FIELD 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

Basic preparations that should become routine before every sampling activity

- Use safety checklists when preparing for a field trip. Develop your checklists from existing site safety information and site reconnaissance (job hazard analysis or site safety plan).
- Keep a field folder for each surface-water and ground-water site at which water-quality data will be collected. The safety related contents of a field folder include:
    - Copies of the checklists mentioned above.
    - Site type (hazardous waste, confined space, cableway, wading site, bridge site, boat site) and site description.
    - Site location (include map, site sketch, and description).
    - Locations and phone numbers of emergency facilities, such as a hospital or first aid station, police and fire departments, utility companies.
- Additional information specific to the site: for example, if it is open to hunting, and season dates; appropriate clothing (such as orange safety vests).
- Make an itinerary for every field trip and leave a copy at the office and with family or colleagues. Schedule times to check in at work and with family or colleagues when field trips require overnight stays. Follow the established schedule. Notify all concerned parties if your schedule changes.
- Obtain or reserve communication equipment, such as a cellular phone or two-way radio.

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Vehicle Safety

Introduction

The following sections provide vehicle safety guidelines and procedures. This section covers the following topics:

- General Vehicle Safety
- Defensive Driving
- Backing Large Vehicles
- Accidents
- Mobile Phones and Radios
- Railroad Crossings
- Passengers

General Vehicle Safety

Motor vehicle accidents are the leading cause of death and crippling injury in the United States. Traffic safety laws are important components of vehicle safety, but the most important aspect of vehicle safety is the driver.

IMPORTANT: ALL UT employees who operate a motor vehicle for university business (whether a university, rental vehicle, or personal vehicle) must possess a valid STate of Tennessee driver's license for their vehicle's class.

To ensure driving safely, follow these driving practices:

- Driving while under the influence of alcohol or drugs is strictly prohibited.
- Obey all traffic laws, signs, and signals.
- Respond to dangerous driving conditions, as appropriate.
- Maintain a safe distance between your car and any car in front of you. Allow at least one car length for each 10 MPH (e.g., three car lengths if you are driving 30 MPH).
- Keep your eyes moving to avoid fatigue, especially if you plan on driving for a long period.
- Always use your turn signal to indicate your intended action.
- Leave yourself an "out" by either driving in the lane with a shoulder, driving in the middle lane of a multi-lane road or following other vehicles at a safe distance.

Defensive Driving

The principles of defensive driving include the following:

1. **Knowledge**. Know your vehicle and know the law.

2. **Control**. Always maintain control of your vehicle. To improve your control, perform routine vehicle maintenance and respond to road conditions, as appropriate.

3. **Attitude**. Be willing to obey all laws and be willing to yield to all other vehicles and pedestrians.

4. **Reaction**. Respond to driving conditions appropriately. Do not impede your reaction time by driving when tired or under the influence of alcohol or drugs.

5. **Observation**. Be aware of potential accidents and take preventive measures. Always try to anticipate the actions of other drivers.

6. **Common Sense**. Do not risk your safety to save time. Avoid "Road Rage" - Do not respond to rude or obnoxious drivers.

Backing Large Vehicles

Backing a large vehicle can be very difficult. Try to avoid backing whenever possible. If you must back a vehicle, follow these guidelines:

1. Before you enter the vehicle, inspect the area you want to back into.

2. If possible, have someone outside help guide your vehicle into position.

3. If your vehicle does not automatically sound a warning horn or beeper when in reverse, sound the horn once before moving backwards.

4. Back slowly and check your mirrors often.

Accidents

If you are ever involved in a vehicle accident, follow these guidelines:

1. Check for injuries. If anyone is injured, immediately all EMS (911).

2. Call the police and obtain an accident report from the police department for each and every accident involving a vehicle on official university business.

3. If there are no injuries, you are blocking traffic, and your car can be driven, move the car to a safe location nearby. (If the accident occurs on a freeway lane, ramp, shoulder, median, or busy metropolitan street, you *must* move your car if it is safe and possible to do so.)

4. If you can not move your car, try to give warning to oncoming traffic to prevent other accidents by raising your hood, turning on your hazard lights, or lighting flares.

5. Exchange the following information with other drivers involved in the accident:

   - Name, address, and phone number
   - Vehicle identification number, license number, and description
   - Insurance information
   - Driver's license number

Mobile Phones and Radios

Whether hand-held or "hands-free," mobile phones and CB radios are **not** to be used, and should be switched off if possible, when driving on the open roads. They can be used freely when the vehicle is parked.

This policy applies when university vehicles are driven off UT property, rental vehicles are used on UT business, or personal vehicles are driven for UT business.

Railroad Crossings

Compared with other types of collisions, train/motor vehicle crashes are 11 times more likely to result in a fatal injury. On the average, there are more train-car fatalities each year than airplane crashes. Unfortunately, driver error is the principal cause of most RR crossing accidents. Many drivers ignore the familiar tracks they cross each day, and some drivers disregard train warning signals and gates.

All public highway-rail crossings are marked with one or more of the following warning devices:

1. **Advance Warning Signs**. Advance warning signs indicate that a railroad crossing is ahead. These signs are positioned to allow enough room to stop before the train tracks.

2. **Pavement Markings**. Pavement markings may be painted on the pavement in front of a crossing. Always stay behind the stop line when waiting for a passing train.

3. **Crossbuck Signs**. Railroad crossbuck signs are found at most public crossings. Treat these signs as a yield sign. If there is more than one track, a sign below the crossbuck will indicate the number of tracks at the crossing.

4. **Flashing Lights and Gates**. Flashing lights are commonly used with crossbucks and gates. Stop when the lights begin to flash and the gate starts to lower across your lane. **Do not attempt to go around the gates**. Do not attempt to cross the tracks until the gate is raised and the lights stop flashing.

IMPORTANT: You must stop at least 15 feet from a train track when: (1) warning lights flash; (2) a crossing gate or flag-person signals an approaching train; (3) a train is within 1500 feet of the crossing; or (4) an approaching train is plainly visible and in hazardous proximity.

Vehicle Safety

Follow these guidelines when you encounter a railroad crossing:

1. Always expect a train.
2. When approaching a crossing, LOOK, LISTEN, AND LIVE.
3. Be sure all tracks are clear before you proceed. Remember, due to their large size, it is easy to misjudge the speed and distance of an oncoming train. If you have any doubts, stop and wait for the train to pass.
4. Watch for vehicles, such as school buses, that *must* stop before train tracks.
5. Never race a train to a crossing.
6. Always stop for flashing lights, bells, and gates. Never drive around a gate. (State law also requires pedestrians to stop when a railroad crossing gate is down.)
7. Do not allow yourself to be boxed in on a track with cars in front and behind you.
8. Never stop on train tracks. If your car stalls on train tracks, call 911 immediately. If a train approaches, abandon the car and run away from the tracks.
9. When driving at night, look low to the ground for moving trains. (one third of all train-car collisions occur at night when cars run into moving trains.)
10. Watch out for a second oncoming train after the first train has passed.

Passengers

Only UT employees or persons on official business for the University of Tennessee are allowed to be transported by UT vehicles. The University of Tennessee cannot and will not accept the liability for any other persons in UT vehicles.

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.

EH&S Safety Manual Index

Topics Include: General Safety (GS), Fire Safety (FS), Environmental Compliance (EC), Hazardous Materials Management (HM)

For Complete information about each EH&S module, visit *http://ehs.utk.edu/safety%20manual/Safetymanual2kj.html*

Name of Policy	Policy Number
Accident Investigations	GS 35
Actions of Regulatory Agencies	GS 30
AED's	GS 145
Air Monitoring	HM 30
Air Pollution - Title V permit	EC 40
All Terrain Vehicles	GS 130
Arsenic	HM 40
Art and Theater Hazardous Waste Guidelines	EC 2
Asbestos Management Plan	EC 45
Bicycles	GS 140
Bloodborne pathogens	GS 10

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Laboratory Safety at a Glance

Revised 04/2012

Important Resources & Contacts

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
EH&S website: web.utk.edu/~ehss

Lab Safety Coordinator: Pam Koontz, 974-5084
Haz. Waste Management: April Case, 974-5084
Radiation Safety Dept.: Marsha Smith, 974–5580
Biological Safety Officer: Brian Ranger, 974-1938
Principal Investigator: _____

Report Safety Concerns to
safety@tennessee.edu

Facilities Services: 946-7777
Media Relations: 974-2225

EH&S Training

web.utk.edu/~ehss/training/training.htm

- All employees must take training outlined in laboratory primer and by PI
- All employees must complete required training and associated quizes and provide a copy of completion to PI
- Employees must update training anually
- Employees must update training when work activities change

Employees working in labs must be supervised until ALL training is completed

Chemical Hygiene & Safety

web.utk.edu/~ehss

Chemical Hygiene

- No eating or drinking in labs
- Read MSDS before using chemical
- Use appropriate Personal Protective Equipment
(PPE)—refer to primer for guidance (e.g. lab coat, closed-toe shoes, safety glasses)
- Use gloves suitable for chemical and task-refer to primer for guidance

Chemical Management

- Label all secondary containers with chemical, owner, date, and hazard
- Use Chemical Inventory System (CI) (web.utk.edu/~ehss) or contact Pam Koontz pjkoontz@utk.edu

Hazardous Waste Disposal

- Refer to UT Waste Management Plan EC 1 for storage, labeling, and disposal guidelines.
- Store all hazardous waste in a Sattelite Accumulation Area (SAA)
- Notify EH&S liasion to start or to dismantle a SAA
- Take EH&S Hazardous Waste Generator training
before using SAA
- Hazardous waste should be brought to waste room at loading dock, or contact EH&S at 974- 5084 to coordinate a pickup. Contact April Case
acase3@utk.edu for more information

Principal Investigator (PI)

- One PI for each lab space resolves safety issues
- Meet withPI before working in the lab
- Discuss new work with PI

For a complete description of these and all other policies, please refer to the EH&S Website at **web.utk.edu/~ehss/**

Basic Water Safety

Field activities related to working near deep streams, rivers, lakes, and other water bodies:

1. Before entering a water body, test the depth with a long pole or stick. Never enter water above 3-ft or within 6-in of the top of your waders.
2. Working around water requires the ability to swim. Listed below are basic safety rules to ensure a safe swim.

- Learn to swim. The best thing anyone can do to stay safe in and around the water is to learn to swim.

- Always swim with a buddy; never swim alone.

- Know your swimming limits and stay within them. Don't try to keep up with a stronger, skilled swimmer or encourage others to keep up with you.

- Swim in supervised areas only. Obey “No Diving" signs that indicate the area is unsafe for headfirst entries. Enter feet-first into water rather than head first if you don’t know the depth. In addition, learn the correct way to dive from a qualified instructor.

- Watch out for the "dangerous too's" -- too fired, too cold, too far from safety, too much sun, too much strenuous activity.

- Do not chew gum or eat while you swim; you could easily choke.

- Use common sense about swimming after eating. In general, you do not have to wait an hour after eating before you may safely swim. However, if you have had a large meal, it is wise to let digestion get started before doing strenuous activity such as swimming.

- Alcohol and swimming don't mix. Alcohol impairs your judgment, balance, and coordination, especially in the water. It affects your swimming and diving skills and reduces your body's ability to stay warm.

- Always wear a Coast Guard-approved life jacket when boating and fishing.

- Know local weather conditions and prepare for electrical storms. Because water conducts electricity, it is wise to stop swimming or boating as soon as you see or hear a storm.

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By: CEE Safety Committee

Safe Wading Tips

That Could Save Your Life --
And at the very least make your fishing a lot more fun
-- *by Mac Huff*

Following are a Baker's Dozen of suggestions to make wading safer and your days in the rivers more enjoyable.

1. Minimum beginnings. Felt soles are minimum wading equipment on your shoes in rocky rivers. Studs and cleats will increase the security of your shoes on rocky surfaces.

2. Tri it! A wading staff is an indispensable piece of equipment when wading conditions are difficult, giving you a vital, third point of support. The third point of support will make all wading easier by letting you maintain two points of contact while one foot is making a stride. A wading staff may make the difference between staying dry and falling in, and lowers your anxiety level during difficult wading.

3. Give 'em a belt. A wading belt is mandatory when using waders. It will slow the flow of water into the legs and boots of your waders and make escape from the river easier. When I fall in, my legs and feet usually remain dry until I get into shallow water and stand up to walk out. I have learned, even as uncomfortable as it is in icy water, to stay horizontal as I approach shore and drain the water out of the tops of my waders before I stand up. My arms are already soaked and will probably require dry garments, but if I drain the water out of the waders and keep my pants and socks dry I can finish my day of fishing in comfort.

4. Go slow. This has broader implications than you may think. It obviously includes being careful while wading, but also encompasses taking time to evaluate current conditions and particularly to evaluate conditions when you are visiting unfamiliar rivers or locations. When entering the river and moving through the water, make your moves slow and controlled to minimize the risk of falling. With experience "slow" will become much quicker, but wading is always slower than traveling on dry land and as the hazards become greater your approach demands greater caution.

