatus as both are deformed, energy which will be released upon failure. An example is a simple tensile test of a steel coupon. The coupon begins to visibly "neck down" and then fails suddenly, causing a loud noise but doing no harm. The reason that it does no harm is that both ends are fixed by the bearing platens which hold the specimen.

Another common example of the release of strain energy is a compression test of a concrete cylinder. Unlike steel, concrete has essentially no ductility and, in turn, little warning of failure. When it fails, it shatters, and chunks of concrete are apt to fly off in unpredictable directions. For a cylinder of moderate strength which has just recently been removed from a moist curing environment, this "explosion" is relatively modest. For a higher strength concrete that has dried out, the explosion can be dramatic. The simple cure is the use, which is simple common practice, of enclosing the specimen in a protective screen.

The real danger in this category occurs in the kind of test where there is a significant release of strain energy which may occur at specimen failure when some non-standard test set-up is used. Then the source of danger from strain energy release is typically not obvious. And it is here that the three key ideas of awareness, caution, and common sense become crucial. Be aware that a strain energy release is going to happen; be cautious and assume that, consistent with Murphy's First Law, anything that can go wrong will go wrong. Then apply common sense either to prevent it or protect against it. An example of common sense is simply not to stand too close to a specimen about to fail or, if the failure load is uncertain, at any time during the test.

Projecting Elements

Test frames, hold-down devices, or stored specimens such as steel plate or reinforcing steel bars are three examples of potential hazards from projecting elements. Most of the time any danger from these can be eliminated by some sort of minimal protective device such as a split tennis ball stuck onto the projecting end of a bolt.

Falling Objects

Unlike a construction site, there is typically no concern about objects falling on a worker's head; thus, hard hats are not typically needed. An exception to this statement occurs when an overhead crane is being used; then the possibility exists that something could conceivably fall on a worker's head, and hard hats should be employed. The most common accident involving falling objects is simply dropping something on a foot, in which case a minor accident is likely, and a

serious accident is not improbable. The logical preventative measure is to have all workers wear steel-toed safety shoes when working in the structural testing laboratory.

Falls

A testing laboratory is not quite like a construction site where ladders and scaffolding are commonplace. On the other hand, when large structural specimens are being tested, the use of ladders and possibly scaffolding may very well be necessary. An estimate by the Consumer Products Safety Commission several years ago estimated that 225,000 emergency room visits per year resulted from ladder accidents. Most ladder and scaffolding accidents occur from inappropriate use of the ladder or scaffold by a worker. The safety precautions to take are several: (1) Use good equipment. A ladder should be a Type 1 or 1a. A scaffold should be erected carefully to be structurally stable. (2) All OSHA instructions as to safe use of ladders and scaffolds should be followed. (3) There should always be two persons present when either a ladder or scaffold is being used; one person should hold the ladder to stabilize it while a second person climbs.

Burns

Working with hot materials such as asphalt can be extremely dangerous. Contrary to working with hot water, molten asphalt will adhere to exposed skin thereby causing more severe burns. Wear thermally insulated gloves, pants, and laboratory coats to prevent asphalt burns. Safety glasses and a face shield to protect your eyes and face. Closed toe/closed heel shoes to protect your feet. Do not stick your head over an open tank or kettle and avoid open stirring to prevent burns and overexposure to fumes. Use protective equipment to keep asphalt off of your skin and out of your eyes. Do not allow water to splash into hot asphalt because it can bubble up explosively. Avoid heat and sparks around your asphalt work since some asphalt additives can be flammable.

Potential Safety Hazards

A wide variety of equipment and hazardous procedures are necessary to complete tasks in the 1st Floor Labs. Also, a number of projects occur in the field (work away from campus) and require working alongside construction equipment and vehicle traffic, working around water, working from articulating boom lifts at elevated heights, and working in fabrication plants (steel fabrication, precast concrete plants, etc…). Therefore, experimental research has many potential safety hazards and may include the following:

1. Unsafe workers.
2. Insufficient, cluttered, and /or shared work space.
3. Hydraulic test equipment
    - Hydraulic actuators and material frames
    - High pressure oil
    - High force testing
    - Brittle material testing
    - Large scale specimen testing
4. Equipment and tools
    - Hand tools
    - Welding and torching equipment
    - Pneumatic and electric power tools
    - Pallet jacks and portable lift equipment
        - Ovens
        - Concrete and asphalt mixers
5. Ladders, scaffolding, boom lifts and scissor lifts
6. Confined spaces
7. Working at elevated heights
8. Vehicle and construction traffic
9. Overhead, lattice and hydraulic boom cranes
10. Rigging and moving loads
11. Chemical and bio-hazards

Safety Gear and Proper Clothing

When working in hazardous surroundings, hard hats, steel-toe boots, work gloves, safety glasses, coveralls or work pants, and sleeved shirts are necessary items. When working in the Structures Lab, these items must be in your possession at all times, and must be worn when involved in the following activities:

1. Operating the crane and conducting activities adjacent to personnel operating the crane.
2. Conducting activities involving construction, removal, or demolition of a specimen or load frame.
3. Conducting activities within the concrete mix area.
4. Conducting activities alongside the strong wall of the structures lab.
5. Removing or placing items in the storage racks on the north side of the structures lab or when conducting other activities adjacent to the storage racks.
6. Forklift or other hydraulic or electric drills.
7. Conducting/ observing experiments involving hydraulic actuators, screw jacks, or other testing apparatuses capable of generating large forces.
8. Using any hand tool or power tool.

Hearing protection, consisting of earplugs and/ or earmuffs, is required when operating equipment that creates loud noises. A dust mask or respirator is required when working in dusty or vaporous conditions. Rubber gloves are available when working with wet concrete and other chemicals. A full face-shield is required when grinding.

Hard hats, safety glasses steel- toes rubber boots, steel shoe coverings, foam inserts for hearing protection, dust masks, and rubber gloves, can be found in the metal cabinet alongside the window near the structures lab west entrance or in the CE Shop. Please see Paul Bergson if you cannot locate these items or if replacement items need to be ordered.

When using welding or torching equipment, an approved upper-body jacket must be worn with leather welding gloves to prevent burns, and ear-plugs must be used to prevent sparks from entering your ear-cannel. When torching you must use tinted goggles or face shield, and when welding, you must wear a full-face welding helmet.

When a project requires work at heights above six feet, fall protection equipment must be worn and affixed to a secure tie-off point. Fall-protection gear consists of a full- body harness and a lanyard. Please see Larry Roberts this equipment and information regarding proper tie-off.

Shorts, skirts, dresses, tank tops, open-toe (sandals), and high-heel shoes, are not considered proper apparel in any laboratory on the 3rd floor at any time. A limited number of lockers are available in the structures lab for people interested in storing work clothes. Paul Bergson should be contacted for locker space.

If you are involved in a field project adjacent to any roadway you must wear a safety traffic vest and you vehicle must have a flashing light mounted on the roof. See Paul Bergson for this

equipment. Also, proper warning signs and traffic cones must be placed to alert oncoming traffic of your presence. A traffic control plan must be prepared and approved by Paul Bergson prior to conducting any field activities that will occur adjacent to vehicle traffic.

Crane Operations

The Civil and Environmental Engineering Building is equipped with two cranes each capable of lifting 10,000 pounds. This crane is operated by use of a hand held control device, allowing convenient operation. However, this permits control from areas where it is difficult or impossible to observe crane movement. Combination of the exceeding lifting capacity and/or improper crane movements can result in serious damage, injury or death. [Due to the great hazards involved, only Ken Thomas and Larry Roberts will be allowed to operate the crane, as per Dr. Penumadu and the CEE safety committee.]

The following rules apply to safe crane operation

1. **If you have never used the crane before, you must consult with Ken Thomas or Larry Roberts.**
2. **Always check the load rating of your lifting components, and be aware that the load rating reduces when lifting at an angle or using a choker.**
3. **Before lifting objects, run the crane up and down over a few feet several times. This insures complete lubrication of the load brake.**
4. Always inspect lifting components prior to use. Any damage components must not be used and must be reported to Ken Thomas or Larry Roberts.
5. Always wear a hard hat when operating the crane. It is the operator's responsibility to inform other personnel in the vicinity to wear a hard hat.
6. Never operate the crane without clear view of the crane hook and load.
7. Pay attention to what you are doing (do not let your brain wander).
8. Never stand directly under the load you are moving or pass directly over other personnel. If you are placing concrete and using concrete bucket, you must cover all actuators, hydraulic manifolds and critical instruments with tarps.
9. When moving large pieces of equipment or specimens, you must first consult with Ken Thomas or Larry Roberts.
10. Always be aware of what is around you when moving equipment and specimens.
11. Follow proper rigging procedures. If you are unsure consult Ken Thomas or Larry Roberts.
12. Always use a shackle when connecting two straps. Never loop or choker a strap through the eye of another strap.
13. Do not use badly worn straps, chains, wire ropes or shackles when rigging. Report these items to Ken Thomas or Larry Roberts. Do not use nylon straps if colored strands are visible or there are obvious cuts.
14. Never use the crane as a loading device (i.e., applying an upward vertical force to free or wedge structural members).
15. Measure the height from the bottom of your load to the crane hook before moving equipment or specimens in or out of the structures lab.
16. Do not use chains as part of your rigging equipment unless approved for use by Ken Thomas or Larry Roberts.

Revised: 7/25/2013
By: CEE Safety Committee

Hydraulic Testing Equipment

The Structures Lab and Materials Lab are equipped with test equipment (hydraulic and screw type systems) capable of sudden movements and the capacity to generate large forces. Most of this equipment is MTS hydraulic test frames and hydraulic actuators. A central pump running at an operating pressure of 3000 psi supplies the hydraulic fluid for all MTS equipment.

The following rules apply to safe hydraulic equipment operation:

1. **If you have never used MTS equipment, you must contact Ken Thomas or Larry Roberts**
2. **Know where all crush points are around the actuators and keep your body parts away from these areas.**
3. Do not attempt to change any hydraulic hose or fitting that is attached to MTS equipment. Improper removal or installation procedures may result in injury to you or damage to sensitive hydraulic components.
4. Notify Ken Thomas or Larry Roberts immediately upon detecting any hydraulic fluid spills or leaks from hydraulic equipment. If they are not available, shut the station off.
5. Do not use your fingers or hands to try and stop a leak in a hydraulic hose or other hydraulic component. Substantial pressures may result at which the oil may penetrate the skin causing deep wounds or severing of fingers.

Revised: 7/25/2013
By: CEE Safety Committee

Structures Lab and High-Bay area, Hydraulic Test Equipment, and Load Frame Components

All areas within the Department of Civil and Environmental Engineering use the high-bay area and overhead doors as well as Facilities Management and Fire and Rescue personnel (in the event of a fire alarm). Before using this area for temporary storage of specimen(s), equipment, and load frame components, you must obtain prior approval from Ken Thomas or Larry Roberts. This space is restricted, and a clear pathway through the high-bay area and overhead doors must be kept open for general shipping and receiving, to transfer oversized equipment and specimens in and out of the building, and for safe access. Also, the garbage dumpster outside the building is emptied daily and it is important to keep a clear path for the waste management workers to have access to the dumpster. If you cast concrete on the high-bay areas, it is important to wash and remove and residual concrete. There is a covered wash area at the east end of the building which should be used to clean wet concrete from tools and equipment.

Revised: 7/25/2013
By: CEE Safety Committee

Work Plan Information

Before any lab work or fieldwork can be performed, a work plan must be completed and approved by Ken Thomas or Larry Roberts and your Advisor(s). The work plan shall include a list of tasks, specimen and load frame drawings, calculations, schedule, list of equipment and personnel to carry out the work tasks, instrumentation plan, rigging plan, and space requirements.