Mac Huff
Veteran Oregon Fishing Guide

Note from Tom Rosenbauer**: This article from one of our endorsed guides contains some of the finest nuggets of wading tips I've ever seen. I've been wading trout streams for 40 years, but I've learned a lot from Mac's article. In particular, point number 5 below is the finest treatment of the relationship between balance and wading I've ever read.* ***If you know someone who could benefit from these tips, please feel free to e-mail this page to them. *It could save your fishing buddy's life!*

5. Stand firm. Create a wide base to stand on when you are on a slippery surface. Widen your stance so your feet are shoulder-width apart; flex your knees to lower your center of gravity. When I enter a river or stream I automatically shift into a stance with my feet slightly wider than my hips and with my knees flexed. As the wading gets deeper and more difficult, my knee flex

increases just as athletes sink deeper into their stances to achieve greater agility. Learn to slide your feet and, as with other athletic activities, never cross your feet. This stance will seem foreign and awkward in the beginning, but practice will make it feel natural - besides, you will have great reinforcement to use this advice when you fall in because your feet are close together or you lose your balance with your feet crossed.

The mechanism that usually makes you fall is having your foot slip under you, or toward the center of your body. By having your feet wide apart your slipping foot tends to shift your center of balance to the opposite foot. With wading experience and practice you will probably find that you are able to wade faster by taking advantage of this phenomenon. In "easy" wading situations you will, in effect, "skate" across the bottom, allowing your boot to slide into a secure position by sliding outward and forcing your weight onto your other, secure foot, followed, at roughly a slow walking speed, by the next successive step.

Foot placement and balance are other important and critical elements of safe wading. Typically, your foothold will not be flat and uniform, like a floor, so you must adjust your foot position. Your foot must be turned inward or outward, as well as up or down, to fit the foothold. Precise foot placement is essential to safe wading. Most of the time the foot must be placed precisely in a small area.

In addition, I find that placing my foot in a secure foothold among cobbles or boulders is most secure when I stand on my arch, rather than the ball of my foot. Visualize that you are securing your foot in the junction between rocks so the boot heel holds the foot from sliding forward and the curve of the arch holds the foot from sliding back.

If you are constantly searching for your balance or your foot is constantly slipping from yourchosen foothold, then you should evaluate your foot placement and determine whether you are fitting the terrain or hoping that the terrain is fitting your step. Only experience can teach you to recognize the feel of secure footholds and the more you practice wading the easier wading will become.

6. Find the low places. In the water, when you can’t see where your feet are landing let gravity help. Slide your feet into position and work them into the valleys between rocks and cobbles, rather than standing on rounded top of slippery rocks.

7. Step sideways. In shallow water, less than knee deep, you may be able to walk "normally" with a modified, wide stance. As water gets deeper and footing becomes obscured by water depth or turbidity sidestepping will maintain a wide, stabile base. NEVER cross your feet while stepping! When I am exploring the bottom with this sidestep method, most of my weight is on my stationary foot, which helps prevent me from falling by either tripping forward over a high rock or slipping spread-eagle over the far edge of a smooth rock ahead of me. The idea is to not commit to the moving foot until you know you can stand on it. Typically, when I’m using this

stride I'm in fishing water, so it is an easy method to move and cover water. In these difficult conditions if my next move is 30 feet or more I will wade back to shore, walk down the bank, and then back out into the water.

8. Go with the flow. This recommendation is aimed primarily at efforts to cross a stream. It's easier and safer to move at a slight downstream angle with the current than move directly across or against the current. There is often a trick to finding the balance between shallow water with fast current and deeper water with a slower current. Either situation can be disastrous, knocking you down and sweeping you into faster, deeper water, so test the current as you proceed. This is the perfect place to use a wading staff. If you don't carry one, it might be worthwhile to use a streamside stick.

While fishing you will often want to move upstream. Take advantage of slower current while fishing upstream. Move through shallower water or use current breaks behind boulders.

There will be times when you must move against the current to cross or get out of your location. Don't let yourself wade down a gravel bar above deep water to discover that you have to wade back against a current that is too strong to move against! Sometimes apparently moderate currents can be treacherous when the water gets well above your knees, and wading that was easy with the current becomes seemingly impossible when trying to move back against it. Always approach moving water with a great deal of caution until you know your capabilities.

9. Move ahead. Try to make your movements sideways or forward. Your balance and recovery are better in these directions, where you can see well. If you hook your heel while backing up, your chance of falling increases dramatically. If you must back up, rather than turn around, feel behind you with the lead foot (usually your downstream foot), set it securely and bring the other foot into position. Hooking your heel is often the problem that tips you over while backing up in a stream, but any slip is more hazardous while trying to move backwards. Getting into a predicament that requires you to back up is a situation where you would trade your fly rod and all your flies for a wading staff.

10. Choose your substrate. Sand and gravel bottoms are usually secure and safe bottoms to wade on. Wade here when you can. Cobbles are more difficult because there are irregular surfaces to deal with and the surface of each cobble is an algae-covered, zero-friction trap looking for a victim. Why hasn't NASA discovered this stuff? Next up the difficulty list is boulders. These add the problem of navigating among large obstacles to the slippery problems of cobbles, and, there are more "tall" rocks to trip you than you find on a cobble beach. The same "tall" rocks that may trip you may provide relief from the current and make wading easier by moving into the slipstreams of upstream boulders. Boulders also will hold pockets of sand and gravel, which cobbles don't, and you may find secure footholds amidst treacherous footing. Once you learn to recognize these substrates they may give you an opportunity to move aggressively from a tenuous position to absolute security.

Mud bottoms may seem safe, but they also hold many pitfalls. Firm mud or clay bottoms are very slippery with felt soles. If the bottom is flat, you probably won't fall, but be careful that you don't get stuck and have difficulty climbing out of the stream. Mud accumulates in slow-current

areas, and logs and sticks left by floods may trip you, and the silt you stir up will continue to obscure your vision. Finally, the erosion that occurs in muddy backwaters may create unexpected and slippery drop-offs.

The most treacherous bottom type is bedrock. These are areas with large surfaces of solid rock that have been polished smooth by eons of water erosion. The obvious problem is the large slippery surface. While cobbles are equally slippery, your foot can soon find a joint between rocks for a foothold, but on the large, flat surface of polished bedrock there is no redemption for a misplaced step. Even with careful sidesteps, if your foot slips it may skate so far out that you lose your balance and fall

11. Are you ready to move up? It's often tempting to fish from the top of a midstream boulder. The problem comes when it's time to get back down. Be sure you have a safe route back down before you climb up.

12. Plan your escape. This starts before you even enter the river. Should you even be wading here? What will you do if you fall in?

13. Final safely considerations. A personal floatation device is necessary for waders that can't swim and may be a good investment for anyone in big rivers and cold water. Both CO2 inflatable suspenders and solid, kapok-filled vests can be found in stores selling whitewater gear. A whistle is one of a mountaineer's 10 essentials and is an excellent safety item for waders to carry for emergency location.

Mac's Choice of Waders

Decades ago when I unloaded my one and only pair of stocking-foot waders, I swore I would never own anything except boot foot waders again. My dissatisfactions with stocking foot waders were twofold. First, they were slow to put on. With my boot foot waders I was often in the river fishing while my buddies were still at the car dressing. Second, they were too cold. In the inland Pacific Northwest a great deal of our fall, winter and spring fishing is in water with temperatures in the 30s. The fit and constriction of wading shoes over stocking foot waders caused cold feet in the icy winter waters.

I recently acquired a pair of Orvis' Tailwaters XT waders and now I'm ready to retire my trusty boot foot waders. Orvis raised the bar with their Tailwaters XT waders, giving anglers the benefits of both stocking foot and boot foot waders.

Last December I made steelhead fishing trips to local rivers where water temperatures were in the mid-30s, and was pleasantly surprised at the warmth of the Tailwaters XT boot's insulation. On my first trip I hurriedly packed and forgot the second pair of socks that I wear with my waders. With the water at 35 degrees I was dismayed, but it was an hour's drive back home, so the only choice was to wear just my light liner socks. To my surprise my feet remained warm all day and were warmer than with my trusty neoprene boot foot waders on trips earlier that week.

Additional surprises were the extra support and foot protection that the wading shoes of

the Tailwaters XT waders provided. I had long since forgotten how nice firm ankle support could be when wading through boulders and cobbles. Boot foot waders offer no lateral support, and as the boot material wears it creases and rubs my ankles while hiking between drifts. I've fortunate to have sturdy ankles and didn't think about it, but was very pleased with the greater comfort and strength of the Tailwaters XT boot. This feature alone makes wading safer and more comfortable. But I also discovered that the Tailwaters XT wader boots have a hard sole that protects the soles of my feet while walking over the hard, uneven surface of a river bed. I have had stone bruises on my feet through the years of wading with conventional boot foot waders, but I saw few alternatives and walked gently over the cobbles while the bruises healed.

Orvis has given anglers an option that will allow warm feet with all of the support and protection of conventional wading shoes. The boots may be laced firmly for longer hikes and then loosened slightly if you are wading in cold water and your feet begin to chill.

Mac Huff has lived in and fished northeast Oregon for the last 28 years. He received a degree in Wildlife Biology in 1976, worked as a biological technician for Oregon Department of Fish and Wildlife that summer, and continues to contract biological work for the U.S. Forest Service. He operated a sporting goods store in Enterprise, Ore. for 13 years before selling the business to devote his energy to Eagle Cap Fishing Guides, a business he started in 1994 with partner Frank Conley. Mac has fly fished since childhood, guided for the last 15 years, and is an FFF certified fly casting instructor.

River fishing is the emphasis in northeast Oregon and the three rivers that he spends most of his time fishing are the Grande Ronde, Wallowa, and Imnaha rivers. Most of his guided trips are float-fishing trips, using either a Clackacraft drift boat or a 14-foot cataraft. Each craft easily accommodates two anglers and can transport up to three anglers. His fishing seasons begin in late May, usually Memorial weekend, when trout season opens, and continues through the summer and winter until April 15, when steelhead season closes. Early season trout fishing is usually good, but trout fishing improves later in the season when water levels drop and continues to be good through Oct. 31 when trout season closes. Steelhead season opens Sept. 1, and a few steelhead are available then, but fishing improves each week through November. Winter fishing depends on the weather, but by late February ice is reliably melted and fishing is fair to fabulous through April 15, depending on water level.
Mac Huff

Eagle Cap Fishing Guides
Orvis Endorsed Fly Fishing Guide
P.O. Box 865
Joseph, Oregon 97846

Bear Safety

If You Encounter a Bear…

- Remain calm and avoid sudden movements.
- Give the bear plenty of room, allowing it to continue its activities undisturbed. If it changes its behavior, you're too close so back away.
- If you see a bear but the bear doesn't see you, detour quickly and quietly.
- If a bear spots you, try to get its attention while it is still farther away. You want it to know you're human so talk in a normal voice and waive your arms.
- Remember that a standing bear is not always a sign of aggression. Many times, bears will stand to get a better view.
- Throw something onto the ground (like your camera) if the bear pursues you, as it may be distracted by this and allow you to escape.
- Never feed or throw food to a bear.

If a Bear Charges…

- Remember that many bears charge as a bluff. They may run, then veer off or stop abruptly. Stand your ground until the bear stops, then slowly back away.
- Never run from a bear! They will chase you and bears can run faster than 30 mph.
- Don't run towards or climb a tree. Black bears and some grizzlies can climb trees, and many bear will be provoked to chase you if they see you climbing.
- If you have pepper spray, be sure that you have trained with it before using it during an attack.

If a Black Bear Attacks…

- Be loud, waive your arms, and stand your ground.
- Fight back! Be aggressive and use any object you have.
- Only if you are sure the bear attacking is a mother who is protecting its cubs, play dead.
- If you have pepper spray, use it. Begin spraying when it's within 40 ft so it runs into the fog. Aim for the face.

As with all trips, be sure to research where you are going and what wildlife is in the area. Preparation and knowledge is the key to ensuring a safe trip for you and yours. Keep an eye out for bear warnings and always talk to a ranger if you have questions or concerns.

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

Cold Stress Prevention

7 Safety Tips to Prevent Hypothermia and Frostbite

Yesterday we discussed the importance of keeping work areas clear of snow and ice. By following proper procedures in getting rid of unwanted ice and snow, you avoid the heightened risk of slipping or falling on the job.

Unfortunately, the cold weather brings with it more risks that are invisible to the naked eye. Actually, they're really invisible. With the dropping temperature across the nation, workers are under the threat of suffering from cold stress. Those who belong to the construction, agriculture, maritime and commercial fishing industries are the most exposed to the fatal hazards of cold weather.

Cold stress can be a fatal threat to every worker. Once exposed to cold or freezing temperature for long periods of time, they run the risk of losing a serious amount of body heat. If not treated immediately, this could lead to brain damage and even death.

Here are safety tips to prevent cold stress or cold-induced illnesses or injuries:

1. Train employees for the cold and changing weather.

Training sure is a timeless necessity in the workplace. In these colder days, workers must be trained not only about cold-induced illnesses and injuries, but also to determine environmental or work site conditions that may cause cold stress. They should be especially trained in recognizing the signs and symptoms of cold stress or cold-induced injuries like hypothermia and frostbite.