Revised: 7/25/2013
By: CEE Safety Committee

General Lab Rules

The following rules apply:

1. **Do not step on or set equipment or debris on any signal or actuator controller cable.** Damage may occur in the cable that is not visible. Please cover all cables that are on the floor with angle or channel sections.
2. When erecting objects that require aligning boltholes or two separate components, **never use your finger to align the boltholes,** always use a spud wrench or drift pin**.**
3. **You must keep your work area clean and free of debris.** This is especially important considering the number projects in the lab. If you are not keeping your area clean and clear of debris, Ken Thomas or Larry Roberts will inform you to clean and you will have 3 days to do so. If you do not clean with in the specified time frame, your research will be shut down for safety review.
4. **Never place any part of your body in an area that is considered a crush point.** Crush points include: area adjacent to all hydraulic equipment, rigging components, lifting equipment, pallet jacks, etc.
5. If you break or notice any defects in the equipment you are using, immediately inform Ken Thomas or Larry Roberts (or Gil Huie). This ensures that you will not be held responsible for repairing the equipment.
6. If you intend to use equipment that generates excessive noise (ex. Jackhammer, concrete saw, pneumatic vibrators, etc…) continuously over a long period of time (days), you must inform Ken Thomas or Larry Roberts of the dates so he can notify the Faculty and Staff.
7. Do not leave tools on load and frames or specimens, and at the end of the day put all tools back where they belong.
8. When working in any lab or the CE shop after hours (nights and weekend) you must inform your Advisor and have a second person present.
9. You are prohibited from entering the structures lab, operating any equipment, or conducting any physical work if you have taken cold or flu medication (over-the- counter or prescription), pain medication, or you are under the influence of mood altering substances (drugs, alcohol, etc..).
10. If you have a medical or physical condition that prevents you from doing certain tasks, please inform Ken Thomas or Larry Roberts so other arrangements can be made. This information will be kept private.
11. If you are taking medication(s) prescribed by a doctor, please Ken Thomas or Larry Roberts and provide a note from the doctor stating what physical activities you can and cannot perform. This information will be kept private.
12. On objects that have the potential to impale someone (for example, rebar sticking out of concrete), place a plastic cap on the end of the bar.
13. Do not interrupt CE shop personnel when they are in process of using shop equipment (milling machines, welding/torch equipment, etc.).
14. Consult with Ken Thomas or Larry Roberts for CE shop policy on equipment use and sign-out.
15. Please visit www.osha.gov , for additional safety information that may be specific to your needs.
16. All electrical cords must be protected and removed from aisle/walkways on a daily basis. If the electrical cord is cut or broken do not repair it, just throw it away. Use a properly rated electrical cord for the equipment you are using. An underrated electrical cord is safety and fire hazard.
17. Know where all the fire extinguishers are. If you use one, inform Ken Thomas or Larry Roberts immediately so the fire extinguisher can be refilled.
18. **All injuries must be reported.** File an employee incident report and have your supervisor sign it.
19. Do not be afraid to ask questions**.** We are here to assist you.

Revised: 7/25/2013
By: CEE Safety Committee

Emergency Contacts

1. 911 Medical or fire emergency
2. Ken Thomas – (865)603-1936
   Larry Roberts- (865)804-1323
   Nancy Roberts- (865)599-1632
3. CEE Office- (865)974-2503

Revised: 7/25/2013
By: CEE Safety Committee

Policy Subject: ***Student Shop Safety***	Effective: 8/1/2012
Affected Area: Machine Shops on Campus	Reviewed/Revised: 8/1/2012

1.0 Purpose, Applicability, and Scope

1.1 Purpose- This policy identifies the requirements for University machine shops to operate safely and educate students on safe techniques to use the equipment.

1.2 Applicability - This policy applies to all machine shops and other areas on University property where power tools are typically operated. These tools include, but are not limited to lathes, milling machines, table saws and drill presses.

2.0 Abbreviations, Acronyms, and Definitions

2.1 **Acronyms**

EHS: Environmental Health and Safety
OSHA: Occupational Health and Safety Administration

2.2 **Definitions**

Machine Shop: A workshop or area where power-driven tools are used for making, finishing, or repairing machines or machine parts. Machining processes include, but are not limited to turning, drilling, milling, shaping, planing, boring, broaching and sawing. Advanced machining techniques include electrical discharge machining (EDM), electro-chemical erosion, laser cutting, or water jet cutting to shape work pieces. These machines might have automatic capability but might not be equipped with automatic part handling or bar-feed mechanisms nor automatic tool changing systems.

Material safety data sheet (MSDS)- Detailed information bulletin prepared by the manufacturer or importer of a chemical that describes the physical and chemical properties, physical and health hazards, routes of exposure, precautions for safe handling and use, emergency and first aid procedures, and control measures.

3.0 Roles and Responsibilities

a. Students, Staff, Facility (Shop Workers) shall :

i. Must never work alone in the shop.
ii. Must complete general shop safety training and machine-specific training before using any machine.

iii. Must observe all shop safety rules in this policy when working in the machine shop.
iv. Must observe all shop-specific rules beyond the scope of this policy.
v. Must report all injuries to a Shop Supervisor promptly, regardless of seriousness.
vi. Must promptly report unsafe conditions, actions or near-miss incidents to Shop Supervisor.

b. Shop Supervisors who have employees and students under their control shall:
i. Ensure that all users of shop are familiar with general and shop-specific safety rules.
ii. Enforce all safety rules and make all users aware of the consequences of rule violations.
iii. Ensure that all users of shop have attended general shop safety and machine-specific training before starting their work in the shop.
iv. Provide tool/equipment specific training to each user of the equipment they will be using.
v. Must report all accidents and near-miss incidents and ensure timely correction of unsafe conditions.
vi. Must give full support to all safety procedures, activities and programs.
vii. Must maintain all training records
viii. Must maintain access to MSDS for all chemicals used in the shop.
ix. Must clearly display Shop Safety Rules signs and shop hours on the shop door.

c. EHS shall:

i. Review and update this policy and training.
ii. Conduct periodic audits of various shops and provide technical assistance and consultation when requested.
iii. Provide general shop training when requested
iv. Provide respirator fit testing when requested.
v. Conduct accident investigations in shops in cases of accidents and near-miss incidents.

d. Department shall:
i. Must ensure that adequate supervision is provided for the shop staff.
ii. Must provide adequate resources for maintenance, repairs and safe guarding equipment.
iii. Must inform all shop users to follow University policy and safety rules.

4.0 Procedure

Machine shops are present in many departments and academic laboratories that are used by the faculty, staff and students. Shop equipment and tools are routinely used to complete various projects that, if not handled properly, may result in a serious injury or death. The purpose of this program is to provide a basic overview of the common hazards associated with the use of hand

and power tools and equipment that are found in machine shops in laboratories or otherwise, to establish fundamental shop safety rules and to outline the use of safe work practices and use of proper personal protective equipment. Each user of a machine shop is required to attend general shop safety training. However, this training is not a substitute for a machine-specific safety training that should be provided by your Shop Supervisor. Employee awareness of potential hazards combined with the following proper safety procedures can reduce accidents and injuries significantly. It is therefore, of vital importance that supervisors become familiar with those sections and standards in this policy that pertain to the operation(s) under their control. The success of this program depends upon the cooperation and support of everyone, including: students, staff, facility and the Shop Supervisor.
It should be understood that these are minimum standards that apply to all University academic shops, present on all campus. More detailed shop specific rules may be developed by Shop Supervisors and Departments, must also be followed.

5. Training

Both general and machine specific shop safety training is required before students can work in the shop. General shop training can be provided by the department or EHS and should be completed before machine specific training. Specific training should involve instructions and hands-on demonstration.

Machine Specific Training should include the following components:

1) Description and identification of the hazards associated with a particular machine;
2) Proper safety precautions when working with a particular machine;
3) Limitations of the tools/equipment and when and what NOT to use;
4) Safeguards, protection they provide, and ensuring their presence before using a machine;
5) Proper personal protective equipment and how to use it.
6) What to do (e.g., contact supervisor, tag the machine) if a damaged guard, missing part unusual noise, etc., is noticed.
7) How to use emergency buttons and other measures, when needed.
8) Maintenance and cleaning procedures

6.0 Recordkeeping

Material safety data sheets, accident investigations, and medical records must be kept indefinitely.

An individual training record shall be maintained for each employee and kept for period of employment three years.

7.0 Attachments

General Shop Safety Guidelines

8.0Associated Standards

OSHA Standard 29 CFR 1910.22 General requirements
OSHA Standard 29 CFR 1910.35. Means of Egress
OSHA Standard 29 CFR 1910.133. Eye and Face Protection
OSHA Standard 29 CFR 1910.134. Respiratory Protection
OSHA Standard 29 CFR 1910.135. Hand Protection
OSHA Standard 29 CFR 1910.136. Foot Protection
OSHA Standard 29 CFR 1910.178. Powered Industrial Trucks
OSHA Standard 29 CFR 1910.212.General Requirements for all Machines
OSHA Standard 29 CFR 1910.242. Hand and Power Tools and Equipment, General
OSHA Standard 29 CFR 1910.243. Guarding of Portable powered Tools.
OSHA Standard 29 CFR 1910.252. General requirements for Welding

Appendix 1

General Shop Safety Guidelines:

EHS has developed these guidelines for those who currently, or might in the future, use power tools and heavy machinery in shops and laboratories. These guidelines DO NOT serve as a replacement for formal training in lab techniques or shop safety. Only trained personnel should use shop equipment after they have been trained by their supervisor. Failure to follow proper precautions can result in serious injury or death.

1. Never Use a Machine If You Are NOT Trained – Always Get Training Before Operating Any Machinery.
You must attend general safety training and specific training on the machine you intend to use. If you are unfamiliar with a particular tool or instrument, do not use it until you are properly trained on its usage.

2. Never Work Alone – Always Use "Buddy System".
At least two adults must be in the shop when power tools are being used. You must get permission from your Shop Supervisor for off-hours and weekend work if the shop permits off-hours work.

3. Never Use Machine When Impaired
The use of alcohol or drugs prior to the use of shop machinery is strictly forbidden and is ground for suspension or termination of shop access privileges. Be aware of other situations which may impair your ability to work safely, including illness, tiredness, stress, hurrying, or the use of medication that could make you drowsy.

4. **Never Start Work If You Cannot Do The Job Safely - Just Don't Do It.**
There are limits to what can be built in a given shop and in a given time, and how safely you can do it in hurry .If it cannot be done safely don't start it.

5. Never Wear Open Toe Shoes - Use Closed-Toe Shoes in the Shop.
Sandals, flip-flops or other open-toed shoes are prohibited at all times in machine shops. Tools, chips and fixtures are sharp, and often hot. Shoes will help protect your feet from injury. Flame retardant shoes are recommended when welding.

6. Never Work Without Proper Eye Protection - Always Wear Appropriate Safety Glasses or Goggles When Working or Cleaning Tools.
The minimum standard for protective eyewear is safety glasses with side-shields; machine users must observe this standard at all times. Eyewear which offers additional protection against splashing or other hazards may be indicated based on a risk assessment of the process or procedure. Prescription glasses with plastic lenses must meet ANSI Standard Z87.1 for safety.

7. Never Work With Loose Hair, Jewelry, Clothing, etc. – Always Remove or Secure Anything That Might Get Caught in Moving Machinery.
All shop users must secure or remove personal items that may become entangled in a machine. Long hair, necklaces, ties, dangling ID badges, jewelry, loose clothes, watches or rings, may get caught in

tools and can drag you along resulting in serious injury or death. Check with shop supervisor for appropriate attire.

8. Never Bring Hands Close to Sharp Objects – Always Keep Your Hands At a Safe Distance From Sharp Tools.
Make sure that nothing that you do will cause you to be cut by working too close to a sharp tool or moving machine part. Maintain a safe distance.

9. Never Create a Dusty and Smoky Environment - Dust, Chemicals and Smoke Can Be Dangerous to Your Health, so Work in Well-Ventilated Areas, Minimize Contamination and Use Appropriate Protective Equipment (PPE). *Only use dust or fume-generating machines in their intended areas. Ensure the shop is well ventilated and appropriate PPE is used when working with such machines.*

10. Never Be Shy to Seek Help –Always Ask If You're Unsure about the Safe Operation of a Tool or Any Aspect of a Job – Have Shop Staff Check the Tool or Work with Which You Are Unfamiliar.
Exercise common sense and clarify your tasks and responsibilities before starting work.