Here are signs and symptoms of hypothermia:

- Cool skin
- Slower, irregular breathing
- Slower heartbeat
- Weak pulse
- Uncontrollable shivering
- Severe shaking
- Rigid muscles
- Drowsiness
- Exhaustion
- Slurred speech
- Memory lapses

The following are signs and symptoms of frostbite:

- Paleness of the skin
- Sensation of coldness or pain
- Pain disappears after a while with the freezing of the tissues.
- Tissues become increasingly whiter and harder.

Cold Stress Prevention

2. Use a buddy system.

Sure, you may want to be left to yourself while working. But believe me, this is not the time to enjoy solitude while accomplishing your tasks outdoors. You don't want to be working one minute and thawing your fingers the next.

So get a partner and work on monitoring each other for signs of cold stress. Don't be stubborn because most of the time, it's just difficult to determine danger signs when you only have yourself to rely on.

3. Adjust your work schedule to the cold or changing weather.

Don't punish yourself too much. Just because you have to work outside and it feels like stepping into a walk-in freezer, it doesn't mean you have to bask in the frigid winds all day.
Schedule work during the warmest part of the day. Break a task into shifts so you can take frequent, short breaks in warm dry shelters.

4. Layer clothing.

At this time of the year, the saying "less is more" surely does not hold true. Well, maybe partly true since wearing less clothes means getting exposed to more cold-stress-related threats.

Remember that it's better to go for several thin layers of clothing instead of wearing just a couple of thick layers. For clothes next to the skin, choose those with synthetic fabrics to avoid absorption of sweat. An ideal choice is polypropylene. For your outer layer, choose fabrics made of waterproof and wind-resistant material.

5. Wear complete PPE (personal protective equipment).

You know you need it. Wear warm gloves, hats and hoods. In extreme conditions, don a warm woolen hood that covers your neck, head and ears. If you get hot while working, just open your jacket. Don't remove your hat and gloves. The key is in wearing clothing that can be adjusted to changing conditions.

Avoid wearing tight-fitting footwear as this restricts blood flow. Your shoes or boots should allow you to wear either one thick or two thin pairs of socks.

6. Eat and drink hot or warm foods and liquids.

You might have to say goodbye to hot coffee and choco for a while. Drinking caffeinated and alcoholic beverages is not recommended while working in cold weather. Instead, go for warm, sweet beverages like sports drinks and sugar water. Keep in mind that you are also at risk of dehydration under cold weather so make it a habit to drink up.

Good news, though. You can feast on hot pasta dishes, soups and other foods rich in calories. Remember, though, that if you're sick or under medication, you are more at risk to get cold stress. This is especially true if you have hypertension, diabetes or a cardiovascular disease.

7. Wear eye protection.

Ice or snow + excessive ultraviolet rays = eye injury. Yes, this is one proven equation. Before working outside, check first if you may be exposed to glare or, worse, blowing ice crystals. If conditions point to the affirmative, then go wear the right kind of eye protection.

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By: CEE Safety Committee

Dehydration - Prevention

The following tips may help you prevent dehydration.

- Drink plenty of water before, while, and after you are active. This is very important when it?s hot out and when you do intense exercise. You can drink water or rehydration drinks.
  - Drink plenty of water before, during, and after exercise.
  - Take a container of water or sports drink with you when you exercise, and try to drink at least every 15 to 20 minutes.
  - Use a sports drink if you will be exercising for longer than 1 hour.
- Encourage your child to drink extra fluids or suck on flavored ice pops, such as Popsicles. Children ages 4 to 10 should drink at least 6 to 10 glasses of liquids to replace lost fluids.
- Do not drink coffee, colas, or other drinks that contain caffeine. They increase urine output and make you dehydrate faster.
- Avoid high-protein diets. If you are on a high-protein diet, make sure that you drink at least 8 to 12 glasses of water each day.
- Avoid alcohol, including beer and wine. They increase dehydration and make it hard to make good decisions.
- Do not take salt tablets. Most people get plenty of salt in their diets. Use a sports drink if you are worried about replacing minerals lost through sweating.
- Stop working outdoors or exercising if you feel dizzy, lightheaded, or very tired.
- Wear one layer of lightweight, light-colored clothing when you are working or exercising outdoors. Change into dry clothing as soon as you can if your clothes get soaked with sweat. **Never** exercise in a rubber suit.

Sunburn - Topic Overview

- Sunlight can help our mental outlook and help us feel healthier. For people who have arthritis, the sun's warmth can help relieve some of their physical pain. Many people also think that a suntan makes a person look young and healthy. But sunlight can be harmful to the skin, causing immediate problems as well as problems that may develop years later.
- A sunburn is skin damage from the sun's ultraviolet (UV) rays. Most sunburns cause mild pain and redness but affect only the outer layer of skin (first-degree burn). The red skin might hurt when you touch it. These sunburns are mild and can usually be treated at home.
- Skin that is red and painful and that swells up and blisters may mean that deep skin layers and nerve endings have been damaged (second-degree burn). This type of sunburn is usually more painful and takes longer to heal.
- Other problems that can be present along with sunburn include:

Procedure Subject: **Heat Stress Prevention Policy**	Effective: 8/1/11
Areas Affected: Areas on campus and activities where heat related injuries could occur.	Reviewed/Revised: 8/1/11

1.0 Purpose, Applicability, and Scope

1.1 Purpose - The purpose of this procedure is to reduce the risk of illness, injury, or death for those individuals on campus who work in hot environments and are susceptible to heat related illnesses.

1.2 Applicability – This shall apply to all students, staff and faculty on the Knoxville campus of the University of Tennessee.

1.3 Scope – This standard applies to all heat related illnesses as defined in section 2.2 below.

2.0 Abbreviations, Acronyms, and Definitions

2.1 Abbreviations/Acronyms

ACGIH-American Conference of Industrial Hygienists
EHS – Environmental Health and Safety
OSHA-Occupational Health and Safety Administration

2.2 Definition

Heat Cramps - Painful muscle spasms, as a result of exposure to excess heat. This occurs when a worker drinks a lot of water, but does not replace salts lost from sweating.

Heat Syncope - Weakness, fatigue and fainting due to loss of salt and water in sweat and exercise in the heat.

Heat Exhaustion – A condition usually caused by loss of body water because of exposure to excess heat. Symptoms include headache, tiredness, nausea, and sometimes fainting.

Heat Rash- skin irritation caused by excessive sweating during hot, humid weather.

Heat Stress: Relative amount of thermal strain from the environment.

Heat Stroke – A serious disorder resulting from exposure to excess heat. It results from sweat suppression and increased storage of body heat. Symptoms include hot dry skin, high temperature, mental confusion, convulsions, and coma. Heatstroke is fatal if not treated properly.

Natural wet bulb (NWB) temperature is measured by exposing a wet sensor, such as a wet cotton wick fitted over the bulb of a thermometer, to the effects of evaporation and convection. The term natural refers to the movement of air around the sensor.

3.0 Roles and Responsibilities

a. EHS shall:

i. Assist supervisors with providing annual training to employees who work in hot conditions.
ii. Ensure the Heat Stress policy is being followed and revise periodically.
iii. Assist supervisors in determining appropriate engineering and administrative controls in minimizing heat load on employees.
iv. Provide training to employees on heat risk exposure and heat related illnesses if requested by departments.
v. Upon request, can evaluate the workplace for heat stress risk and recommend ways to manage exposure to heat.
vi. Investigate any accidents that occur as a result of heat-related illnesses.

b. Supervisors shall:

i. Recognize heat stress and risk factors.
ii. Provide fluid replacement for employees working under hot conditions.
iii. Identify specific areas in which workers are exposed to or likely to experience significantly hot environments.
iv. Determine tasks and activities that require extensive physical activity in hot environments.
v. Identify those workers whose job duties place them at risk for suffering a heat-related illness.
vi. Identify personal protective equipment or specialized clothing that may increase the heat load on workers.
vii. Review the use of engineering controls such as ventilation systems, cool rest areas, or other items in place at your facility that can reduce the heat load on workers.
viii. Review the use of work practice controls such as periodic rest breaks, work scheduling, or other practices that can reduce the heat load on workers
ix. Provide training for all employees who work under hot conditions.

c. Employees shall:
   i. Participate in heat stress training and learn the signs and symptoms of heat stress, as well as risk factors.
   ii. Follow all instructions given to reduce risk of heat-related injury.
   iii. Monitor themselves and coworkers for signs of heat-related illnesses.
   iv. Promptly report any known or suspected unsafe conditions, or unsafe procedures to the supervisor.

4.0 Procedures

Heat related illnesses are influenced by several factors, such as: climate and environmental conditions, demands of the work, clothing and personal characteristics. Environmental factors include air temperature, air movement, humidity and radiant heat. Personal characteristics include such factors as age, weight, gender, fitness level, medical condition(s), metabolic heat, diseases, water and salt balance, and medication the employees are taking. A study conducted by NIOSH links the signs of heat stress to an increase in workplace accidents.

The human body regulates high temperatures by two primary mechanisms: blood flow and sweating. Blood is circulated to the skin, increasing the skin temperature and allowing the body to give off the excess heat through the skin. Sweating occurs when the body senses the heat loss due to increased blood circulation is not enough to cool the body. Evaporation of the sweat cools the skin and eliminates large quantities of heat from the body. If the body is unable to release excess heat, it will store it. When this happens, the body's core temperature rises and the heart rate increases. If the body continues to store heat the person may begin to have difficulty concentrating, may become irritable and lose the desire to drink. The next stage is often fainting which would signal a medical emergency. Listed in Table 1 are the common heat disorders with the accompanying symptoms and appropriate first aid measures.

Table 1:

The table below illustrates some of the signs and symptoms associated with heat stress. If an employee experiences any of these symptoms, they should be taken for medical treatment immediately.

Condition	Signs/Symptoms	First Aid
Heat Cramps	Painful muscle spasms Heavy sweating	Increase Water intake Rest in shade/cool environment
Heat Syncope	Brief fainting Blurred vision	Increase Water intake Rest in shade/cool environment
Dehydration	Fatigue Reduced movement	Increase Water intake Rest in shade/cool environment
Heat Exhaustion	Pale and clammy skin Possible fainting Weakness, fatigue Nausea Dizziness Heavy sweating Blurred vision Body temp slightly elevated	Lie down in cool environment Water intake Loosen clothing Call 911 if symptoms continue once in cool environment.
Heat Stroke	Cessation of sweating Skin hot and dry Red face High body temperature Unconsciousness Collapse Convulsions Confusion or erratic behavior Life threatening condition	Medical Emergency! Call University Police to summon ambulance Move Victim to shade, immerse in water

CONTROL OF HEAT STRESS:
The following engineering and administrative controls should be followed to prevent heat-related disorders:

1. **Engineering Controls**: Heat may be controlled through general ventilation and spot cooling by local exhaust ventilation at the point of high heat production. Shielding may be needed for protection against radiant heat sources. Other control measures include opening windows or using fans to create airflow. Outdoor work areas need to have a shaded area accessible to the employees. Shaded areas can be created by using tarps or canopies or equipping tractors with canopies or cabs.
2. **Acclimatization**: Employees need to adapt to new temperatures. This adaptation period is usually 5 days. New employees and employees returning from an absence of two weeks or more should have a 3-5 day period of acclimatization. This period should begin with 50% of the normal workload the first day and gradually build up to 100% on the last day.
3. **Weather Conditions**: Check weather conditions frequently during the day and adjust the work schedule. It might be appropriate to change the actual hours of work to minimize working during the heat of the summer months. Heavy work should be

scheduled for the cooler hours of the day. Non-essential tasks should be postponed when there is a heat warning issued.

4. **Work/Rest Cycles**: Heavy and minimal work activities should be alternated. Tasks should be rotated among workers. Employees should be allowed sufficient breaks in a cool area to avoid heat strain and promote recovery. Shade or an air-conditioned break room should be provided.
5. **Personal Protective Equipment**: During work in hot environments, workers should use the lightest weight or "breathable" protective garments that give adequate protection. This may include the wearing of shorts if this does not create a hazard for the legs. The clothing should be light colored. For work in extremely hot environments, cool vests are available from several manufacturers. These vests typically provide 1-2 hours of cooling, recharge in 20 minutes, and maintain a constant temperature of 55°F.
6. **Fluid Intake**: Fluids, such as water or electrolyte replacement drinks (i.e. Gatorade), need to be conveniently available to workers so they can drink about 8 oz. of liquids every 20 minutes. The ideal temperature for liquids should be 50°F- 60°F. For remote outdoor work locations, this means providing a cooler of liquids and ice that the workers can transport with them to the location. Alcohol, coffee, tea, and caffeinated sodas should be avoided, since these increase dehydration and interferes with heat loss.
7. **Other Administrative Controls:** The following administrative controls can be used to reduce heat stress:
    1. Reduce the physical demands of work, e.g., excessive lifting or digging with heavy objects
    2. Provide recovery areas, e.g., air-conditioned enclosures and rooms
    3. Use shifts, e.g., early morning, cool part of the day, or night work
    4. Use intermittent rest periods with water breaks
    5. Use relief workers and use the buddy system
    6. Slow down pace of work, if needed
    7. Assign extra workers and limit worker occupancy, or the number of workers present, especially in confined or enclosed spaces.
    8. Consider a worker's physical condition when determining fitness to work in hot environments. Taking certain medications, lack of conditioning, obesity, pregnancy, and inadequate rest can increase susceptibility to heat stress.

Measuring Burden of Heat on Workers:

Every worker who works in extraordinary conditions that increase the risk of heat stress should be personally monitored. These conditions include wearing semi permeable or impermeable clothing when the temperature exceeds 21°C (69.8°F), working at extreme metabolic loads (greater than 500 kcal/hour), etc. Personal monitoring can be done by checking the heart rate, recovery heart rate, oral temperature, or extent of body water loss.

Heart rate is one of the most reliable indices of heat stress. The heart rate of a worker encompasses the combined demands of work level, body temperature elevation, environmental heat, and cardiovascular fitness. Heat rate increases disproportionately with heat load. A heart rate of 180 to 200 beats per minute is the maximum capacity for adults. A good rule of thumb is as follows: count the pulse rate for the last 30 seconds of the first three minutes after rest begins. If the first pulse (measured for 30-60 second) is maintained at 110 beats per minute, no increasing stress has occurred as the work progresses. If the pulse rate is higher, than 110 beats per minute after measuring the pulse during this period, then there is a possibility that the employee is experiencing some heat stress.

Oral temperature can be checked with a clinical thermometer after work but before the employee drinks water. If the oral temperature taken under the tongue exceeds 37.6°C, shorten the next work cycle by one third.

Body water loss can be measured by weighing the worker on a scale at the beginning and end of each work day. The worker's weight loss should not exceed 1.5% of total body weight in a work day. If a weight loss exceeding this amount is observed, fluid intake should increase.

Measuring the Environment*:

EHS can use a WBGT (wet bulb globe thermometer) to access heat stress, using the following equation:

$$WBGT = 0.7NWB + 0.3GT$$

Outdoors with solar load

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

where: WBGT = Wet Bulb Globe Temperature Index
NWB = Natural Wet-Bulb Temperature
DB = Dry-Bulb (air) Temperature
GT = Globe Thermometer Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer. The measurement of environmental factors shall be performed as follows:

1. The range of the dry and the natural wet-bulb thermometers should be -5°C to +50°C, with an accuracy of ±0.5°C. The dry bulb thermometer must be shielded from the sun and

the other radiant surfaces of the environment without restricting the airflow around the bulb. The wick of the natural wet bulb thermometer should be kept wet with distilled water for at least one-half hour before the temperature reading is made. It is not enough to immerse the other end of the wick into a reservoir of distilled water and wait until the whole wick becomes wet by capillarity. The wick must be wetted by direct application of water from a syringe one-half hour before each reading. The wick must cover the bulb of the thermometer and an equal length of additional wick must cover the stem above the bulb. The wick should always be clean, and new wicks should be washed before using.

2. A globe thermometer, consisting of a 15 cm (6-inch) in diameter hollow copper sphere painted on the outside with a matte black finish, or equivalent, must be used. The bulb or sensor of a thermometer (range -5°C to +100°C with an accuracy of ±0.5°C) must be fixed in the center of the sphere. The globe thermometer should be exposed at least 25 minutes before it is read.

3. A stand should be used to suspend the three thermometers so that they do not restrict free air flow around the bulbs and the wet-bulb and globe thermometer are not shaded.

4. It is permissible to use any other type of temperature sensor that gives a reading similar to that of a mercury thermometer under the same conditions.

5. The thermometers must be placed so that the readings are representative of the employee's work or rest areas, as appropriate.

Once the WBGT has been estimated, EHS can estimate workers' metabolic heat load and use the ACGIH method to determine the appropriate work/rest regimen, clothing, and equipment needed to control the heat exposures of workers in their facilities.

*Taken from OSHA Technical Manual on Heat Stress

5.0 Recordkeeping

EHS and departments will maintain a copy of all training records for a minimum of three years.

Any medical records concerning heat stress related injuries at the workplace will be maintained indefinitely by the affected departments.

6.0 Training and Information Requirements

After completing Heat Stress training, employees should understand:

- The seriousness and prevalence of heat stress
- How the body’s internal cooling system handles heat

- How hot environments increase the likelihood of accidents
- How and why the body's internal cooling mechanisms may fail
- The types of heat-related illness they or co-workers most likely face on the job, including their causes, common symptoms and treatment/first aid
- The environmental factors (such as air temperature, radiant heat, humidity and air movement) in a given work area which should cause heightened alert for signs of heat illness
- The work-related factors that increase the risk of heat-related illness (such as type of work, level of physical exertion required, duration of activity and required protective clothing or gear)
- Unique personal factors (such as age, weight, alcohol/caffeine use, history of heat-related illness, etc.) that can put them at increased risk
- Basic preventative measures workers can take to reduce the risk of heat stress

7.0 Attachments

Appendix A: Heat Index Chart

8.0 Associated Standards

OSHA General Industry - 29 CFR 1910.95

Electrofishing Safety

1. **Purpose:** This chapter is modified to specify the minimum Occupational Safety and Health requirements and procedures for U.S. Geological Survey (USGS) electrofishing operations. This chapter provides guidelines for the safe construction, modification, and operation of electrofishing equipment.

2. **Scope**. The provisions of this chapter apply to all USGS activities using electricity to collect samples of animals in aquatic habitats.

3. **Background**.

A. *Hazards Training*. All USGS personnel serving as electrofishing Team Leaders will demonstrate knowledge of the principles and techniques of electrofishing by: (1) satisfactory completion of a National Conservation Training Center course; (2) an equivalent course as detailed in the Training and Education Requirements Section (Section 6) of this chapter; or (3) a course approved by the Regional Safety Manager.

B. *Currents and Wave Forms*. Different types of electrical current produce different electrical current shapes or wave forms. Alternating current (AC) produces a wave form that consists of a sequence of positive and negative waves that are equal (usually sinusoidal) and follow each other alternately at regular time intervals. Direct current (DC) produces a unidirectional, constant electrical current. Pulsed direct current (PDC), a modified direct current, produces a unidirectional electrical current composed of a sequence of cyclic impulses.

C. *Responses of Fish*. The responses of fish to electricity are determined mainly by the type of electrical current in use and its associated wave form. These responses include avoidance, electrotaxis (forced swimming), electrotetanus (muscle contraction), electronarcosis (muscle relaxation or stunning), or death. Forced swimming without orientation relative to the electrical current (oscillotaxis) is a typical fish response to alternating current. AC can be damaging to fish, resulting in hemorrhaged tissue, ruptured swim bladders, or fractured vertebrae. These conditions are due to severe electrotetanus caused by the alternating polarity of AC. DC forces fish to swim with orientation toward the anode (galvanotaxis). The modified PDC can sustain galvanotaxis longer than unmodified DC, and with less likelihood of damage to the fish than unmodified DC or AC. Water conductivity also influences the response of the fish to the electrical field and is the single most important limiting factor in the effectiveness of electrofishing.

4. **Authorities and References.**

A. 29 CFR 1910, General Industry Standards.

B. Federal Boat Safety Act of 1971, as amended (46 U.S.C. 1451-89).

C. National Fire Protection Association (NFPA) 70-2004, National Electric Code (NEC).

D. DOI DM 485, Chapter 22, Watercraft Safety.

E. U.S. Fish and Wildlife Service, Occupational Safety and Health, Part 241 FW 3, 6, and 8, Release No. 442, March 19, 2004.

5. **Definitions.**

A. *Alternating Current* (AC). Typically, a sinusoidal waveform with reversing electrode polarity. The electrodes alternate between acting as an anode or cathode at a waveform frequency in hertz or cycles per second. The direction of flow is reversed at frequent intervals, usually 120 times per second (60 cycles per second or 60 Hertz).

B. *Anode.* The positive electrode for direct current (DC) or pulsed DC system.

C. *Bonding*. The permanent joining of metallic parts to form an electrical conductive path that assures electrical continuity, with the capacity to safely conduct current.

D. *Branch Circuit*. The circuit conductors between the final overcurrent device protecting the circuit and the electrical load(s).

E. *Case Neutral*. An electrical connection between the generator windings and the generator case (generator exterior).

F. *Cathode.* The negative electrode for DC or pulsed DC systems.

G. *Circuit Breaker*. A device that monitors the current and automatically opens the circuit when an overcurrent occurs.

H. *Conductor*. A device (wire, SO cable, SJ cable, etc.) that transmits an electric charge. A conductor is also a wire or combination of wires not insulated from one another, suitable for carrying electric current.

Electrofishing Safety

I. *Deadman Switch.* A switch that is “normally open” and requires constant pressure to supply electrical current to the circuit.

J. *Direct Current* (DC). An electrical waveform that exhibits relatively constant or continuous current with no reversing electrode polarity. DC is the unidirectional flow or movement of electric charge carriers (usually electrons).

K. *Electrofishing*. The use of electricity in water to capture or control fish or other aquatic organisms.

L. *Electrofishing Team Leader*. The onsite individual in charge of the electrofishing operation.

M. *Emergency Stop Switch*. A switch that shuts off system power when pressure is applied. Activating an emergency stop switch is facilitated by "mushroom" or "slap-switch" style configurations.

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

O. *Isolation Transformer*. A transformer inserted into a system to separate one section of the system from undesired influences from other sections.

P. *Netter*. The individual who nets the fish or other aquatic organisms during electrofishing operations.

Q. *Power Control Circuit*. The circuit that interconnects and adjusts the power from the pulsator or generator to the electrodes.

R. *Pulsator* (control box). The device used to modify the pulsed electric current delivered from the power source.

S. *Pulsed Direct Current*. An electrical waveform created by making regular interruptions in a continuous DC waveform.

T. *Watertight*. Constructed so that moisture will not enter the enclosure.

U. *Weatherproof.* Constructed or protected so that exposure to the weather will not interfere with safe operation.

6. Training and Education Requirements.

A. The Team Leader in each electrofishing field crew must initially complete the National Conservation Training Center Electrofishing Course (FIS2201) **or** the Electrofishing by Correspondence Course (FIS2C01) to satisfy certification competency for factors (1-5) below:

(1) Basic principles of electricity and the generation of electrical fields in water.

(2) Basic concept and design guidelines for electrofishing equipment.

(3) Capabilities, limitations, and safety features of electrofishing equipment.

(4) Safety precautions to employ while using electrofishing equipment.

(5) Awareness of methods to reduce fish trauma due to electrofishing.

B. Team Leader refresher training is required every 5 years and can be met via completion of any one of the courses listed below:

(1) The National Conservation Training Center Electrofishing Course (FIS2201).

(2) The National Conservation Training Center Electrofishing by Correspondence Course (FIS2C01).

(3) A course, approved by the respective Regional Safety Manager, that covers the principles and techniques of electrofishing that is at minimum of 16 hours in length and covers items 6A (1-5).

C. In addition to the training listed in Parts A and B above, all Team Leaders shall maintain current certification in First Aid and Cardio-Pulmonary Resuscitation (CPR).

D. Since a minimum of two members of an electrofishing team must hold current certification in CPR and First Aid, the Team Leader shall validate that at least one other crew member has current certification in First Aid and CPR, prior to every electrofishing operation. Refer to USGS *Occupational Safety and Health Program Requirements Handbook*, 445-2-H, Chapter 14, "Safety and Health Training," for a description of field hazard safety training that applies to sampling locations more than 15 minutes from professional medical services.

E. The Team Leader will train or verify all electrofishing crew members have been trained on the following:

(1) Overview and safe operation of electrofishing equipment components and procedures.

(2) Hazards involved in electrofishing. All persons must be aware of the hazards involved in using portable electro shockers in running waters. These hazards include slippery surfaces, swiftly running currents, areas of deep water, and obstacles such as logs or similar objects. Additional hazards (depending on the region) include snakes and wasps in tree branches overhanging the water.

(3) Basic emergency procedures for incidents involving drowning, unconsciousness, and electrical shock.

(4) Defensive driving techniques, including towing and backing of boat trailers and safe boating operations if an electrofishing boat is used.

(5) Additional information specific to the local operation.

F. Operators of electrofishing boats must have successfully completed the DOI Motorboat Operator Certification Course certification and maintain current certification. Refer to USGS *Occupational Safety and Health Program Requirements Handbook*, 445-2-H, Chapter 31, "Watercraft Safety," for subject training requirements. Under no circumstances will an employee perform electrofishing operations while alone in a stream.

G. Training requirements as detailed in 6A, 6B, and 6C above can be satisfied by a Team Leader or crew member that is performing these duties as an employee of another Bureau, state agency, or scientific institution.

7. **Electrofishing Specifications.**

A. *Electrofishing Boat Specifications.*

(1) *Design*.

(a) Boat design and equipment must be in compliance with U. S. Coast Guard, State, and DOI regulations.

(b) The boat bow deck will be painted with a nonslip or skid-resistant coating or roughened in some manner to lower the possibility of slipping.

(c) Anodes will be mounted in a fixed position during operation.