11. Never Leave Your Work Area Disorganized – Always Clean Up After Yourself.
Before you leave your work site all tools must be returned to their storage location, machines must be cleaned and wiped down and the floor swept, as necessary. Leave appropriate time for cleanup at the end of your project.

12. Never Remove Safety Guards – They are Present for a Reason
Safety guards must never be disabled or removed under any circumstances. You must ensure that safety guards are in place on moving parts before you start working. Follow all appropriate shut-down procedures before working on a machine if the repair requires removal or alteration of guarding.

13. Never Use Gloves While Using Rotating Equipment – Check With Supervisor, if Needed. Remove Them Before Starting Work.
Gloves can become entangled in rotating machine parts resulting in serious injuries.

14. Never Leave Broken or Damaged Tools or Abnormal Equipment Unreported – Always Inform Your Supervisor to Remove Broken Items from Service for Repair.
Broken parts or equipment can result in serious injuries and delays. Make sure you tag broken or damaged equipment and inform Shop Supervisor to arrange repair before next use.

15. Never Make Any Adjustments to a Machine When it is in Operation -Always Talk to Your Supervisor for Permission When Adjustment is needed.
Make sure you are competent and have permission from your supervisor to affect repairs. Ensure power is off, equipment is properly locked out and safety devices are in place.

Driving Simulator Experiment Procedures

1. When subjects arrive at the University of Tennessee Driving Simulator Laboratory (UTDSL), subjects are greeted and given a brief introduction about the simulator lab and a review of the testing procedures.

2. The tester presents an informed consent form to the subject and gives a few minutes for the subject to read and understand it. The informed consent form is approved by the Institutional Review Board (IRB) at the University of Tennessee. The subject information and the data collected are to remain confidential according to the Human Research Institutional Review Board guidelines at the University of Tennessee. The tester explains the risks associated with the driving simulator, chiefly, motion sickness. The tester also explains to the subject that they will have complete anonymity with regards to this project.

3. After the form is signed, the subject is allowed into the simulator. The tester ensures the subject's comfort before turning out the lights and beginning the simulation.

4. Warming up. Before the subject begins driving, the subject is informed of several directions. Subjects are told that this session is only a practice session which is designed to help them learn how the vehicle handles. The session should help subjects with starting, stopping, turning, and general control of the vehicle. Subjects are told to drive as they would normally drive. The subjects are also told that when approaching an intersection, both a verbal and visual instruction will be given to inform the subject of the proper direction to follow. Subjects are told that if there is a feeling of simulation sickness, especially a strong one, they can stop the vehicle at any time and take a break from testing. Subjects are told that there is no penalty for needing to stop the vehicle and take a break. Finally, before the subject is allowed to go, they are asked if they have any questions before beginning.

5. After finishing the warming up session, the subject is asked if they would like a break before continuing onto the studied session. Subjects are offered refreshments at this time as well. After the break, if any, subject reenters the vehicle and the studied scenario begins. The subject is told that if they need to take a break for any reason, they can at any time.

6. The tester then explains the purpose of the experiment to the subjects and introduces the survey before asking the subject to answer it. After each subject finishes the survey, the tester thanks them for their participation in the study.

Response Information

(for driving simulator lab)

***Minor Illness or Minor Injury*:** UT Police will transport any faculty, staff, student, or visitor (students to the UT student clinic if only minor issues; faculty, staff or visitors to UT emergency room.)

Usually Building Services responds quickly in the case of needing a clean-up if someone vomits. (Due to the presence of bodily fluids, facilities services staff are trained to do that safely, using PPE, including gloves etc.)

If driving simulator researchers wish to clean up instead, they must First contact Brian Ranger in advance for bio-safety training principles, plus standard microbiological procedures training.

Phone numbers to post in lab:

911 for emergencies

974-3111 for UT Police

946-7777 for Facilities Services

974-5084 for Envr. Health & Safety, Chuck Payne

974-1938 for Bio-Safety dept., Brian Ranger

Phone number for faculty PI (principal investigator) to include:

Dr. Lee Han at 865 974-7707 and/or

Dr. Stephen Richards at 865 974-0724

Recommended Motion Sickness Response Supplies and PPE*

(for driving simulator lab)

Nitrile disposable gloves of several sizes

Liquid proof disposable plastic lab aprons

Safety glasses with side shields or splash goggles

Commercial air sick bags in box or dispenser near or in driving simulator cab

Vermiculite, kitty litter or other general purpose spill absorbent

Leak tight plastic garbage bags w/ twist tie closures or tape

bio-hazard bags for outside containment bag

Bucket with lid or similar container to hold supplies (later to hold used disposal bags)

Small whisk broom and dust pan

Sponges, wash tub, small mop

Commercial cleaner, such as Simple Green

Disinfectant such as Pine-Sol, Windex multi-surface disinfectant or bleach (diluted 1:10 in water)

Posted response phone numbers (on driving simulator lab wall)

*It is highly recommended that driving simulator researchers phone facilities services at 946-7777 to ask for housekeeping personnel to do cleanup related to motion sickness due to potential bodily fluids hazards and expectations that they have received minimal introductory bio-safety training for such types of cleanup.

Revised: 9/18/13
By: CEE Safety Committee

INFORMED CONSENT STATEMENT

You are invited to participate in a research study. The purpose of this research is to utilize the DriveSafety DS-600 model driving simulator located in Perkins Hall room 72 to conduct tests of participants' driving performance. You will be tested to analyze the effects of different factors on your driving performance. The objective of this study is to explore how drivers react to various configurations of roadway features.

INFORMATION ABOUT PARTICIPANTS' INVOLVEMENT IN THE STUDY

You will be asked to read and sign this consent form. You will then be asked your age and relevant driving experience for proper data collection. After information is collected, you will be asked to open the door of the car cab and sit down in the seat of the simulator cab. Next, you will be asked to drive an 8 minute practice session in order to familiarize yourself with the simulated driving environment. Then, you will be asked to complete a course totaling 15-20 minutes in the University's driving simulator. Each session will be comprised of a virtual driving course developed by the researchers. The total amount of time required of you as a participant is approximately half an hour. Breaks in the testing will be permitted at your discretion.

RISKS

The only potential risk to you during testing could be motion sickness due to the conflicting body queues of visual movement without actual body movement. You can quit the test anytime during the test without penalty if you feel uncomfortable or simply do not wish to continue.

BENEFITS

In transportation research, the use of driving simulators to conduct research is growing rapidly due to the declining costs of high quality technology. The results of the study will provide useful guidance in regards to roadway design standards.

CONFIDENTIALITY

All information in the study records will be kept confidential. Data will be stored securely and will be made available only to persons conducting the study. No reference will be made in oral or written reports, which could link participants to the study.

CONTACT INFORMATION

If you have questions at any time about the study or the procedures, (or you experience adverse effects as a result of participating in this study,) you may contact the researcher, _____ at _____. If you have questions about your rights as a participant, contact the Office of Research Compliance Officer at (865) 974-3466.

PARTICIPATION

Your participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at anytime without penalty and without loss of benefits to which you are otherwise entitled. If you withdraw from the study before data collection is completed your data will be destroyed.

CONSENT I have read the above information. I have received a copy of this form. I agree to participate in this study.

Investigator's signature _____ Date_____.

Participant's signature _____ Date _____.

Revised: 9/18/13
By: CEE Safety Committee

FORM A

Certification for Exemption from IRB Review for Research Involving Human Subjects

---

A. PRINCIPAL INVESTIGATOR(s) and/or CO-PI(s) (For student projects, list both the student and the advisor.)**:**
_____

B. DEPARTMENT: Civil & Environmental Engineering (Transportation Department)

C. COMPLETE MAILING ADDRESS AND PHONE NUMBER OF PI(s) and CO-PI(s):

_____

_____

_____

_____

D. TITLE OF PROJECT: Driver Behavior at Passive Grade Crossings: A Driving Simulator Study

E. EXTERNAL FUNDING AGENCY AND ID NUMBER (if applicable)**:** Southeastern Transportation Center 406629

F. GRANT SUBMISSION DEADLINE (if applicable)**:** N/A

G. STARTING DATE (NO RESEARCH MAY BE INITIATED UNTIL CERTIFICATION IS GRANTED.)**:** August 2012

H. ESTIMATED COMPLETION DATE (Include all aspects of research and final write-up.)**:** December 2012

I. RESEARCH PROJECT

1. **Objective(s) of Project** (Use additional page, if needed.)**:** See Attached
2. **Subjects** (Use additional page, if needed.)**:** See Attached
3. **Methods or Procedures** (Use additional page, if needed.)**:** See Attached
4. **CATEGORY(s) FOR EXEMPT RESEARCH PER 45 CFR 46** (See instructions for categories.)**:** 45 CFR 46: Paragraph 2

J. CERTIFICATION: The research described herein is in compliance with 45 CFR 46.101(b) and presents subjects with no more than minimal risk as defined by applicable regulations.

Principal Investigator: _____ _____ _____
Name Signature Date

Student Advisor: _____ _____ _____
Name Signature Date

Department Review Committee Chair: _____ _____ _____
Name Signature Date

APPROVED:
Department Head: _____ _____ _____
Name Signature Date

COPY OF THIS COMPLETED FORM MUST BE SENT TO COMPLIANCE OFFICE IMMEDIATELY UPON COMPLETION.

Revised: 9/18/13
By: CEE Safety Committee

FORM A

Certification for Exemption from IRB Review for Research Involving Human Subjects

INSTRUCTIONS FOR COMPLETING FORM A
PLEASE TYPE THE INFORMATION REQUESTED ON THE FRONT OF THIS FORM

Provide the required information in the space available if at all possible. If additional space is necessary, attach a separate sheet. Submit one copy of this form to the Chair of your Departmental Review Committee for review and approval. [PLEASE NOTE: This form may be reproduced on a personal computer and printed on a high quality printer (*e.g.*, LaserJet, DeskJet). Form A was originally created under WordPerfect 6.1 and printed on a HP LaserJet III printer using a 9-point CG Times font.]

ALL SIGNATURES MUST BE ORIGINAL on this form. When certified by your department or unit head, a copy of the signed Form A will be returned to the Principal Investigator and a copy will be returned to the Research Compliance Services Section, Office of Research.

I.1. OBJECTIVES: Briefly state, in non-technical language, the purpose of the research, with special reference to human subjects involved.

I.2. SUBJECTS: Briefly describe the subjects by number to be used, criteria of selection or exclusion, the population from which they will be selected, duration of involvement, and any special characteristics necessary to the research.

I.3. METHODS OR PROCEDURES: Briefly enumerate, in non-technical language, the research methods which directly involve use of human subjects. List any potential risks, or lack of such, to subjects and any protection measures. Explain how anonymity of names and confidentiality of materials with names and/or data will be obtained and maintained. List the names of individuals who will have access to names and/or data.

I.4. CATEGORY(s) FOR EXEMPT RESEARCH PER 45 CFR 46: Referring to the extracts below from Federal regulations, cite the paragraph(s) which you deem entitle this research project to certification as exempt from review by the Institutional Review Board. **45 CFR 46.101(b): Research activities in which the only involvement of human subjects will be in one or more of the following categories are exempt from IRB review:**

(1) Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as: (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, **unless**: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; **and** (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

PLEASE NOTE: *An exemption cannot be used when children are involved for research involving survey or interview procedures or observations of public behavior, except for research involving observation of public behavior when the investigator(s) do not participate in the activities being observed. [45 CFR 46.401(b)]*

FORM A

Certification for Exemption from IRB Review for Research Involving Human Subjects

(3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (2) above, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) Federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

(4) Research involving the collection or study of existing data, documents, records, pathological specimens or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

(5) Research and demonstration projects which are conducted by or subject to the approval of Federal Department or Agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

(6) Taste and food quality evaluation and consumer acceptance studies, if wholesome foods without additives are consumed or if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminants at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the US Department of Agriculture.

For additional information on Form A, contact the Office of Research Compliance Officer by e-mail or by phone at (865) 974-3466.

Rev. 01/2005

FORM A

Certification for Exemption from IRB Review for Research Involving Human Subjects

I.1. Objective of Project: Briefly state, in non-technical language, the purpose of the research, with special reference to the human subjects involved.