(2) *Clear Working Space*. General boat housekeeping must provide adequate working space to conduct safe operations. Care will be exercised to prevent clutter that may result in safety hazards.

(3) *Boat Inspection*. The boat and equipment will be visually inspected for safety by the supervisor or operator in charge prior to each use. Significant deficiencies, which could result in employee injury, will be corrected prior to operation or use of the equipment.

(4) *Controls for Electrical Equipment*.

(a) The boat operator must have ready access to an on/off switch, emergency stop, or deadman switch to cut the power in case of an accident.

(b) A minimum of one netter on the bow work deck will have a deadman switch connected to the power control circuit.

(5) *Grounding/Bonding*. All metal surfaces within a boat will be electrically connected, grounded, and bonded to the boat hull to eliminate differences in electrical potential that may result in electric shock. The metal boat hull may also be used as a cathode. Zinc strips should be attached to the hull as "sacrificial anodes" to avoid possible electrolysis problems when the metal hull is being used as a cathode. The electrolysis will occur on the zinc strips to preserve the integrity of the hull.

(6) *Battery Enclosure*. An acid proof, nonmetallic enclosure and holder will be provided for wet cell batteries.

(7) *Conductor Protection*. All conductors will be enclosed in watertight, flexible or rigid conduits. Appropriately rated, heavy-duty insulated cables can be used where external connections are necessary, e.g., to the booms, pulsator, or deadman switch. All conductors installed in a common raceway (conduit) must be continuous (without connectors, breaks, or splicing) and independently and correctly insulated. All low voltage (24 volts or less) circuit conductors will be in 300 VRMS minimum cable if contained in the same conduit as the high voltage conductors.

(8) *Lighting*.

(a) Lighting and other auxiliary circuits should not exceed 24 volts. However, 110 volt lamps may be used if the lamp is shielded with a protective housing.

(b) When the boat is operated at night, adequate onboard lighting (12-24 volts) will be provided for working areas.

(c) Adequate lighting will be provided during electrofishing operations to avoid safety hazards such as striking logs, rocks, and overhead tree branches.

(9) *Safety Rails*. Safety rails will be provided around the outside of the netting area and will be at least 105 centimeters (42 inches) high, and constructed of at least 1.8 centimeters (3/4-inch) heavy-wall steel pipe or 3.75 centimeters (1-1/2-inch) heavy-wall aluminum pipe. Rails will be designed to withstand a 90 kilogram (200-pound) side thrust. The work deck will be covered with nonskid material and sloped to allow drainage. The high gunnels of wooden draft boats are satisfactory as safety rails.

(10) *Fire Extinguishers*. Each boat will be equipped with at least one 2.25 kilogram (5-pound) ABC fire extinguisher mounted in a holder for easy boat operator access and away from gas cans, generators, or other fire sources.

(11) *Refueling*. Portable fuel tanks must be removed from the boat for refilling.

(12) *Standard Safety Equipment*.

(a) As a minimum, all crew members aboard electrofishing boats will wear boots that are at least knee-high, with non-skid type soles, and constructed of a material that will insulate the wearer from electrical shock. Chest or hip

waders are recommended and can offer an extra margin of safety in case the boat is not properly grounded.

(b) All field personnel engaged in electrofishing who are not aboard a boat will wear chest or hip waders to insulate the wearer from electrical shock. Suitable waders are generally constructed of neoprene, PVC, silicon, etc. Breathable, lightweight waders may not have adequate electrical insulating properties. All footwear will be equipped with non-slip soles.

(c) All persons will wear U.S. Coast Guard approved personal flotation devices (Type III minimum) when working near, on, in, or over water, except in those cases where an approved site-specific job hazard analysis defines the conditions for an exemption. (See USGS Occupational Safety and Health Program Requirements Handbook, 445-2-H, Chapter 15, "Job Hazard Analyses,": http://www.usgs.gov/usgs-manual/handbook/hb/445-2-h/ch15.html.) This requirement applies to all types of electrofishing equipment [see 7.S.(1)].

B. *Electrical Equipment Specifications and Operation (General)***.** Only commercially built electrofishing equipment that has been approved by a nationally recognized testing laboratory may be used. Homemade electrofishing gear should never be used to collect fish.

(1) *Case Neutral Removal*. Alternating current (AC) voltage from the generator will be isolated from the ground either by removing the neutral connection from within the generator or by incorporating an isolation transformer. (**Warning**: A generator with the case neutral removed cannot be used for land-based, nonelectrofishing operations unless the case neutral is reconnected.)

(2) *Conductor Voltage*. Insulation of the conductors within an electrofishing system must accommodate RMS voltages generated by the power source and pulsator without breakdown. For equipment that generates a maximum of 1,000 VRMS, conductor insulation rated at 600 VRMS is sufficient. For systems that generate a maximum of 300 VRMS, conductors with insulation rated at 300 VRMS may be used.

(3) *Conductor Size*. Conductor size (current-carrying wire) will be approved for rated RMS amperage of equipment as follows:

Maximum Amperage	Minimum Conductor Size
10	16 AWG

15	14 AWG
20	12 AWG
30	10 AWG
AWG = American Wire Gauge	

(4) *Conductor Placement*. All conductors will be enclosed in watertight, rigid or flexible conduits or appropriate heavy-duty rubber insulated cables.

(5) *Connections*. All equipment must be turned off before making any connections, replacing parts, or performing repairs.

(6) When using conduit, splices in wiring are only permitted in condulets or junction boxes. If connections are necessary, the rating of the connector must be the same or greater than the wire.

(7) Connectors used in association with flexible cables will be of the locking, watertight type. The connection to the generator should be protected by a splash cover, e.g., a rubber hood.

(8) All conduit and junction boxes must be weatherproof.

C. *Circuit Breakers*.

(1) The electrofishing system, e.g., generator, pulsator, or console, will include circuit breakers or fuses to provide circuit protection.

(2) If external to the generator or pulsator, circuit breakers or fuses used for providing branch circuit protection should be labeled as to purpose.

(3) An on/off switch must be readily available on the generator power source and pulsator. It is recommended that either the pulsator or generator be equipped with a mushroom, push-button, or slap style emergency stop switch to speed system shutdown.

(4) It is recommended that amperage and voltage meters be installed to monitor power delivered to the electrodes.

(5) Power control (safety) circuits will be low voltage and not exceed 24 volts.

(6) The netter will have a deadman switch connected to the power control circuit from the pulsator or generator source. This allows the current between the electrodes to be broken in case of an accident.

(7) An audible or visual signal is recommended to alert a worker when the equipment is in operation.

(8) An immersion switch is recommended to turn the unit off in case the backpack is submerged in water, regardless of whether entry is vertical or tilted.

(9) An emersion switch is recommended to inactivate the probe when it is removed from the water. This reduces the chance of shocking a co-worker with the wand.

(10) The operator will have a switch to the pulsator or power control unit so that the electricity can be turned off quickly in case of an emergency.

(11) All purchased equipment must have a tilt switch to break the circuit in case the operator falls. The switch must be a type that has to be manually reset after the operator has regained his/her footing.

D. *Batteries*. Batteries should be non-spillable, gel-cell batteries. Terminals should be clean with no visible cracks or holes in the casing or wiring insulation

E. *Gloves*.

(1) All team members will wear rubber gloves of sufficient length to isolate hands from external surfaces. Never touch both electrodes simultaneously while power source is running. The following are dielectric strengths (volts per mil thickness) of four materials per ASTM method D-14975:

Neoprene	600 volts/mil
Polyurethane	330 volts/mil
PVC	250 volts/mil
Silicone	100 volts/mil

(2) Note that when a range of voltages was listed by ASTM, the lowest voltage per millimeter (mil) thickness was used. In addition, without periodic testing with specialized equipment, you cannot be sure of the dielectric strength of your gloves.

(3) Electrical protective equipment must be capable of withstanding the AC proof-test voltage specified in 29 CFR 1910.137 Table I-2 or the DC proof-test voltage specified in Table I-3 of the same standard.

(4) Insulating gloves and boots will be visually inspected before each use and will be replaced if any of the following defects are evident: a hole, tear, puncture, or cut; ozone cutting or ozone checking (the cutting action produced by ozone on rubber under mechanical stress into a series of interlacing cracks); an embedded foreign object; any of the following texture changes: swelling, softening, hardening, or becoming sticky or inelastic; any other defect that damages the insulating properties.

F. *Polarized Sunglasses*. Plastic polarized sunglasses should be worn when there is glare.

G. *Net Handles*. Net handles will be constructed of a nonconductive material (fiberglass, polyvinyl chloride tubing, or nylon) and will be of sufficient length to avoid hand contact with the water. Metal or aluminum dip nets will not be used.

H. *Noise.*

(1) When crew members are subjected to sound levels exceeding those listed in the following table, the crew members must be included in a Hearing Conservation Program. This program is required by OSHA's Occupational Noise Exposure Standard, 29 CFR 1910.95. The program includes topics such as hearing protection, annual training, and annual audiograms.

Duration Per Day (Hours)	Sound Level dBA Slow Response
8	85
6	87
4	90
3	92
2	95
1.5	97
1	100
0.5110	105
0.25 or less	110

(2) The Hearing Protection Program is detailed further in USGS *Occupational Safety and Health Program Requirements Handbook*, 445-2-H, Chapter 19, "Industrial Hygiene – Hearing Conservation Program." The purchase of nonmetallic two-way

communication headphones is authorized. To be effective, this type of headphone will reduce generator and motor noise significantly and provide clear communication between the netter and the equipment operator. The use of earplugs and hand signals, agreed upon by the entire crew, are also available for work in noisy environments.

I. *Exhaust from Power Source*. The exhaust from gasoline powered engines will be directed away from the equipment operator. Exposed hot pipes will be enclosed in protective screening to reduce the potential of burn exposure to crew members. The use of galvanized pipe for exhaust is discouraged due to the potential release of toxic gases produced under extreme heating conditions.

J. *Gasoline and Refueling***.**

(1) Gasoline will be stored and transported in approved containers designed for fuel storage. The container must be approval by Underwriters' Laboratories, Inc., the Factory Mutual Engineering Corporation, or another nationally recognized testing laboratory. Plastic containers (rather than metal) are recommended for use.

(2) All equipment will be turned off during refueling. Hot surfaces will be allowed to cool before refueling. It is recommended that all tanks be filled prior to each operation to avoid the potential for explosion or fire during refueling. Flames and/or smoking are not allowed during refueling.

(3) Gasoline refueling will not take place on a plastic surface, e.g., a plastic lined pick-up truck bed.

(4) Portable gas tanks will be placed on the ground for refueling.

K. *Equipment Inspection*. All external wiring, cables, and connectors will be visually inspected for physical damage or corrosion before each use. Any equipment deficiency representing a potential safety hazard will be corrected before each field operation or during actual use when the damage occurs.

L. *Electrical specifications for Portable Electro Shockers (backpack, tow barge, shore-based, pre-positioned, etc.)*.

(1) Electrode handles will be constructed of a nonconductive material and be long enough to avoid hand contact with the water.

(2) The positive electrode (anode) used with portable electro shockers will be equipped with a manually-operated, normally open pressure switch that breaks the electric current upon release. Do not bypass the manual switches with hold-down mechanisms such as tape.

M. *Backpack Electrofishing Units***.**

(1) Batteries used as an electrical power source will be of the gel type that will not leak when tipped or overturned.

(2) Backpacks will be equipped with a quick release belt (hip) and shoulder straps.

(3) All equipment must be equipped with a tilt switch that opens the circuit in case the operator falls. Switches that are manually reset are preferred over automatic resets. New equipment requests should come with manually reset switches when available.

(4) No netting will be used on the hand-held electrodes except when sampling for lamprey ammocoetes, or when the unit is equipped with an automatic shut-off switch that opens the circuit when an electrode is out of the water.

N. *Shore-based Electrofishing Units***.**

(1) Each electrode operator must have an individual activation switch.

(2) The generator must be manned to provide immediate shutdown in case of an emergency.

O. *Tow-Barge Electrofishing Units***.**

(1) Each electrode operator must have an individual dead man switch.

(2) The barge hull must be made of nonconductive material with the cathode attached to the hull bottom.

(3) The generator must be manned to provide immediate shutdown in case of an emergency.

(4) The tow barge operator must have a deadman switch that stops the electrical power in case the operator falls away from the barge.

Electrofishing Safety

P. *Electric Seine Electrofishing Units*.

(1) Each brail (seine pole) must have an individual activation switch wired in series to control the power applied to the electrodes.

(2) The generator must be manned to provide immediate shutdown in case of an emergency.

Q. *Prepositioned Area Electrofishing Units***.** The generator must be manned to provide immediate shutdown in case of an emergency.

R. *Color Coding/Labeling of Significant Hazards*. To ensure visibility, the color red will be used to identify fire extinguishers, safety cans, and stop buttons for electrical equipment. The color fluorescent orange will be used to identify all other safety switches.

S. *Safe Work Practices*.

(1) All persons will wear U.S. Coast Guard approved personal flotation devices (Type III minimum) when working near, on, in, or over water, except in those cases where an approved site-specific job hazard analysis defines the conditions for an exemption (See USGS Occupational Safety and Health Program Requirements Handbook, 445-2-H, Chapter 15, “Job Hazard Analyses,": http://www.usgs.gov/usgs-manual/handbook/hb/445-2-h/ch15.html.)

(2) Leave the water immediately if waders or gloves develop leaks.

(3) Avoid operating electrofishing equipment near people, pets, livestock, or wildlife that are in or near the water.

(4) Cease operations in inclement weather (moderate to heavy rain, lightning, or thunderstorms).

(5) Rest often to avoid fatigue, and drink plenty of fluids to avoid dehydration and heatstroke.

(6) Do not wear conductive jewelry or clothing (such a watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, or metal headgear).

(7) The anode should never touch the cathode or any other metal equipment.

(8) The electrofishing operation must be shut down and repaired if anyone feels an electric shock, however minor. An incident report will be provided to the Collateral Duty Safety Program Coordinator and the immediate supervisor.

T. *Automated External Defibrillators (AED)*. It is highly recommended that every electrofishing boat be equipped with an AED. If AEDs are provided, then a minimum of two crew members will be AED certified and a formal written program established at the local level, inclusive of medical director oversight.

U. *Immunization Program*. It is recommended that field personnel working on an electrofishing crew be offered a booster tetanus vaccination every 10 years. Personnel should consult a physician to determine if hepatitis A and/or hepatitis B vaccinations are recommended based on their personal health and the areas where they are working.

V. A formal bloodborne pathogens program, inclusive of offering employee immunizations, shall be established for those trained in First Aid/CPR-AED operations. See USGS *Occupational Safety and Health Program Requirements Handbook,* 445-2-H, Chapter 25, for boodborne pathogen requirements.

8. **Responsibilities.**

A. *Bureau Safety Manager***.**

(1) Assists Regional Safety Managers in identifying appropriate electrofishing safety training programs.

(2) Conducts assessments of Bureau and regional science programs during formal reviews and inspections, when possible.

(3) Provides Bureau oversight and direction for electrofishing activities.

B. *Regional Safety Manager*.

(1) Reviews and approves non-National Conservation Training Center electrofishing safety training programs upon request.

(2) Conducts assessments of regional science programs during formal reviews and inspections.

(3) Provides regional oversight and direction for the program.

C. *Regional Safety Officer.* Conducts assessments of field programs during formal reviews and inspections.

D. *Collateral Duty Safety Program Coordinator*. Maintains current list of personnel possessing an electrofishing certificate of competency within their organizations, and provides the RSO or field managers with a copy of the list upon request.

E. *Managers/Supervisors*. Ensure that all persons serving as electrofishing Team Leaders have received the appropriate training and certification and forward documentation to the Collateral Duty Safety Program Coordinator.

F. *Project Chiefs*. Ensure compliance with the provisions of this chapter and the following requirements:

(1) Provide personnel assigned to work on an electrofishing crew with proper boots, gloves, and any other personal protective equipment required to ensure their safety while electrofishing.

(2) Instruct other crew members on the safety procedures and potential hazards in electrofishing before the electrofishing field effort is undertaken.

(3) Advise the project office of the location, start time, and end time of the scheduled electrofishing event.

(4) Provide the personnel who are performing electrofishing operations with the required training and immunizations.

G. *Electrofishing Team Leaders*. Only individuals demonstrating knowledge of electrofishing techniques are eligible to serve as electrofishing Team Leaders. Team Leaders will be considered knowledgeable of the principles and techniques of electrofishing upon satisfactory completion of an initial U.S. Fish and Wildlife Service, e.g., National Conservation Training Center course, "Principles and Techniques of Electrofishing," and, subsequently, a Regional Safety Manager-approved refresher course, as detailed in paragraph 6B of this chapter. Team Leaders are responsible for the following:

(1) Identifying hazardous conditions associated with proposed electrofishing operations, determining measures to protect electrofishing team members, and briefing team members appropriately.

(2) Maintaining all electrofishing equipment in a safe condition. Visually inspect all external wiring, cables, and connectors for physical damage before each use. Any equipment deficiency that may present a safety hazard will be corrected before each field operation or when equipment damage occurs during actual use.

(3) Verifying that personnel follow proper safety procedures and use the proper safety equipment.

(4) Ensuring that adequate warning is provided to the public so that public exposure to the potential hazards of electrofishing operations is avoided. Boats should be clearly marked with "Danger Electricity" signs.

(5) Shutting down electrical power should the public approach closer than 100 feet to electrofishing operations.

(6) Ensuring precautions are taken to avoid harm to domestic animals or wildlife.

(7) Ceasing all electrofishing operations and relocating all crew members ashore during inclement weather.

(8) Ensuring that only those persons necessary to conduct a safe and efficient operation engage in each electrofishing activity and verifying their training to ensure that electrofishing operations are conducted in a safe and efficient manner.

(9) Ensuring that at least one other member of the team is certified in CPR and First Aid.

(10) Making available a well-equipped, watertight First Aid kit. Questions concerning the contents of the First Aid kit may be directed to the Collateral Duty Safety Program Coordinator, the Regional Safety Officer, or the Regional Safety Manager, as appropriate.

(11) Reviewing the "USGS Electrofishing Considerations Checklist" found in Appendix 42-1, adding specialized items that pertain to each individual operation, as appropriate.

(12) Ensure that the job hazard analysis for each site contains emergency instructions and documented routes to medical facilities and is made available to all team members.

H. *Personnel (Electrofishing Crew Members).*

(1) The Team Leader and at least one electrofishing crew member must complete training and maintain a current certification in First Aid and CPR.

(2) If operating an electrofishing boat, complete the DOI Motorboat Operator Certification Course and maintain certification.

(3) Wear appropriate protective equipment as required.

(4) Report all potential work hazards, accidents, incidents, and job-related illnesses and injuries to their supervisors immediately.

/s/ Karen D.
Baker 10/8/09

_____ _____

Karen D. Baker Date
Associate Director for Administrative Policy and Services
Designated Agency Safety and Health Official

Safety Guidelines for Field Data Collection

Submitted to: The Southeastern Transportation Center

Submitted by:
Dr. Fred Wegmann
Dr. Jerry Everett

February 2010

INTRODUCTION

Safety concerns are always present when personnel are working near or adjacent to a highway. Safety considerations must include the workers as well as the motoring public. Construction safety has received extensive attention, but this research focuses on personnel working near or adjacent to the highway and involved in activities such as: collecting data, setting up data collection equipment or administrating roadside interviews. Part Six of the Manual of Uniform Traffic Control Devices (MUTCD) discusses temporary traffic controls for maintenance activities. Some State Departments of Transportation provide their data collection personnel with supplemental policies, procedures and guidelines which will be discussed in this paper.

Policies and guidelines will be discussed in the context of intrusive and non-intrusive surveys. Intrusive surveys involve a surveyor having personal contact with a motorist along the roadway such as an origin-destination survey. These surveys involve stopping the vehicle on or adjacent to the roadway, a toll booth, rest area or truck weigh station. Non-intrusive surveys do not involve direct contact with a motorist and use such methods as placing road tubes across a highway or reading license plates.

Some states do not administer roadside intrusive surveys because of safety concerns. Other states permit these survey techniques only on lower volume, low speed roadways if adequate safety precautions are practiced. Some states rely on less intrusive techniques such as handing out postcards to motorists on ramps or in rest areas rather than conducting on site surveys. Questions that should be addressed include what are adequate safety provisions, where can these intrusive surveys be practiced safely and what procedures should be followed to ensure a safe environment? A recent study noted at least 10 states are relying on roadside interviews to collect valuable transportation planning data and a number of states have adopted written policies and practices manuals. (2) The observations from these states can be supplemented with the experiences of consultant firms that routinely conduct such surveys. Even non-intrusive surveys involve personnel working on or adjacent to the roadway which require safety guidelines and procedures to be developed and consequently followed.

PROJECT OBJECTIVE

The objective of this project is to define best safety practices associated with the collection of field data on or adjacent to highways. Guidelines for best practices will be based on experiences of agencies and private sector firms that have extensive experience with providing a safe operating environment for both field personnel and the motoring public. Best practices will be developed for different data collection activities defined as: duration of activities, location of activities on or adjacent to the roadway, roadway type and the roadway operating environment. Both intrusive and

non-intrusive data collection activities will be considered. Information will be presented on:

1. General requirements
2. Non-intrusive data collection techniques typically less than one hour at a site
3. Non-intrusive data collection techniques typically more than one hour at a site
4. Intrusive data collection techniques

GENERAL PROVISIONS

Most traffic data collection techniques are covered come under the general provisions of Part Six in the MUTCD "Temporary Traffic Control" (TTC). However, data collection procedures are not specifically covered in this section. Appropriate control devices used for the establishment of temporary traffic controls are presented in Part six of the MUTCD, stratified for different work activities in terms of: duration of activities, location in relation to the roadway, work type and highway type. As stated in Section six with reference to a temporary traffic control:

> "Each TTC zone is different. Many variables, such as location of work, highway type, geometrics, vertical and horizontal alignment, intersections, interchanges, road user volumes, road vehicle mix (buses, trucks, and cars), and road user speeds affect the needs of each zone. The goal of TTC in work zones is safety with minimum disruption to road users. The key factor in promoting TTC zone safety is proper judgment."

Typical applications of TTC zones are organized according to duration, location, type of work and highway type and will pertain to typical data collection activities. These applications are taken from Table 6H-1 (see Table 1) and are provided in the MUTCD.(1) As can be noted, these applications cover general TTC activities, but do not include a detailed layout for each situation.

Table 1: Index of Applications (taken from Table 6H1)
Modified to Reflect Typical Data Collection Activities

TYPICAL APPLICATION DESCRIPTION	TYPICAL APPLICATION
Work Outside of Shoulder (see Section 6G.06)	
Work Beyond the Shoulder	TA-1
Work on the Shoulder (see Section 6G.07 and 6G.08)	
Work on Shoulders	TA-3
Short Duration or Mobile Operation on Shoulder	TA-4
Shoulder Closure on Freeway	TA-5
Shoulder Work with Minor Encroachment	TA-6
Work Within the Traveled Way of Two-Lane Highways (see Sections 6G.10)	
Lane Closure on Two-Lane Road Using Flaggers	TA-10

Lane Closure on Two-Lane Road with Low Traffic Volumes	TA-11
Temporary Road Closure	TA-13
Work in Center of Road with Low Traffic Volumes	TA-15
Surveying Along Centerline of Road with Low Traffic Volumes	TA-16
Work in Center of Road with Low Traffic Volumes	TA-17
Work Within the Traveled Way of Urban Streets (see Section 6G.11)	
Lane Closure on Minor Street	TA-18
Work Within the Traveled Way at an Intersection and Sidewalks (see Sections 8G.13)	
Lane Closure on Near Side of Intersection	TA-21
Right Lane Closure on Far Side of Intersection	TA-22
Left Lane Closure on Far Side of Intersection	TA-23
Half Road Closure on Far Side of Intersection	TA-24
Multiple Lane Closures at Intersection	TA-25
Closure at Side of Intersection	TA-27
Sidewalk Closures and Bypass Sidewalks	TA-28
Work Within the Traveled Way of Multi-lane, Non-access Controlled Highways (see Sections 8G.12)	
Interior Lane Closure on Multi-lane Street	TA-30
Lane Closure on Street with Uneven Directional Volumes	TA-31
Lane Closure on Divided Highway	TA-33
Lane Closure with Temporary Traffic Barrier	TA-34
Mobile Operation on Multi-lane Road	TA-35
Work Within the Traveled Way of Expressways and Freeways (see Sections 8G.14)	
Work in Vicinity of Exit Ramp	TA-42
Partial Exit Ramp Closure	TA-43
Work in Vicinity of Entrance Ramp	TA-44

For additional information and to access Typical Application sections please visit
http://stc.utk.edu/STCresearch/completed/Y1_PDFs/Y1-P01final_wegmann.pdf

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Safety Hazards of Batteries

Battery technology is at the heart of much of our technological revolution. One of the most prevalent rechargeable batteries in use today is the Lithium-ion battery. Cell phones, laptop computers, GPS systems, iPods, and even cars are now using lithium-ion rechargeable battery technology. In fact, you probably have a lithium-ion battery in your pocket or purse right now!

Although lithium-ion batteries are very common there are some inherent dangers when using **ANY** battery. Lithium cells are like any other technology – if they are abused and not used for their intended purpose catastrophic results may occur, such as: first-, second-, and third-degree burns, respiratory problems, fires, explosions, and even death. Please handle the lithium-ion batteries with care and respect.

User Safety Precautions

Short-Circuiting

- **When the battery is not in use, you MUST disconnect the battery from the battery connector. When the battery is connected to the battery connector, do not leave unattended since the two wires with the alligator clips can touch which will heat up the battery. Short circuiting will damage the battery and generate heat that can cause burns.**
- Don't leave the battery in the charger once it is fully charged. The battery charger will flash on and off with a red indicator light every 20 seconds when the battery is fully charged. Overcharging the batteries will not increase the performance and could lead to damage.