In transportation research, the use of driving simulators to conduct research is rapidly increasing as the cost of the necessary technology to do so decreases. The purpose of this research is to utilize the DriveSafety DS-600 model driving simulator located in Perkins Hall room 72 to conduct tests of subjects driving performance and behavior. The subjects will be asked to drive the fixed base car cab in a virtual environment. The car cab is similar to a Ford Focus and the virtual environment is shown on five large projector screens. In this research, approximately 65 subjects will be tested on their behavior at various railroad crossings. At each crossing, drivers will have a chance to see a type of sign, the presence of a train, and an additional factor based upon a random selection. The additional factor for one crossing is sight distance, both good and bad, and the factor for the second crossing is the presence of another driver and how its actions at the crossing affect the subject. The testing will last approximately 8-12 minutes based upon driver performance. Before the test, the driver will be asked to drive a practice session lasting approximately 8-10 minutes to acclimate themselves with the simulator.

I.2. Subjects: Briefly describe the subjects by number to be used, criteria of selection or exclusion, the population from which they will be selected, duration of involvement, and any special characteristics necessary to the research.

Subjects at least 18 years of age or older with a valid driver's license that are willing to participate will be utilized for data collection. There is not an exact number of drivers necessary for this study; however, for statistical significance, at least 64 drivers will be needed. The subject will be asked to complete a practice session of approximately 8-10 minutes before conducting the study. Subjects will then be asked to drive a different scenario for approximately 8-12 minutes that will be used for data collection.

I.3. Methods or Procedures: Briefly enumerate, in non-technical language, the research methods which directly involve use of human subjects. List any potential risks, or lack of such, to subjects and any protection measures. Explain how anonymity of names and confidentiality of materials with names and/or data will be obtained and maintained. List the names of individuals who will have access to names and data.

Initial risk of the subjects is simply opening the door and sitting down inside of the simulator cab. The subjects will be misled as to the true purpose of the testing before beginning. Drivers will be told to focus on several things, excluding the railroad crossings. This is to aid in ensuring that the drivers will treat the crossings as they would when normally driving, rather than when they believe they are being evaluated. Next drivers will be asked to complete an 8-10 minute practice session before completing a second 8-12 minute simulation for data collection. After the testing, drivers will be told of the true focus of the test and will be given a questionnaire. The session will be comprised of a virtual driving course developed by the principal investigator. The only potential risk to a subject during testing would be motion sickness due to the conflicting queues of visual movement without any body movement. The names of the subjects will remain anonymous. The only information that will be obtained is the driver's age and relative driving experience. The student's advisor, Dr. Steve Richards, will have access to the collected data.

Potential health and safety risks associated with the CEE driving simulator

With regards to the CEE department Drive Safety DS-600c driving simulator, Chuck Payne of the Environmental Health and Safety department at UTK briefly presented at the June 3, 2013 CEE safety committee meeting to the other members about a generally known minor health and safety risk (motion sickness) occasionally caused by computer and software generated simulations being run by human subjects. Apparently temporary uncomfortable sensations or feelings are not all that uncommon with virtual reality (VR) activities. Further explaining this effect within an Institutional Review Board (IRB) certification exemption form, one of the PIs of the CEE driving simulator stated "The only potential risk to a subject during testing would be motion sickness due to the conflicting queues of visual movement without any body movement." In a different IRB certification exemption form, more information listed said "The main potential risk is motion sickness, which is typical and with minimal risk as most driving simulators like this one. In case of motion sickness or any other kind of discomfort, subjects will be advised that they can quit the experiment at any time." And from the informed consent statement, which volunteer drivers of the simulator read and sign—

"**RISKS** The only potential risk to you during testing could be motion sickness due to the conflicting body queues of visual movement without actual body movement. You can quit the test anytime during the test without penalty if you feel uncomfortable or simply do not wish to continue."

During mid 2010 at the request of the CEE department head, 3 personnel of the EHS department at UT conducted an on-site evaluation of the new CEE driving simulator, including test drives themselves, carried out with the aid of transportation graduate students. Later a UT bio-safety officer also was consulted with regard to possible risks.

Among conclusions and recommendations from the leader of the EHS group to CEE department staff:

1) that only minor risk was to be expected from use of the simulator by volunteer test drivers;
2) that posting of some emergency phone numbers in the lab would be a good idea;
3) and that having cleanup absorbent materials along with simple PPE was recommended in case motion sickness lead to vomiting. UT Building Services are trained should be the primary resource for a clean-up.

Some discussions later centered around the heat output by the computer and multiple projector units in Perkins room 72 by the driving simulator and successful efforts through several months time were made by members of the department and facilities services to improve the air conditioning capability, decrease its noise levels, and improve ventilation in the room for the better comfort, health and safety of future volunteer drivers and graduate student testers.

Revised: 9/18/13
By: CEE Safety Committee

Potential health and safety risks associated with the CEE driving simulator

At one time soon after installation of the unit, the manufacturer was consulted regarding an objectionable burning electrical smell coming from the cab, which was explained to be due to the newness of the equipment in service, some of their paint and surface coatings, and heat of some of the components. That issue soon resolved by itself as they had predicted.

Discussions followed as to other aspects of volunteer's comfort, concerning perhaps using room 73's foyer as a waiting room for test volunteers, or as a relaxation area for anyone feeling a little queasy or dizzy after their simulator rest drives, and it was brought up as well the option of offering cold drinks to volunteers afterwards, and even an option was considered and discussed of having off campus volunteers bring someone with them in case they did not feel well enough to walk safely out of the building or drive themselves home afterwards. Some of these options were instigated, others were not.

One of the PIs stated recently that their first couple years of research indeed had shown that health and safety risks to volunteers were minimal; also looking into that risk was one of the goals of some of their early research studies. He explained further that "In terms of the driving simulator, it is a much simpler version of what you ride at Disney World or even at some county fairs, where the VR based machines have far more degrees of freedom, different motions. Since our driving simulator's motion system has not been working, we actually don't have any DOF at the moment. But with or without the motion base, there are no documented safety concerns with driving simulators."

UTK Laboratory Orientation/Training

Welcome to UTK's CEE Lab. This short training is to help orient those that are learning how to work in a laboratory environment as well as help those that are joining our lab to become acquainted with our procedures.

- **Safety** - # 1 priority – we have several hazardous agents in our laboratory and your safety and the safety of others is the most important thing here. If you notice anything unsafe or feel that the situation you have been placed in is unsafe, please let your lab supervisor and PI know so steps can be taken to ensure everything is in proper working/safe order.
- **Lab Space** – we have a large laboratory with several people sharing spaces as well as having "personal" space.
  - General Laboratory Space – these areas are used by everyone in the lab and should be clean before and after you use them. Nothing should be left there over night. You do not know who may need the space before you return. If it is critical that something not be moved, then leave a note making the next person aware of the situation.
  - Your personal laboratory space should be kept in a neat and orderly manner as to ensure that everyone is safe at all times.
- **Labeling of ALL bottles/tubes/etc…** - ***ALL*** bottles/tubes/etc… containing liquids, solids, powders or any other material ***MUST*** be labeled. This is an OSHA requirement and must be followed. If unlabeled items are found during an environmental safety inspection by the University, your PI/supervisor will receive notification of the violation. Do **NOT** store chemicals in food containers.
  - **Suggestions for labels**
    - add your initials/name so we know to whom it belongs
    - date made
    - expiration date
    - storage conditions
- **Equipment** – We have multiple types of analytical pieces of equipment in our laboratory. You ***may NOT*** use any equipment without first being trained by the

appropriate person. Several pieces of equipment that we have can be "delicate" and improper usage can cause thousands of dollars worth of repairs to be made. You must also "log in" in the appropriate Log Book whenever you are using a piece of equipment. These notebooks are necessary for keeping the equipment properly maintained as well as information that can be very useful if something goes wrong (that way we can find out what was in a sample, etc… so the proper repairs can be made for minimal cost). Training is required for many laboratory items listed under the OJT (On the Job Training) section of this safety manual such as the following items:

- **Electronic balances**
- **Bending beam rheometer**
- **Concrete compression machine**
- **Concrete mixers (portable and stationary)**
- **Coredry**
- **CTE**
- **Cut-off saw**
- **Cyclic direct shear machine**
- **Direct shear machine**
- **Extractors**
- **Extruders**
- **Freeze-thaw machine**
- **Gyratory compactor**
- **Impact hammer**
- **Impact testing machine**
- **Instron universal testing machine**
- **LA abrasion machine**
- **Loading frames**
- **Masonry saw**
- **Mechanical compactor**
- **MIST equipment**
- **Mixers**
- **MTS equipment**
- **NCAT oven**
- **Drying ovens**
- **Pressure aging vessel**
- **Pressuremeter**
- **Resonant frequency meter**
- **Rockwell hardness machine**
- **Sieve shakers**
- **Soil grinder**
- **Soldering station**

  - **Strain gage meter**
  - **Triaxial test equipment**
  - **Vacuum pumps**
  - **Viscometer**
  - **Water baths**
  - **Windsor probe**
- **Ordering –** Your PI will review ordering and procedures with you. Be sure to allow for delivery time when you are planning your experiments and items which need to be ordered.
- **Notebooks –** Laboratory notebooks are recommended and are to be kept in the laboratory. When keeping your notebook be sure to keep as detailed information on the items used and procedure as you can. You want to be specific enough so that if someone came behind you to repeat the experiment they will be able to do so without having to hunt you down. If you are continuously repeating the same experiment, then reference the pages where it is written step by step and then just write any exceptions and your results. A good example of what to include would be:
    - List of materials used in that particular experiment
    - Catalog #, lot # and manufacturer of materials
    - Procedure followed
    - Printout of results included (i.e. summary of test results, pictures of test setup, etc…)
- **General Laboratory Etiquette** – when working in a lab remember that courtesy will go a long way.
  - DO NOT borrow other peoples' items without their permission. You do not know how something was prepared and if what it is labeled is actually what you are needing.
  - If you borrow something, return it to the place that you got it from.
  - If you use a general laboratory space, then leave it clean and ready for the next person to use.
  - If you share space with someone else, please be courteous and leave it clean and ready to use.
  - Plan ahead – equipment and general areas in the lab are used by multiple people. Be sure to check for availability prior to starting a

lengthy experiment. Your priority is NOT someone else's priority. Some items have sign-in sheets which need to be used. If no one has signed up to use something, then it should be available. Be sure to think your experiments through prior to starting to be sure everything you need is there/available.

- General disposable supplies – we have lots of supplies in the lab used by everyone. If you are using something and notice that the item is low or completely out, please be courteous and fill it back up. If you take the last box of something, be sure to place an order request with all the necessary information so that it can be re-ordered in a timely manner.

_____ I have seen the Safety presentations.
Initials

_____ _____
Signature Date

_____ _____
Trainer Signature Date

Name: **Fall Protection Plan**	Effective: August 1, 2013
Areas Affected: All areas on campus and university sponsored activities that involve a fall hazard.	Reviewed/Revised: August 1, 2013

1.0 Purpose, Applicability, and Scope

1.1 Purpose - The purpose of this document is to provide guidance to prevent falls from elevated surfaces.

1.2 Applicability – This plan shall apply to students, staff and faculty. On campus facilities shall be included plus situations where students, staff or faculty could be exposed to a fall hazard while engaged in offsite, university-sponsored activities.

This does not apply to the following situations:

1. Recreational or athletic events including rock climbing, sky diving, competitive diving, hang gliding, and similar activities.

2. Where climbing gear is used.

3. Stairs or fall hazards on the same level.

2.0 Abbreviations, Acronyms, and Definitions

2.1 Abbreviations/Acronyms

ANSI – American National Standards Institute

CFR – Code of Federal Regulations

EHS – campus Environmental Health and Safety

GFCI- ground fault circuit interrupter

NFPA – National Fire Protection Association

OSHA- Occupational Safety and Health Administration

2.2 Definitions

Elevated walking surface- is a location where an individual could stand and is more than four feet above an adjoining surface.

Extreme fall hazard – these are locations and situations where a fall is likely and the resulting injuries could be fatal.

Fixed ladders – ladder that are permanently attached (e.g. bolted, anchored) to a building or structure.

Holes – include HVAC floor openings, trap doors, temporary openings in the walking surface for construction or maintenance, skylights, man hole covers, and alike. The minimum area defining a hole is one square foot. Note that a smaller limit may be necessary for locations where children are present.

Personal Fall Arrest System – consists of a full body harness, D-ring connector, lanyard and a suitable anchor point. Other components may include horizontal life line, self-retracting lift line, positioning belt, and shock absorbing lanyard.

3.0. Roles and Responsibilities

Environmental Health and Safety will:

a. Maintain this written plan and place in the online safety manual
b. Assist with interpretation of the plan
c. Conduct site reviews, including complaint follow up, upon request
d. Assist departments or individuals to the extent feasible with compliance
e. Maintain records as required
f. Provide training upon request
g. Investigate accidents involving falls
h. Disseminate information related to fall hazard prevention as necessary

Departments that may have individuals who are exposed to a fall hazard shall:

a. Ensure the individuals are trained as appropriate
b. Consult with Environmental Health and Safety when specific questions arise related to this plan
c. Report any deficiencies or problems
d. Maintain records as required
e. Ensure site-specific fall prevention plans are developed if necessary.

Individuals who may be exposed to a fall hazard shall:

a. Report any accidents, hazards or near misses associated with fall hazards to their supervisor or EHS
b. Use recognized safe work practices associated with ladders, personal fall arrest systems, nets, scaffolding and powered lifts.
c. Participate in training as necessary

4.0 Procedure

EHS shall conduct safety inspections to identify fall hazards on campus and make recommendations as necessary.

Extreme fall hazard shall be considered imminent danger. Any staff or faculty member is authorized to stop work when these situations are encountered. See Safety Procedure GS 102 (Imminent Danger) in the UTK safety manual for additional details.

Fall Prevention Plan – A site specific plan is available only for employees engaged in leading edge work, precast concrete erection work, or residential construction work (See 1926.501(b)(2), (b)(12), and (b)(13)) who can demonstrate that it is infeasible or it creates a greater hazard to use conventional fall protection equipment.

Signs may be used to warn of a fall hazard, but shall not be the sole means of protection.

The following text lists various fall hazards and appropriate controls. Consult EHS for additional details or information.

A. Elevated Walking or Working Surfaces – Fall hazards from these locations shall be controlled by one of the following:

1. Guardrail constructed in accordance with NFPA standards or the building code with respect to strength (200 lbs.), rail height (42 inches minimum), and mid-rail or baluster spacing (maximum 4 inch clear width). Note that OSHA guardrails, detailed in 29 CFR 1910.23 may be used for limited situations or for existing situations where children under the age of 12 are unlikely to be present. Work on a ladder adjacent to a guardrail may negate the protective feature of the rail and should be addressed before work starts.

2. Personal Fall Arrest Systems – must be installed and used in accordance with the manufacturer's specifications.

3. Nets – in accordance with the OSHA construction standard (29 CFR 1926.105) or applicable ANSI standards.

4. Warning Line – generally available only on construction sites with various limitations. See the OSHA construction Standard (29 CFR 1926.502(f).

5. Controlled Access Zones - generally available only on construction sites with various limitations. See the OSHA construction standards (29 CFR 1926.502(g).

6. Safety Monitoring System - generally available only on construction sites with various imitations. See the OSHA construction standards (29 CFR 1926.502(h)

B. Fixed Ladders

1. Shall be designed and installed in accordance with OSHA standard (29 CFR 1910.27).

2. Fixed ladders 20 or more feet in height shall have a personal fall arrest system. Note that existing ladders more than 20 feet in height may use a cage as defined by the 29 CFR 1910.27(d).

C. Portable Ladders

1. Shall be rated for the anticipated load and used in accordance with recognized standards.

2. See Appendix A for guidance on ladder use

D. Scaffolding

1. Shall be in accordance with the OSHA construction standard (29 CFR 1926 Subpart L) or General Industry (29 CFR 1910.28) and the manufacturer's specifications. Note there are many different types of scaffolding.

2. Shall be installed by trained individuals and inspected periodically.

3. May require the use of personal fall arrest system based on the nature of the work.

E. Boatswain Chair

1. Shall be used in accordance with the manufacturer's specifications.

F. Open Pits and Excavations

a. Fall hazard shall be guarded with a fence or barriers when unattended.

b. Signs shall be posted warning of the hazard at intervals not to exceed 50 feet around the perimeter of the fence or barrier.

G. Holes in the Walking Surface

1. Holes shall be guarded with any of the following:

    a. Floor grate, screen or temporary cover of sufficient strength to carry twice the anticipated load.

    b. Where a cover or grade is not feasible, other methods (guardrails, barriers, warning lines) shall be used.

    c. Covers shall be secured to prevent movement and require marking if located on a construction site.

H. Towers, Light Poles and Alike

1. A mechanical lift is the preferred method to access to the upper level of towers, light poles, and similar structures.

2. Towers, light poles and alike that are metallic may be conductive. It may be necessary to use electrical equipment that is low voltage, double insulated or protected by a GFCI in these situations.

3. Personal fall arresting systems must be used where present.

I. Trees

a. A mechanical lift is the preferred method to access the upper portions of a tree.

b. Where a mechanical lift can't be used, climbing gear must be considered. Training is required for climbing gear.

J. Lifts, Powered Platforms

a. A personal fall arrest system is typically necessary with a mechanical lift.

5.0 Recordkeeping

Records shall be kept for training as required in section 6.0 below and in accordance with Records Retention for Safety, Health and Environmental Protection procedure, GS 43, found in the safety manual.

6.0 Training and Information

Training is required for the following equipment and situations for individuals using:

A. Personal fall arresting systems

B. Installing and using scaffolding

C. Positioning devices

D. Boatswain chairs

E. Powered Platforms as defined by 29 CFR 1910.66 and other mechanical lifts

F. Nets

Appendix A - Ladder Safety

This section was taken from: https://www.osha.gov/Publications/portable_ladder_qc.html

 Read and follow all labels/markings on the ladder.

 Always inspect the ladder prior to using it. If the ladder is damaged, it must be removed from service and tagged until repaired or discarded.

 Always maintain a 3-point (two hands and a foot, or two feet and a hand) contact on the ladder when climbing. Keep your body near the middle of the step and always face the ladder while climbing (see diagram).

 Only use ladders and appropriate accessories (ladder levelers, jacks or hooks) for their designed purposes.

 Ladders must be free of any slippery material on the rungs, steps or feet.

 Do not use a self-supporting ladder (e.g., step ladder) as a single ladder or in a partially closed position.

 Do not use the top step/rung of a ladder as a step/rung unless it was designed for that purpose.

 Use a ladder only on a stable and level surface, unless it has been secured (top or bottom) to prevent displacement.

 Do not place a ladder on boxes, barrels or other unstable bases to obtain additional height.

 Do not move or shift a ladder while a person or equipment is on the ladder.

 An extension or straight ladder used to access an elevated surface must extend at least 3 feet above the point of support. Do not stand on the three top rungs of a straight, single or extension ladder.

 The proper angle for setting up a ladder is to place its base a quarter of the working length of the ladder from the wall or other vertical surface.

 A ladder placed in any location where it can be displaced by other work activities must be secured to prevent displacement or a barricade must be erected to keep traffic away from the ladder.

 Be sure that all locks on an extension ladder are properly engaged.

 Do not exceed the maximum load rating of a ladder. Be aware of the ladder's load rating and of the weight it is supporting, including the weight of any tools or equipment.

ON JOB TRAINING (OJT) FORM

OJT Skill(s)/Topic:_____

DATE	Trainer/Instructor Signature	Employee Supervisor Name	Employee Name Printed	Employee Signature

Revised Date: 9/18/2013

Drilling Rig Safety

Objectives

The purpose of the drilling rig safety plan is to establish the general guidelines and requirements for the prevention of injury and ensure the health and safety of the workers involved. Since it is impossible to cover every possible hazard one might encounter on the drilling rig, please use common sense when working.

General Statement

You are expected to conduct all operations so the health and safety of all is given the highest priority. No operation shall be pursued at the expense of the safety of individuals performing a task. Failure to comply will be grounds for disciplinary action.

General Procedures

The following personal hygiene and work practice guidelines are intended to prevent injuries and adverse health effects. This guideline is the minimum standard procedures for reducing potential risks associated with work near the drilling rig.

- Eating, drinking, smoking, taking medication, chewing gum or tobacco is prohibited in the immediate vicinity of the work.
- Hands and face will be thoroughly washed prior to eating, smoking, or putting anything in the mouth.
- Personal visitors are not allowed on site.
- Whenever possible, one should stand upwind of the work.
- Always be alert to potential changes in exposure conditions such as strong odors, unusual appearance in cuttings, oily sheen on water, etc.
- Always be alert as to unusual behavior, dizziness, or other symptoms exhibited by you or by others at the site as this may indicate exposure to harmful substances.
- Noise may pose a health and safety hazard, particularly during drilling. A good rule of thumb is that if you have to shout in order to communicate at a distance of three (3) feet in continuous noise; you should be wearing hearing protection. Likewise, any impact noise from activities such as driving split spoon samplers which is loud enough to cause discomfort would indicate the use of hearing protection.
- Always use the appropriate level of personal protection, lesser levels of protection can result in preventable exposure: excessive levels of safety equipment can impair efficiency and increase potential for accidents to occur.

Revised: 7/26/2013
By: CEE Safety Committee

Drilling Rig Safety

Drilling Safety is Everyone's Responsibility

Drilling is inherently a dangerous operation. Many improvements on drilling rigs have contributed to making drilling safer, including emergency cut-off switches located at the back of the rig, chain and gears that have been replaced by sealed hydraulic motors, hydraulic drill stem breakouts and hydraulic driven wire lines eliminating the need for rope and catheads, just ot name a few. Most accidents still can be attributed to human error. Human error can be future subdivided into: inexperience, carelessness, being tired, or substance abuse. Accidents from these causes can be greatly reduced by taking the obvious preventative measures.

The following is a list of DO's and DON'Ts which may help avoid unnecessary accidents:

- ✓ Do – Contact Tennessee One-Call System (1-800-351-111) at least three (3) working days before commencing drilling operations.
- ✓ Do – Everyone, not just the driller, should know how to turn off the rig.
- ✓ Do – Wear gloves, your skin is too delicate to leave unprotected.
- ✓ Do – Keep equipment and tools in good working order and condition.
- ✓ Do – Wear your hard hat, it doesn't take much metal falling to do serious harm.
- ✓ Do – Wear your safety belt while driving.

- × Don't drill too close to overhead power lines or underground power sources.
- × Don't refuel the engine while it is running. Leaking gasoline and a spark can cause a serious explosion.
- × Don't wear loose clothing around a drilling rig. Clothing caught in turning machinery will pull the rest of your body into the machine.
- × Don't drill out of control. There is a direct correlation between accidents and drilling too fast.
- × Don't do things that require excessive strength (i.e., breaking pipe joints, moving heavy tools, etc.) This is a precursor to getting hurt suddenly or causing long term health problems. Let the tools and the drilling rig do the work.
- × Don't drill while lightning is seen or thunder is heard. Drill masts are excellent lightning rods.

Revised: 7/26/2013
By: CEE Safety Committee

Drilling Rig Safety

Drilling Safety Guide

We care about your safety not only when you are working on or around the drilling rig, but also when you are traveling to and from site, moving the drilling rig and tools from location to location on a site, or providing maintenance on a drilling rig or drilling tools. This safety guide is for your benefit. Failure to heed the safety procedures contained herein could result in serious injury or death.

Every drill crew should have a designated safety supervisor who has the authority to enforce safety on the drilling site. Any drilling rig worker's first responsibilities are to obey the directions of the safety supervisor.