Disassembly

- Never disassemble a battery as the materials inside may be toxic and may damage skin and clothes.
- DO NOT place a battery in fire; this may cause the battery to rupture. The electrolyte is very flammable and if an ignition source exists, then fire and even an explosion could result.
- NEVER place batteries in water, as this may cause the battery to rupture and release poisonous gasses. Furthermore, when the electrolyte is combined with water, there is the potential for hydrofluoric acid to form – an extremely toxic and

corrosive substance. To learn more about hydrofluoric acid, visit the following link to the Centers for Disease Control's website: http://www.bt.cdc.gov/agent/hydrofluoricacid/basics/facts.asp

Soldering

- Never solder anything directly to a battery. This can destroy the safety features of the battery by damaging the safety vent inside the cap.

Charging

- Never charge with an unspecified charger or specified charger that has been modified. This can cause breakdown of the battery or swelling and rupturing.
- Never attempt to charge a battery which has been physically damaged.
- Avoid designing airtight battery compartments. In some cases, gases (oxygen, hydrogen) may be given off, and there is a danger of a battery bursting or rupturing if ignited by sparks.
- Do not use a battery in an appliance or purpose for which it was not intended.

Safety Procedures

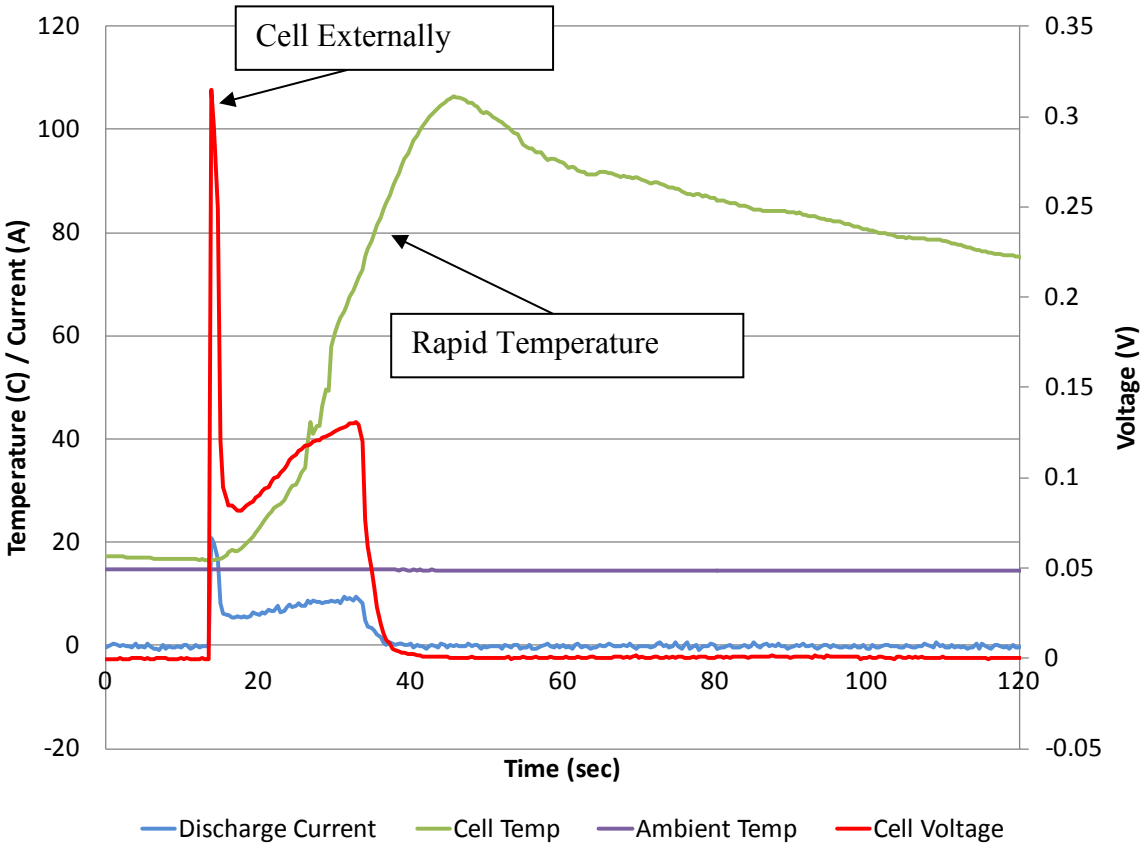
- If the foil packaging on the battery does break, vent the room and leave area.
- If a fire starts, call the fire department immediately. The only extinguisher that will work on a Lithium-ion Battery fire is a Class D Fire Extinguisher or Dry Sand or Dry Table Salt.

Battery Disposal

Lithium-ion batteries are found in many electronics like laptops, digital cameras, power tools, and cordless phones. These batteries are very popular because they can be recharged and because they are able to supply power for a long period of time. However, even lithium-ion batteries reach a point where they can no longer hold a charge and need to be disposed of. When this time comes, it is important to know how to recycle the battery, and not simply put it in a trash can. Determine your states recycling policy.

There are many reasons to recycle these batteries rather than throw them away where they may end up in a regular landfill. This is because they enter the solid waste stream and can contaminate soil and water. Please check with your school on their policy of recycling of batteries.

Externally Short Circuit Cell



- After the cell was externally shorted (akin to dropping a wrench across the positive and negative terminals), the temperature of the cell rose to approximately 106°C (223°F).
- The excessive temperatures within the cell caused the electrolyte to internally vaporize; this, in turn, pressurized the aluminum packaging material of the battery.
- After pressurization, the aluminum packaging vented out of the bottom of the cell and liquid electrolyte was seen on the test surface.
- Smoke also exited the vent hole but a fire did not result.
- The current draw from the battery exceeded the 12C rating of the cell by a factor of 10.

Transportation of Chemicals in the Field

- Identify chemical and be familiar with the MSDS for those chemicals that you are transporting.
- Use secondary containment for chemicals (i.e. 2 zip-loc bags) for transportation in backpacks.
- Follow general safety procedures from the Wet Safety Manual for personal protective equipment and handling of chemicals.

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

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

Field Research Safety Information

Department of Civil and Environmental Engineering

The University of Tennessee, Knoxville

Issued June 2013

Revised: 8/22/2013
By: CEE Safety Committee

Emergency Response Data

In case of any emergency dial 911. No prefix number is necessary when dialing 911. The University of Tennessee Police Department are responsible for response for any on campus emergencies and can be reached by dialing 911 from any telephone connected to the University of Tennessee telephone system. In all off campus emergencies the local police can best be contacted by dialing 911.

The Civil and Environmental Engineering Department Head is:

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The campus Department of Environmental Health and Safety support personnel can be contacted by calling (865)974-5084 Monday-Friday from 7am to 6pm or by contacting The University of Tennessee Police Department by dialing 911 during non-office hours.

Field Research Safety

All science, whether conducted in a controlled indoor laboratory or in an outdoor field setting, requires regular safety training and thorough consideration of safety issues specific to individual research projects. The office of Environmental Health and Safety exists as a safety consulting resource for all university departments and personnel. Also available are several examples of safety protocols, guidelines and procedures developed by various units within the college to help in the formation of safety protocols for particular projects or activities. Ultimately, safety rests with each individual. Individuals are responsible for their own safety and, through their actions, the safety of those around them. (UCDAVIS College of Agricultural and Environmental Sciences)

Field research is defined here as comprising work activities conducted primarily for the purpose of research, undertaken by employees or students of the university outside of an office or research laboratory. Ultimately, field research involves some risk from both the research activities and chance events that are unpredictable and unavoidable. Part of the risk can be greatly reduced by awareness of hazards and exercising good judgment. Risk in field research may include, but is not limited to, the risk to physical health, emotional well-being and personal safety. The risks may arise because of the nature of the research itself, from the physical climate, or from the political, social, economic and cultural environment of the field work location. (UCDAVIS College of Agricultural and Environmental Sciences) For these guidelines, the following definitions are employed:
A principal investigator (PI) is a faculty member who assembles a team to carry out field research.
A field supervisor is a person appointed by a principal investigator to directly oversee field research on location.
A field worker is a person who carries out research under the direction of a field supervisor. (UCDAVIS College of Agricultural and Environmental Sciences)

A field supervisor is expected to have a safety plan and all of the suitable training for conducting field research. Field supervisors should have the following training: general safety orientation, CPR, wilderness first aid, and general knowledge of all first aid equipment. The following safety factors should be considered when developing the safety plan.

- Scheduling: To the extent possible, field research should be planned in advance. The PI should know when and where field research is being conducted. If the PI is away, then department staff should be advised of pending research.

- Protective Equipment: A properly equipped first aid kit, a cell phone, and extra water are required on all field excursions. Appropriate personal protective clothing and equipment are required to the field workers.
- Contacts: The home phone number of all field workers and supervisors, as well as phone numbers of emergency contacts, should be included in the safety plan maintained by the supervisor. The home and work numbers of the PI needs to be kept in the plan in case field researchers need to contact PI during an emergency.
- Medical Facilities: The telephone number, location and directions to a medical facility in the vicinity of the field site should be written into the safety plan maintained by the field supervisor.
- Vehicles: All state and local laws, rules and regulations must be followed.

Safety Issues for Principal Investigators

- When in the field, the PI has the same responsibilities as a field worker and may take on the responsibility of being field supervisor, or may designate that responsibility to the field supervisor in charge. When not in the field, the PI should make an effort to ensure that field work is performed in compliance with the safety plan, that all personnel are provided the necessary safety training and equipment.
- The PI is responsible for:
- Facilitating the field supervisor with determining the specific health and safety risks and level of risk associated with the particular field project.
- Assembling a field team and establishing a clear chain of command, which is understood by all team participants
- Participate in pre-trip planning specific to the trip, including a review of the safety plan.
- Documenting that each field worker is aware of the provisions of the safety plan, the risks associated with the project, training, and verifying that all safety procedures are in place.
- Ensuring that appropriate controls and safety procedures are in place to deal with the risks reasonably expected to be associated with the field research, as well as provision of appropriate protective equipment and training. (Field Research Safety Information, Ohio State University)

Solitary field research activities in remote areas are strongly discouraged. Field research involving particularly hazardous locations or activities should be conducted by two or more people and only after full assessment of the risks and available controls and safety procedures has been made. In circumstances where solitary field research is necessary, the solitary field worker assumes the responsibilities of field supervisor. A method of regular communication should be implemented, including steps to follow if a scheduled contact is not made.

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Every field researcher has the right, at any time, to refuse to participate in any activity that they feel may endanger their health or safety or that of another person. (UCDAVIS College of Agricultural and Environmental Sciences)

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By: CEE Safety Committee

Physical Health

You should be in good physical health and able to undertake strenuous physical activity. Many field sites are remote. Access often requires hiking over rugged terrain or even rock climbing. The field station itself may be primitive. Your studies may require that you sleep in a tent and cook outdoors over an open flame. You may need to operate heavy equipment such as a chain saw. Outdoor weather is always a consideration – particularly in terms of extremes of temperature. Your work may be abroad and require that you receive immunization for potentially serious illness such as communicable disease beforehand. If you have allergies or serious medical conditions such as diabetes it is important that you bring an adequate supply of your medications with you.
(http://www.osha.gov/SLTC/laboratories/index.html)

Training

Awareness is the most basic and most important step in preparing to work in the field. To adequately prepare for field research, the worker needs to understand what the specific field research project entails and what safety concerns may arise. Field workers should be aware of the locations of emergency equipment, as well as basic emergency procedures. This is analogous to "site-specific" training in laboratories. CPR and Wilderness First Aid training is highly recommended.

All field research workers should be informed of the potential physical and environmental hazards in the area such as poisonous plants, animals, insects, terrain, biological hazards, weather conditions, crime, and disease. The PI and/or field supervisor shall maintain completed medical history forms for each field researcher consisting of emergency contact information. (Rick Curtis, Outdoor Action Program)

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Advanced Planning

If you are involved in international research, it is important to obtain your passport and visas in order well in advance. Make sure that you have health insurance coverage. Obtain any recommended vaccinations and make sure that you are aware of any health concerns and what food is safe to eat in the country and region of the country in which you will be working. Check with the State Department so you know if there are any travel warnings or restrictions.
You need to know and understand the potential hazards presented by the area in which you will do field work. For example, there may be predatory animals (e.g., bears), venomous amphibians, or toxic plants. The dangers may also be human as the area in which you work may be an area in which there has been past/present civil or political unrest. You should make sure that you know what the precautions are for each potentially hazardous situation and that you have received the training to handle these situations. Accidents are always possible when working outdoors – cuts, sprains, falls, insect bites, sunburn, and dehydration are not uncommon. Consequently it is vital that you follow the direction of your supervisor in the field at all times. Do not engage in horseplay.
(U.S. Department of Labor Occupational Safety & Health Administration)

Great Smoky Mountains National Park Field Safety

Your safety depends on your own good judgment, adequate preparation, and constant attention. Proper equipment and the knowledge of how to use it are essential for a safe trip. Your safety is your responsibility. Here are a few basics:

- Let a responsible person know your route and return time. Have them contact the park at (865)436-1230 if you do not return within a reasonable time.
- Always hike with another person.
- Carry a current park trail map and know how to read it. Remember that the park trail map is a flat representation of the park's rugged, mountainous terrain.
- Carry a flashlight or headlamp.
- Take adequate water supply.
- Always carry a first aid kit.
- Check the current weather forecast and be prepared for quickly changing conditions.
- Wear shoes or boots that provide good ankle support.
- Always carry a wind-resistant jacket and rain gear.
- Don't attempt to cross rain-swollen streams.