The safety supervisor is the drilling rig operator. The safety supervisor must:

- Consider the responsibility for the safety and the authority to enforce safety to be a matter of first importance.
- Be the leader in using proper personal protective safety equipment and take appropriate corrective action when proper personal protective safety equipment is not being used.
- Understanding that proper maintenance of tools and equipment and general housekeeping on the drilling rig will provide an environment that will promote and enforce safety.
- Before drilling is started, ensure that anyone operating the drilling has had adequate training and is thoroughly familiar with the drilling rig, its controls, and its capabilities.
- Inspect the drilling rig at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and/or damaged pressure gages and pressure relief valves.
- Check and test all safety devices, such as emergency shut-off switches, at least daily and preferably at the start of a drilling shift. Drilling must not be permitted until all emergency shut-off switches and warning systems are working correctly. Do not allow any emergency device to be passed or removed.
- Check that all gages, warning lights and control levers are functioning properly and listen for unusual sounds each time an engine is started.
- Ensure that each drilling rig worker is informed of safe operating practices on and around the drilling rig.
- Carefully instruct a new worker in drilling safety and observe the new workers progress towards understanding safe operating practices.
- Assess the mental, emotional, and physical capability of each worker to perform the assigned work in a proper and safe manner. Remove any worker from the drill site whose mental and physical capabilities might cause injury to the worker or others.
- Insure that a first aid kit and fire extinguisher are properly maintained on the drilling rig.
- Be well trained in and capable of using first aid kits, fire extinguishers, and all other safety devices and equipment.

Revised: 7/26/2013
By: CEE Safety Committee

Drilling Rig Safety

Fire Prevention

Fire can be the most devastating of accidents that can occur. All must be very conscious of fire prevention measures at all times. The following must be observed:

- The drilling rig must be equipped with a 20 lb. fire extinguisher rated ULC "ABC". The fire extinguisher shall be inspected on an annual basis and tagged accordingly.
- No smoking or open flame where flammable liquids, solvents, or fuels are stored, transported, handled, or used.
- No smoking while operating any equipment.
- No smoking on work sites.
- Equipment powered by internal combustion engines (except diesel powered) must be shut off.

In the event of fire or explosion and if the situation is readily controllable with available resources, take immediate action to do so. If not:

- Clear the area of all personnel working in the immediate vicinity.
- Cease operations of all equipment. No cigarettes or other flame or spark sources shall be permitted in the area.
- Immediately call 911.
- Keep all personnel and the general public away from the hazard.

Physical Hazards

- Traffic – When drilling on the street there is significant potential for "struck-by" accident, make certain that you are wearing a high visibility vest or uniform.
- Noise – Large equipment and engines such as the drilling rig generate significant noise during operation which could affect workers in close proximity to the operating equipment. Because hearing damage is irreversible, it is crucial that measures be taken to preserve the hearing of all personnel. The steps required to implement a hearing conservation program are minor compared to the impact of the damage or loss of one's hearing.
- Heat and Sun – Projects done during the summer months can have an effect on workers. Remain well hydrated and wear protective sun-blocking agents.

Personal Protective Equipment (PPE)

The last line of defense in hazard control is personal protective equipment (PPE). PPE is used when engineering or procedural controls cannot completely eliminate a hazard. The purpose of PPE clothing and equipment is to shield or isolate individuals from the chemical, physical, and biological hazards that may be encountered at a drilling site. For most drilling projects, individual PPE must include a safety hat, closed toe/closed heel shoes, safety glasses and close-

fitting gloves and clothing. Rings and jewelry must not be worn while working near a drilling rig. Other PPE may be necessary based on site specific conditions.

Clearing the Work Area

Prior to drilling, adequately clear and level the site to accommodate the drilling rig and supplies and provide a safe working area. Do no begin drilling if tree limbs, unstable ground, or site obstructions cause unsafe tool handling conditions.

Start-Up

Instruct all drilling rig personnel and visitors to "stand-clear" of the drilling rig immediately prior to starting the engine.

- Make sure brakes are set, all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers or air controls are in the correct positions, and the mechanical hammer is properly seated.
- Start all engines according to the manufacturer's manual.

Procedures and Precautions

Raising the drilling tower – Before raising the drilling tower, the operator must observe the following precautions:

- The surface of the leveling stabilizers will rest on must be reasonably even.
- The surface of the stabilizers will rest on must be able to adequately support the weight of the drilling rig. If the surface is soft, timber or boards must be used under the stabilizers in order to spread the weight over a larger area.
- On a sloping surface, the stabilizers must be able to extend far enough so that the drilling rig is level. Blocking or timbers under the stabilizers may be necessary to meet this condition.
- If possible, the operator should avoid lifting the drilling rig completely off the ground with the stabilizers. It is preferable to have the wheels support some of the weight of the drilling rig.
- The drilling rig must be level.
- Clearance from overhead obstructions including buildings, bridges, power lines, and other utilities must be established. Electricity can shock, burn, or cause death.
- Clearance from underground utilities must be established. Contact Tennessee One-Call System (1-800-351-111) at least three (3) working days before commencing drilling operations.
- The pins that secure the tower when it is in the raised position must be removed until after the tower is raised.

Drilling Rig Safety

Once the drilling rig is leveled with the stabilizers, the drill head must be moved to or below the pivot point of the tower. Under no circumstances should the operator attempt to raise the tower with the drill head above the pivot point of the tower.

When the operator is confident that the ground surface is supporting the stabilizers and when the drill head is at or below the tower pivot point, the operator may raise the tower. As the tower is being raised, operator must scan the entire tower to insure that there is no interference between the people, equipment, buildings, or utilities. If the operator observes any interference or potential interference between the tower and any object or person, the operator must stop raising the tower and re-evaluate the situation.

Once the tower is raised to its full upright position and the operator is satisfied that the tower is safe operating distance from structures and is the legal distance from overhead power lines, the tower securing pins should be put in place.

After the tower is secured with the tower securing pins and all safety conditions have been met, the drill head may be moved up the tower and drilling may proceed.

Proper lifting techniques – Proper lifting takes the hazards out of moving heavy objects. Whenever you lift something:

- Make sure you can lift the load safely, otherwise get help.
- Use a mechanical lifting device, if available.
- Inspect route to be traveled, making sure of sufficient clearance.
- Look for any obstruction or spills.
- Inspect the object to decide how it should be grasped.
- Look for sharp edges, slivers, or other things that might cause injury.

Proper lifting procedures – Whenever you lift something:

- Keep feet parted – one along side and one behind object for better balance.
- Keep back straight, vertical, with spine, back muscles, and body in correct alignment.
- Tuck chin into chest.
- Bend knees and assume squatting position.
- Tuck elbows and arms close to body.
- Keep body weight directly over feet.
- Start lift with thrust of rear foot.
- Move slowly and carefully, avoid twisting the body.

Revised: 7/26/2013
By: CEE Safety Committee

Permits

Please insert any active permits into this section that pertains to any work that is being done.

Name: **Minors in Laboratories and Shops**	Effective: February 28, 2013
Areas Affected: All areas on campus	Reviewed/Revised: February 28, 2013

Purpose, Applicability, and Scope

Purpose- To establish a safety policy and plan for University departments or coordinated programs hosting minors who will be performing independent work in laboratories and shops. Minors participating in supervised instructional programs (e.g. Governor's School, KidsU, etc.) or University-hosted/guided tours are excluded from this policy.

This policy does not contemplate or authorize a minor who is not enrolled in the University as a student to be hired as a University employee. Approval of the appropriate department head is required to hire a non-University student under the age of eighteen (18) as a University employee.

Abbreviations, Acronyms, and Definitions

Abbreviations/Acronyms

ACGIH – American Conference of Governmental Industrial Hygienists
CFR – Code of Federal Regulations
dBA – Decibels, A-weighted scale
EHS- Campus Environmental Health and Safety
IDLH – Immediate Dangerous to Life and Health
NFPA – National Fire Protection Association
NIOSH – National Institute for Occupational Safety and Health
OSHA – Occupational Safety and Health Administration
PI – Principal Investigator
SCBA- Self-Contained Breathing Apparatus
SCUBA – Self-Contained Underwater Breathing Apparatus
TCA – Tennessee Code Annotated

Definitions

"Campus Safety Resources" includes the following groups:

1. Biosafety Office
2. UT Knoxville Office of Environmental Health and Safety
3. UT Institute of Agriculture Safety Office
4. Radiation Safety Office
5. Risk Management Office

"Hazardous Substance" is defined as a chemical, biological, or radiological substance capable of causing injury. "Hazardous Substance" includes definitions, classifications, and criteria established by 29 C.F.R. 1910.1200 Appendix A.

"Laboratory" is defined as a location where teaching, experimentation, or research occurs that involves hazardous substances or physical hazards. Examples include, but are not limited to, chemistry labs, biology labs, and chemical engineering labs. The term laboratory does not include computer labs, geography labs, and similar spaces.

"Minor" is defined as any individual under 18 years of age and not enrolled in the University as a student.

"Physical hazard" includes, but is not limited to, the following:

1. Exposed energized conductors operating at more than 50 volts AC
2. Shear points, crush points, nip points, or run-in points that are not adequately guarded
3. Pressure vessels operating in excess of 15 pounds per square inch for compressed gases
4. Flammable liquids, solids or gases as defined by NFPA 30: Flammable and Combustible Liquids Code
5. Cryogenic fluids and reactive materials as defined by defined by NFPA 45: Standard on Fire Protection for Laboratories Using Chemicals
6. Noise above 90 decibels, A-weighted scale, averaged over an 8-hour day
7. Non-ionizing radiation that exceeds standards published by the American Conference of Governmental Industrial Hygienists (ACGIH)
8. Equipment producing ionizing radiation

"Principal investigator" is the administrative head of the research laboratory or shop. The principal investigator determines research/work objectives, designs experiments, and assigns responsibilities to laboratory/shop staff and students.

"Shop" is defined as an area where wood, metal, masonry, plastic or similar products are manipulated by any means, such as cutting, drilling, boring, fastening (nails, rivets, screws, welds, etc.), sanding, grinding, heating, priming, finishing, or any similar activities.

"Supervisor" is defined as the PI or other senior individual assigned by the PI who is competent in and can responsibly oversee the research/work procedures being performed to include proper technique(s) and safety precautions.

Roles and Responsibilities

1. The PI or designated supervisor shall:

    a. Complete the Safety Assurance form attached, Appendix A
    b. Ensure minors have received appropriate site-specific training
    c. Conduct a hazard assessment for the minors' assignments

d. Consult with campus safety resources as necessary
e. Provide any necessary personal protective equipment
f. Ensure minors do not undertake activities listed in Appendix B – Prohibited Activities
g. Maintain records as required under Recordkeeping section below

2. Campus Safety Resources shall:

a. Provide guidance to departments, supervisors, and PI regarding this procedure
b. Develop general lab/shop safety training
c. Work with campus deans, directors, department heads, or program managers to ensure this procedure is disseminated
d. Review and revise the procedure periodically
e. Maintain records as required under Recordkeeping section below
f. Keep the most current version of this procedure posted in the EHS safety manual and on safety office websites

Hazard Assessment and Safety Assurance

The PI or supervisor shall conduct a hazard assessment of the tasks likely to be conducted by the by minor(s). Note that the Campus Safety Resources are available to assist with the hazard assessment. The hazard assessment shall be documented.

No minor shall be permitted to participate in prohibited activities as listed in Appendix B – Prohibited Activities.

The PI or supervisor will prepare a descriptive form that describes the minor's tasks, to be signed by the minor and the parent/guardian. A template for this form is attached as Appendix A. This descriptive form must include, at a minimum, the following:

1. A detailed description of the minor's activities so that the minor and parent/guardian can make an informed decision about all risks associated with the proposed activity.
2. Hazard specific safety training that must be completed by the PI or supervisor with the minor.
3. Assurance that the minor will be supervised at all times while in the facility and never left alone.
4. Assurance that the laboratory/shop will be in full compliance with all applicable University safety programs and regulations.
5. Identify the PI or supervisor responsible for the minor's activity so that minors/parents/guardians know who to contact with questions or concerns about the activity.
6. The date(s) of the proposed activity for the minors/parents/guardians to consider.
7. Clear, unambiguous language that is understandable to a layperson.
8. A release completed by each minor/parent/guardian.
9. Adequate time for each minor/parent/guardian to review the descriptive form and sign the release.

Training and Information

A general safety orientation shall be provided and maintained by Campus Safety Resources. An electronic format will be made available through Campus Safety Resources' websites. Minors shall take all applicable modules (e.g. chemical safety, biological safety, etc.) of the general, self-study safety orientation before beginning work. In addition, a quiz shall be used to highlight key points and document understanding of the information. Quiz results should be forwarded to Campus Safety Resources so that completion of this requirement can be documented (see Recordkeeping Section below).

The minor's primary supervisor or PI shall address site-specific safety subjects. Subjects for this training shall be developed from the hazard assessment.

Recordkeeping

The following records shall be maintained as part of this program:

1. Training – general and specific
2. Written hazard assessment to cover any hazardous materials or associated procedures in the lab or shop (e.g. chemical hygiene plan; material safety data sheets; Institutional Biosafety Committee-approved registration documents for recombinant DNA, infectious agents, or biological toxins; standard operating procedures which address risk and risk mitigation)
3. Safety Assurance (Appendix A)

These records shall be maintained for at least three years in accordance with safety procedure GS 43: Records Retention for Safety, Health and Environmental Protection, found in the safety manual. Records shall be kept longer in the event the minor is injured or if litigation is expected.

Campus Safety Resource offices shall be responsible for maintaining the general safety training records. The PI or supervisor is responsible for maintaining the lab- or shop-specific safety training documentation, safety assurance forms, and written hazard assessments as listed above.

Standards and References

29 C.F.R. 1910.1200 Appendix A
T.C.A. 50-5-106

Appendix A – Safety Assurance

Name of Minor_____

Worksite Location_____

Activity(ies)_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Attach additional information if necessary

Responsible Principal Investigator or Supervisor

I agree to sponsor the minor(s) identified above and by my signature below agree that:

1. I have read, understand, and will adhere to The University of Tennessee policy on "Minors in Laboratories and Shops."
2. I will ensure the student has received the necessary training before participating.
3. I have reviewed or will review with the minor at the time of arrival on campus the hazards involved with participating in the lab or shop.
4. I have confirmed that necessary personal protective equipment appropriate for, and specific to, hazards will be provided.
5. This individual will be supervised at all times while in the laboratory or shop and never left alone.
6. The laboratory or shop in which the minor will be working is in compliance with all applicable University of Tennessee safety programs and regulations.

Name of Principal Investigator or Supervisor:	
PI/Supervisor Phone:	PI/Supervisor Email:
Signature:	Date:

Minor

1. I have read, been told, and agree to follow the safety policies of The University of Tennessee.
2. I acknowledge and agree that there are risks involved with the activity(ies) as described above.
3. I agree to complete safety/hazard or other required training provided by The University of Tennessee before participation in the activity(ies) described above.
4. I choose to voluntarily participate in this activity with full knowledge that the activity(ies) described above may be hazardous to me.
5. I agree that my participation may be suspended at any time, at the discretion of The University of Tennessee and its officers, agents, and employees, if I jeopardize my own safety or the safety of others.
6. I agree to release, indemnify, and hold harmless The University of Tennessee for any loss, liability, damage, or costs, including court costs and attorney's fees, that may occur as a result of my negligent or intentional act or omission while participating in the activity(ies) described above.

I HAVE CAREFULLY READ THIS DOCUMENT AND HAD SUFFICIENT TIME TO ASK QUESTIONS AND BE GIVEN ANSWERS. I SIGN THIS DOCUMENT VOLUNTARILY.

Name of Minor (print):	
Signature:	Date:

Parent/Guardian

I, _____,(PRINT NAME) am the parent or legal guardian of the participant who has signed above.

1. I have read and understand what my child will be doing and the risks involved.
2. I understand that I may contact the PI or supervisor if I have questions or concerns.
3. I agree that my child's participation may be suspended at any time, at the discretion of The University of Tennessee and its officers, agents, and employees, if the safety of my child or others becomes a concern.
4. I certify my child has adequate health insurance necessary to provide for and pay any medical costs that may directly or indirectly result from my participation in the activity(ies) described above.
5. I have read and I understand this information and I consent to my child taking part in the activity(ies) described above, and I fully enter into and agree to the above Assumption of Risk and Release from Liability set forth above.

Name of Parent or Legal Guardian (print):	
Signature:	Date:

Appendix B -- Prohibited Activities

The follow list of activities shall not be undertaken by minors:

1. Confined Spaces – Entry into a permit-required confined space
2. Fall Hazards - Presence where an unguarded fall hazard exists. Note this does not apply to ladders
3. Hot work involving welding, brazing or torch cutting
4. Lockout/Tagout - Equipment maintenance, set-up, repair, adjustment or testing that would require lockout/tagout
5. Excavation and Trenching - Presence in excavations
6. Heavy Equipment - Operation of backhoes, front end loaders, forklifts, bulldozers, trackhoes, bobcats, and similar heavy equipment
7. UT Vehicles - Operation of UT vehicles, including all-terrain vehicles, motorcycles, carts, and any other motorized or electric conveyances
8. Unguarded Power Transmission - Presence in close proximity to unguarded power transmission equipment such as fly wheels, rotating parts, drive belts/pulleys, screw conveyors, or any similar equipment
9. Operation of power-driven woodworking machines
10. Operation of power-driven metal-forming, punching and shearing machines
11. Operation of circular saws, band saws and guillotine shears
12. Hazmat Spills - Clean up spills of hazardous materials
13. Presence near powder-actuated fasteners
14. Scaffolding - Presence on scaffolding more than 10 feet above the ground
15. Construction Sites - Presence on construction sites
16. Exposure to noise sources exceeding 90 dBA
17. Handling open sources of radioactive materials, exposure to x-ray machines, or being left unattended with any type of ionizing radiation
18. Non-ionizing Radiation – Exposure to laser in hazard classes III or IV; exposure to non-ionizing radiation sources exceeding standards established by the American Conference of Governmental Industrial Hygienists
19. SCBA - Presence in situations where a self-contained breathing apparatus is necessary
20. IDLH - Presence in situations that are considered immediately dangerous to life and health as defined by the National Institute for Occupational Safety and Health (NIOSH)
21. Imminent Danger - Presence in situations that are considered an imminent danger (per safety policy number GS 102 (Imminent Danger); see the UT EHS Safety Manual at http://web.utk.edu/~ehss/)

22. Diving/Swimming – Where a self-contained underwater breathing apparatus (SCUBA) is used
23. Activities in or about establishments manufacturing or storing explosives or articles containing explosive components
24. Operation power-driven hoisting apparatuses
25. *Chemicals Requiring Approval Prior to Use* (per safety policy number HM 45; see the UT EHS Safety Manual at http://web.utk.edu/~ehss/) are not appropriate for minors to work with directly or in close proximity. These include chemicals which may be highly flammable or explosive, may have extremely unfavorable health implications, or possess a significant risk larger than the intended academic benefit
26. Any other activities that the Commissioner of Labor and Workforce Development has declared by regulation to be hazardous or injurious to the life, health, safety and welfare of minors

Laboratory Safety Inspection Report

TABLE OF CONTENTS

AUDIT FINDINGS

Question	Response	Details
A. General Work Environment		
1. Emergency eyewash stations are regularly tested and documented (at least monthly) by lab personnel?		
2. Emergency shower is tested at least annually by Facilities Services?		
3. Emergency eyewash and shower are accessible?		
4. Fire extinguisher is mounted on the wall and access is not blocked by equipment or supplies?		
5. All exits are clearance unobstructed?		
6. Aisles are uncluttered and are without tripping hazards?		
B. Documentation		
1. A written Chemical Hygiene Plan is available in the laboratory?		
2. A Lab Safety Agreement is signed and on file for everyone that works in the lab?		
3. Documentation of general lab safety and lab specific training is available?		
C. Personal Protective Equipment		
1. Required protective equipment (such as gloves, safety glasses, goggles) is available and in functional condition?		
D. Electrical Hazards		
1. Flexible cords are in good condition?		
2. Cover plates are in place for outlets and switches?		
3. Circuit breaker panels are unobstructed?		
4. Machine/instrument access panels are in place?		
8. Ground fault circuit interrupters (GFCI) are used for wet/exterior use?		
E. Chemical Storage		
1. Shelving is adequate for loads imposed?		

Question	Response	Details
2. Refrigeration units for chemical storage are labeled No Food?		
3. Chemical storage cabinets are properly labeled?		
4. Containers are clearly labeled with entire chemical name(s)?		
5. Containers are kept closed except during transfers?		
6. Storage of chemicals is strictly limited in actively used fume hoods?		
7. Containers are compatible with the chemical?		
8. Chemicals are segregated to avoid incompatibilities?		
9. Large/heavy containers are stored on lower shelves?		
10. Corrosives are not stored above eye level?		
11. Storage quantities are minimized?		
12. Secondary containers are used during transport of more than one pint of chemicals?		
13. Materials with shelf lives are dated and disposed of per supplier's recommendations?		
14. Lab check-out procedures for departing lab workers are in place?		
F. Flammables		
1. Flammables are stored in flammable liquid storage cabinet for more than 10 gallons per room?		
2. Refrigeration units are approved for flammables storage?		
3. Flammables are separated from strong oxidizers?		
4. Flammable liquids are not stored near hot plates or other ignition sources?		
G. Compressed Gases		
1. Compressed gases are used in well ventilated areas?		
2. Storage quantities are minimized?		

Question	Response	Details
3. Cylinders are secured from tipping by a chain or strap?		
4. Regulators are compatible with gas cylinder?		
5. Cylinder carts are used for transport?		
6. Protective valve caps are in place?		
7. Empty or unused gas cylinders are promptly returned to supplier?		
H. Waste Disposal		
1. Containers are kept sealed except during transfer?		
2. Containers are labeled with the UT Hazardous Waste label?		
3. Constituents of the waste described on the container label with complete chemical name and percentages?		
4. Hazardous waste storage area is labeled with yellow Hazardous Waste Storage Area sign?		
5. Separate disposal containers are available for broken glass?		
6. Containers are compatible with waste?		
I. Fume Hood		
1. Each chemical fume hood has been surveyed?		
2. Fume hood vents (baffles) are unobstructed?		
3. Fume hoods are used with sash in appropriate position?		
4. Chemical storage is strictly limited in actively used hoods?		
J. Training		
1. Workers have attended General Laboratory Safety Training?		
2. Workers have attended Emergency Action Plan Training?		
3. Workers have attended a laboratory orientation?		
4. Workers have had training beyond EHS training (lab specific training performed by PI)?		

Question	Response	Details
5. Training (EHS and departmental is documented)?		
K. Awareness: Do laboratory workers know		
1. what to do in the event of an emergency, such as fire, injury, including evacuation routes		
2. how to clean up chemical spills		
3. the location /contents of the Chemical Hygiene Plan		
4. the Chemical Hygiene Officer and Safety Manager for the department		
5. what an MSDS is and where to find them and other safety information		
6. what type of personal protective equipment to use and when to use it		
7. what to do with chemical waste		
8. what are the most hazardous materials you use and what precautions to take		
9. if any of the materials used in the lab are carcinogens, highly toxic agents or reproductive toxins. If so, have you completed a prior approval form?		
11. where and how to use emergency equipment, such as safety showers and eyewash stations		
12. to question unfamiliar visitors in the lab		
14. if anyone in the laboratory is conducting unauthorized research activities		
Summary		
Based on the findings and observations made on the day of this inspection, the laboratory in room # HERE are in general compliance with OSHA Standard 1910.1450 and UTIA laboratory safety requirements based on current operations.		
Corrective Actions		
Based on the observations presented in this report, there are no corrective actions for the Principal Investigator or laboratory personnel.		
Recommendations		
Recommendation:		

Question	Response	Details
Please sign upon Audit completion		

Comprehensive Laboratory Hazard Assessment and Controls Form

Building (if applicable) and Room #:
Department:
Completed by (print name and title):
Date Assessment Completed:
Name of Lab Project (if applicable):
Principal Investigator (print name):
Department Head (print name):

Instructions:

This form must be completed by the PI, Lab Supervisor, or their designee to conduct a laboratory hazard assessment specific to activities in their laboratories. The laboratory hazard assessment identifies hazards to employees and students and specifies personal protective equipment (PPE) to protect employees during work activities. The person conducting the assessment must verify that it is complete and that training has been conducted.

Review the Hazard Description (column 3) of each Exposure Condition (column 2) and check the ones that are present (column 1). For every condition present, review the Examples of Engineering Controls and Personal Protective Equipment (column 4) and then complete the Specific Engineering Controls and PPE (column 5) that you intend to use to reduce or eliminate the hazard.

Long pants or skirts, closed toed shoes, and full coverage shirts are minimum requirements for all laboratory work. Hair should be tied back and minimal jewelry should be worn. Additional PPE may be required based on the assessment below. Safety Data Sheets should always be reviewed before working with any new chemicals.

Please note: The PPE Hazard Assessment does not supplant the use of administrative or engineering controls as primary methods to mitigate hazards encountered in the laboratory. PPE is your last line of defense and whenever feasible administrative and engineering controls must be applied before PPE selections are made.

Lab Hazard Assessment Form

Check if Present	Exposure Condition	Hazard Description	Examples of Engineering Controls and Personal Protective Equipment (PPE)	Specific Engineering Controls and Personal Protective Equipment (PPE)
Biological Hazards: Contact BioSafety at 974-1938 with Questions				
☐	Animals	Splash, bites, exposure to animal body fluids; injuries due to animal size, caging; allergies, and disease transmission	Requires approval by IACUC	
☐	Human Blood or other potentially infectious materials	Disease transmission	May require special approval (contact Office of Biosafety); Blood-borne Pathogen training, and Universal Precautions	
☐	Infectious Pathogens	Disease transmission	Good microbiological methods, engineering controls, gloves	
☐	Recombinant DNA	Depends on nature of DNA segments, host vector systems. Introduction of foreign genetic materials into personnel or environment	Requires special approval (contact Office of Biosafety); Good microbiological methods, engineering controls, gloves	
☐	Select agents and toxins	Infectious agents and toxins with potential to pose a severe threat to human health.	Contact Office of Biosafety 974-1938 Requires special permission. See www.selectagents.gov	
☐	Human Subjects	Ensure rights, safety and welfare of human subjects.	Requires approval by Institutional Research Board (IRB) 974-7697	
Chemical Hazards Contact EHS at 974-5084 with questions				
☐	Chemicals,low hazard with low splash probability	Skin and eye irritation	Safety glasses, chemical resistant gloves, lab coat, closed shoe of good structure, long pants; Be aware of the nearest eyewash and shower and have appropriate spill kits on hand.	
☐	Compressed gases	Aphyxiation, accidental tip over, powerful sudden pressurized release, and pinch points	Gas cylinders must be secured to stationary objects in a safe location away from danger or impact; Safety glasses and gloves	

Lab Hazard Assessment Form

Check if Present	Exposure Condition	Hazard Description	Examples of Engineering Controls and Personal Protective Equipment (PPE)	Specific Engineering Controls and Personal Protective Equipment (PPE)
☐	Controlled Substances	Drugs and certain other chemicals (narcotic and non-narcotic)	Proper training, handling & dispensing procedures, recordkeeping, safety glasses; Under the jurisdiction of federal and state laws	
☐	Corrosive liquids w/reasonable probability of splash	Skin and eye damage	Chemical splash goggles and optional face shield, neoprene gloves, lab coat, closed shoes, chemical resistant apron and appropriate spill kits on hand.	
☐	Cryogenic liquids, ultra-cold freezers, dry ice	Aphyxiation, skin, eye and tissue damage, frostbite	Ventilation, safety glasses, goggles and optional face shields for splash hazards, insulated cryogenic gloves, closed toe shoes	
☐	Organic solvents	Skin/eye damage, absorption through skin, organ damage	Chemical splash goggles and optional face shield, heavy resistant gloves, lab coat, closed shoes, chemical resistant apron, eyewash and shower and appropriate spill kits available.	
☐	Volatile hazardous or highly hazardous chemicals	Inhalation of toxic vapors, skin contact	Fume hood, glove box, safety glasses, and gloves; specialty spill kits may be needed, respirators if outside of hoods—call EHS at 974-5084 first for selection/fit	
☐	EPA Regulated Hazardous Waste	Exposure,environmental release	Safety glasses, gloves, proper storage and disposal procedures; Training and safe handling procedures.	
☐	Special cleaning agents	Exposure, allergies	Safety Data Sheets, hazard communication training, proper procedures, gloves, safety glasses	

Lab Hazard Assessment Form

Check if Present	Exposure Condition	Hazard Description	Examples of Engineering Controls and Personal Protective Equipment (PPE)	Specific Engineering Controls and Personal Protective Equipment (PPE)
☐	Toxic Substances	Poisons, neurotoxins, teratogens, mutagens, carcinogens, and subsequent environmental impact.	Proper training, procedures, storage, and disposal	
☐	Hydrofluoric acid (HF)	HF can be fatal if absorbed through the skin; severe burns; contact with metals can cause a hydrogen fire	Face goggle and face shield; heavy chemical resistant gloves (i.e. polyvinyl chloride or neoprene); lab coat	Calcium Gluconate, the antidote to HF, must be available when using this corrosive liquid.
☐	Air or water reactive chemicals	Spontaneous fires;explosions	Work in glove box; Safety goggles; chemically resistant gloves; flame resistant lab coat	
☐	Perchloric Acid	Severe burns; explosion when in contact with flammables	Safety goggles; neoprene gloves; lab coat	Only use fume hoods approved for perchloric acid use
☐	Peroxidizable chemicals	Explosion; death	Date material when opened. Dispose through EHS within 6 months.	
☐	Potentially explosive chemicals	Explosion; death	Engineering controls specific to project will need to be used.	
☐	Washing glassware	Skin lacerations from broken glass	Safety glasses, thick patterned surfaces with no slip grip gloves, lab coat.	
☐	Ultraviolet radiation	Conjunctivitis, corneal damage, skin redness.	UV face shield and goggles, lab coat.	
☐	Hot Substances	Burns, Fire	Safety glasses. Lab coat. Thermal insulated gloves when needed .	
☐	Nano-particles	Unknown health hazards due to small size	Containment, respirators	
Radiological Hazards Contact Radiation Safety 974-5580				
☐	Ionizing Radiation	Cancer, teratogenic	Time,distance, shielding; Permit and controls approved by Radiation Safety Committee.	
☐	Non-Ionizing Radiation	Eye or skin damage, burns, heat, cancer.	Training, curtains (welding), signage, interlocks, beam blocks, safety eyewear	

Lab Hazard Assessment Form

Check if Present	Exposure Condition	Hazard Description	Examples of Engineering Controls and Personal Protective Equipment (PPE)	Specific Engineering Controls and Personal Protective Equipment (PPE)
Physical Hazards Contact EHS at 974-5084 with questions				
☐	Compression (pressure)	Injury from sudden release of energy from valves, compression chambers	Energy control, safety glasses, shields, body position	
☐	Confined Spaces	Exposure, falls, dangerous atmospheres, asphyxiation, noise, vibration	Buddy system, lanyards, ventilation, monitoring	
☐	Elevated heights	Fall injury	Lanyards, anchors	
☐	Energized Equipment	Pinch, crush, caught, pulled in, electrocution	Energy control, signage, guards, no jewelry, tie back long hair; and no loose clothing; Specialty NFPA 71 Arc Flash electrical training and other types of training may be required.	
☐	Extreme Environmental Conditions	Hypothermia (cold), frostbite (cold), heat exhaustion (heat) or heat stroke.	Training, physiological monitoring. Rest cycles and fluid replacement	
☐	Impact	Injury to head or body	Hard hat, impact resistant toed shoes, body position	
☐	Manipulation of large objects	Injury, death	Training, proper lifting equipment, procedures, inspections, buddy system	
☐	Material Handling	Physical injury, strains, sprains	Training, buddy system, gloves, standard operating procedures	
☐	Noise	Deafness, hearing damage, inability to communicate	Noise monitoring, hearing protection, training, and engineering controls (e.g., enclosures, baffles, mufflers)	
☐	Penetration	Injection, wounds	Training, padding of surfaces, signage, and body position	
☐	Respirable Dust	Lung damage	Local exhaust ventilation. monitoring, respirator. Contact EHS at 974-5084 for respirator fit testing and other information.	

Lab Hazard Assessment Form

Check if Present	Exposure Condition	Hazard Description	Examples of Engineering Controls and Personal Protective Equipment (PPE)	Specific Engineering Controls and Personal Protective Equipment (PPE)
☐	Vibrating Equipment	Cumulative trauma disorders.	Gloves, protective shoes, hearing protection	
☐	Hot Equipment (autoclaves); open flames (Bunsen Burners); high temperature ovens and furnaces	Burns; fires, explosions	Gloves, eye protection, training; specialty lab coats that are heat and flame resistant, long furnace tongs	
☐	Slip, Trip and Fall Hazards	Injury, Death	Wear closed-toed shoes that are slip resistant; Look and be aware of hazards.	
☐	Overhead Hazards	Injury, Death	Hard hat, limit access beneath	
☐	Centrifuge	Imbalanced rotor can lead to broken vials, cuts, exposure, centrifuge damage or destruction & impact injuries from rotor failure	Chemical goggles, lab coat, vinyl, or nitrile gloves. OnThe Job training	
☐	Apparatus with contents under pressure or vacuum	Eye or skin damage	Safety goggles, face shield; chemical resistant gloves; lab coat. Fume hood sash down or safety shield barrier	
☐	Work involving lasers (Class 3, Class 4)	Eye damage; skin damage	Appropriately shaded goggles with optical density based on individual beam parameters; appropriate skin protection when working with dyes	
☐	Sharps (including broken glass)	Cuts; exposure	Safety goggles or glasses; lab coat; gloves; leather closed toe shoes; sharps disposal containers & broken glass boxes	
☐	Moving compressed gas cylinders	Crushed foot/toes	Steel toed shoes, gas cylinder dollies/carts	

Lab Hazard Assessment Form

Check if Present	Exposure Condition	Hazard Description	Examples of Engineering Controls and Personal Protective Equipment (PPE)	Specific Engineering Controls and Personal Protective Equipment (PPE)
☐	Sonicator	Ear damage, exposure	Safety goggles; lab coat; gloves; ear plugs	
☐	Working with loud equipment, noises, sounds, alarms, etc..	Potential ear damage and hearing loss	Earplugs or ear muffs as necessary	
☐	Very cold equipment or dry ice	Frostbite, Hypothermia	Safety goggles; insulated gloves; lab coat	
☐	Spark Producing Operations (i.e. Metal Grinding, Welding)	Burns to hands, skins, eyes, hair, clothing.	Fire retardant apparel, gloves, and impact goggles. Keep hair short, covered, or tied away from sparks.	
☐	Working in nuisance dust	Skin or eye damage, respiratory damage	Safety goggles, appropriate gloves, lab coat, closed shoes or boots if necessary, pants, NIOSH approved dust mask or other respiratory protection (call EHS).	
☐	Crush or pinch	Injury, Amputation, Death	Follow warning signs on posted equipment; avoid wearing jewelry; avoid loose clothing	
☐	Off-site work	Bug bites; snake bites; heat exhaustion; cold exposure; falls; vehicle accidents; wild animals	Take first aid kit; emergency preparedness, to include 2-way radios if no cell phone service	

Lab Hazard Assessment Form

Unique or Lab Specific Activities

If your lab conducts any additional or unique activities that are not listed above, identify the potential hazards and appropriate PPE than add these activities to the Unique or Lab-Specific Activities section below. If a lab activity is similar but somewhat different than one of the common activities listed, include it in this section as well. **If you do not have any unique activities, please place "NA" in the first column under Activity Description.**

	Activity Description	Potential Hazard	Recommended PPE
A.			
B.			
C.			
D.			
E.			

Lab Hazard Assessment Form

Additional Comments:

Has this person taken a general Lab Safety Training Course? _____

Certification: I certify this hazard assessment was conducted according to University Policy and the signatures below indicate acknowledgement.

Completed by (print): _____ Date: _____

Completed by(signature):_____

Principal Investigator (print): _____ Date: _____

Principal Investigator (signature):_____