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Encounters with Bears

Bears in the park are wild and their behavior is unpredictable. Although extremely rare, attacks on humans have occurred, inflicting serious injuries and death. Treat bear encounters with extreme caution. Bear pepper spray may be carried within the Great Smoky Mountains National Park for the strict purpose of protection against bodily harm from aggressive wildlife. It should not be applied to people, tents, packs, other equipment or surrounding area as a repellent. Bear pepper spray is a chemical formula designed specifically to deter aggressive or attacking bears. It must be commercially manufactured and labeled as "Bear Pepper Spray" and be registered with the Environmental Protection Agency and individual states. Bear pepper spray must contain between 1% to 2% of the active ingredients capsaicin and related capsaicinoids.

Poisonous Snakes

Two species of poisonous snakes live in the Great Smoky Mountain National Park, the northern copperhead and timber rattlesnake. Although very few snake bites occur in the park, visitors should be cautious where they place their hands and feet, especially around old buildings and stone fences.

Insects

Yellowjacket wasps are the insects of greatest concern. They build nests in the ground along trails and streams and are aggressive when disturbed. Avoid perfume, powder, and scented deodorants which may attract yellowjackets. Stings cause local swelling and can lead to severe allergic reactions in some people. Such people should carry epinephrine kits.

Ice and Wet Leaves

In winter, most trails at high elevation will be covered with ice. Use crampons or other traction devices for your boots. In autumn, loose, slick leaves on the trail cause many hikers to fracture their ankles. Be certain to wear ankle supporting boots.

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Vehicle Safety

Cornell University Policy #3.4, Use of UT Vehicles, provides administrative details for authorizing drivers of owned, rented or leased by the University for official business. Items addressed include: the driver's obligations, the department's or unit's obligations, and procedures for reporting accidents and damage.
(GSMNP Website,
General

- Always notify someone of your itinerary. Know your routes and carry maps.
- Drivers should familiarize themselves with the vehicle before driving.
- Carry a first aid kit and manual in the vehicle at all times.
- Use seatbelts at all times – during both road and off-road travel.
- Make sure you have an adequate number of approved drivers for longer trips to allow sufficient rest for drivers.
- The alternate driver should not sit in the passenger seat; the alternate driver will get more rest in another seat in the vehicle. The front seat passenger should stay awake, monitor the driver for signs of fatigue, and navigate for the driver.
- Generally, drivers should avoid driving more than 2 hours continuously. Drivers should rest and/or rotate every 2 hours.
- Drivers should avoid driving between midnight and 6 a.m. In some areas, drivers should
- be extra cautious and drive only during daylight hours.

(College of Agriculture and Life Sciences Cornell University)

Works Cited

UCDAVIS College of Agricultural and Environmental Sciences. Field Research Safety Introduction, 2013. Web. 31 May. 2013.

Field Research Safety Information, The Ohio State University, 2012. Web. 31 May. 2013.

Lab Safety. U.S. Department of Labor Occupational Safety & Health Administration, 2013. Web. 31 May. 2013. http://www.osha.gov/SLTC/laboratories/index.html

Curtis, Rick. Training. Outdoor Action Training for Field Scientists, 2013. Web May. 2013.

Great Smokey Mountain Park, www.nps.gov/grsm.

Revised: 8/22/2013
By: CEE Safety Committee

Revised: 8/22/2013
By: CEE Safety Committee

Name: **Offsite Safety Guide**	Effective: August 30, 2012
Areas Affected: Any UT sponsored group traveling to a remote area	Reviewed/Revised: August 30, 2012

Policy

It shall be the policy of the University of Tennessee, Knoxville, to identify safety and health concerns for individuals or groups that are traveling off campus to areas that are remote.

Introduction

This document has been designed as a non-mandatory guide to assist individuals and groups who are traveling to remote areas and may encounter unexpected hazards. Note there are some sections of this document that are mandatory and the denoted with italicized font.

Definitions

Remote Areas – Areas of the world, including the United States, that are generally uninhabited and are many miles from potable water, electricity, communication, businesses, residential and other services.

Responsibilities

Department Heads are encouraged to:

1. Use this document as a guide for individuals or groups who are traveling to remote areas
2. Consult with EHS if there are any questions relative to this guide
3. Make suggestions for improving this guide
4. Maintain Appendix A for an appropriate period of time.

Environmental Health and Safety shall:

1. Maintain this procedure in the safety manual online
2. Update the guide as necessary
3. Interpret the intent of the procedure where the meaning may not be clear
4. Assist departments and individuals to the extent feasible with hazard identification, training, and suggestions of appropriate controls

Students shall:

1. Follow directions as specified

2. Not engage in horseplay or other disruptive actions that could lead to an accident
3. Ask question if uncertain of directions or safety protocol
4. Report hazards or near misses that occur
5. Report any accidents, damaged equipment/property or other losses to the person in charge.
6. Use personal protective equipment when necessary
7. Undertake any activities for which they are
    a. Properly trained,
    b. Familiar or understand
    c. Physically capable of performing

Procedure

Individuals or groups who are travel to remote areas are encouraged to use Appendix A to evaluate hazards before departure.

Training

See applicable parts of Appendix A.

Recordkeeping

Appendix A should be kept by the department until the trip is complete. The record must be kept longer if there are any of the following:

a. Injuries
b. Damages or loss to equipment or property
c. Anticipated legal or regulatory actions

In these cases the length of retention shall be based on the nature of the event.

In addition, departments may consider keeping completed copies of Appendix A as reference for future similar trips.

Standards

OSHA General Industry Standards 29 CFR 1910.

Appendix A Offsite Safety Checklist

The following list of questions has been developed to assist those individuals or groups who are traveling to remote areas in an attempt to identify potential safety and health hazards. Not all questions are applicable to every trip. Please contact campus Environmental Health and Safety (EHS) at 974-5084 if you have any questions about this list of if you have a suggestion to improve this document. In addition, EHS is available to the extent feasible to assist with training, procedures, and other aspects related to safety. Section XII below list activities that require review and planning. Note there are other activities with a significant degree of hazard that could be included under section XIII.

I. Communication and Accountability

1. Have plans been made to notify others of the following:

    a. Anticipated departure and arrival time at the destination?
    b. Destination address?
    c. Return date and time?
    d. Periodic check in during the trip?
    e. Contact information at the site, phone #, e-mail, etc.?
    f. Emergency contact information for members of the group?

2. Is there a backup plan for communication?

3. What process will be used to account for individuals who become separated from the group?

4. Will language be a barrier?

5. If cell phones are being used, do all members of the group have a list of needed phone numbers?

II. Personal Protective Equipment (PPE) and Clothing

1. *Will any of the following PPE be necessary during the trip?*

    a. Gloves?
    b. Protective footwear?
    c. Hard hats?
    d. Protective suits?

e. Hearing protection?
f. Respiratory protection?
g. Eye protection?
h. Other _____

2. *Have individuals been appropriately trained in the use of the PPE?*

3. *Has a written PPE assessment form been completed?*

4. Are individuals in the group familiar with the appropriate clothing for the trip?

III. Health

1. Are there any special immunizations necessary when traveling to the area?

2. Are there any individuals in the group who have special health conditions?

3. How will minor injuries be handled?

4. There are endemic diseases in the area that require special precautions?

5. Are there any zonotic diseases specific to the area?

6. How will medical emergencies be handled?

7. Where are the nearest medical facilities?

8. Will there be the need for individuals who are trained in CPR, First Aid or use of an automated external defibrillator?

9. Will any human tissue or fluid samples be taken during the trip?

10. Will any prolonged high levels of noise, capable of causing hearing loss be encountered during the trip?

11. Do all members of the group have health insurance?

12. Will a safe source of food and drinking water be available?

13. Are all members of the group physically fit for their anticipated tasks including
    a. Aerobic fitness?
    b. Acclimated to heat environments?
    c. Altitude?
    d. Strength?

IV. Transportation

1. Will reliable transportation be used to access the area?

2. Is there a backup plan if the primary means of transportation fails?

3. Will any members of the group from UT being operating a motor vehicle, motorcycle, 4-wheeler, ATV or other vehicle?

V. Weather Conditions

1. Are extreme weather conditions likely to be encountered including

a. Temperature extremes
b. Tornadoes
c. Hurricanes
d. Lightning
e. Drought
f. High winds
g. Heavy Snow
h. Wild fires
i. Ice
j. Heavy Rain and/or Flooding
k. Other

VI. Insurance

1. Is special insurance needed for this trip?

    a. If so, has the Risk Management Office been contacted?

VII. Hazardous Substances

1. Will hazardous substances be taken to or from the site?

2. Are individuals in the group familiar with proper handling of these materials?

3. How will hazardous substances be handled as a waste product?

4. Will any chemical or biological samples be sent back to the University?

    a. If so, have appropriate permits been obtained?
    b. Are any of the materials prohibited from entry into the US?

VIII. Biological Hazard

1. Are any of the following likely to be encountered

    a. Venomous spiders, snakes, and alike
    b. Poisonous plants

2. Large mammals (elephants, rhinos, lions, bear, tigers)

3. Dangerous fish (sharks, killer whales,)

4. Dangerous reptiles

IX. Potential Violence and Crime

1. Will any part of the trip involve an area where there is:

a. Civil unrest
b. High crime rates – including theft
c. Potential violence, including kidnapping, rape, assaults, etc.

2. How will valuable equipment and personal effects be protected from theft or vandalism?

3. How will acts of crime against the group be reported and documented?

X. Equipment

1. Will any powered (electric, propane, gas) equipment be used on the trip?

    a. If so, are individual familiar with the proper use of the equipment?

2. Will any heavy equipment (forklifts, backhoes, bulldozers, etc) be used by the individual or group?

3. Will equipment checks be made for proper guarding, electrical safety and proper use?

4. Will there be the need for specific equipment training?

XI. Cultural and Laws

1. Are there any cultural aspects or customs that must be observed?

2. Will work involve any culturally significant areas, buildings or artifacts?

3. Are there any special laws or regulations that must be observed?

XII. Other Activities that Require Review

1. Spelunking
2. Underwater work (SCUBA)
3. *Working at elevated heights without fall protection (barriers or personal fall arrest system)*
4. Parachuting
5. *Excavation over 4 feet in depth with vertical walls*
6. Potential avalanche
7. Horseback riding
8. Work at elevations above 12,000 feet
9. Work near active volcanoes
10. Work in the polar regions
11. Work at sea or on ships, boats or alike.
12. Construction sites
13. Carrying fire arms

Water Sampling Safety

Water-Qualities Activities

Water samples are collected under a wide range of conditions and the work can be dangerous. A knowledge of the hazards involved and means by which they can be minimized should be helpful in preventing accidents and in providing greater safety for sample collectors. It is the responsibility of every field person to take proper precautions to insure their own safety and the safety of others while collecting water samples. Follow normal field safety precautions regarding weather, insects, heat, dehydration, etc., and follow the recommended procedures and precautions for wading, boat, bridge, cableway, or ice measurements. Especially, pay attention to dangers present in the vicinity of the sampling site. List all specific instructions in field files for safety procedures according to TWRI's or established standards.

Collecting Samples from Streams, Rivers, and Lakes

Taking samples from streams, rivers, and lakes for water-quality analysis has unique safety risks. The inability to swim and difficulty in freeing oneself of burdensome equipment or waders if suddenly plunged into deep water are perhaps the most serious risks in taking samples. Remember to always wear your PFD and make sure it is in good condition. Keep your feet spread apart and body aligned parallel to the flow and don't fight the water. At cableways, remember to inspect anchorages at both banks, if possible, and look for signs of excessive wear, vandalism, or accidental damage to the equipment. At bridge sites, follow all State laws for blocking traffic, wear high visibility vests with reflective strips, post appropriate signs at each end of the bridge, and be alert for wide loads and large trucks which may extend over the walkway. Develop a plan for each bridge site for placing traffic control devices. When working on ice, there is no substitute for experience. When possible, work with someone who is experienced working on ice. Be aware of the temperature, whether the stage is rising or falling, and whether the ice is strong enough to support your body and equipment.

Water is a carrier for many disease-producing organisms. Appearance alone is no way to judge the safety of the water. Water-born hazards may come from material dissolved in the water, suspended in the water, or in sediment of the stream bottom. Infections or disease can enter the body through accidental ingestion by mouth or through skin broken by injury or another infection. The following guidelines must be used for protection of personnel working around polluted water:

- Assume the water is polluted.

- Wear rubber gloves to avoid contact with water, especially if it is suspected of being contaminated.
- Obtain immunizations for known hazards.
- Equipment for each personnel should include separate supplies of drinking water, wash water, soap, and a disinfectant.
- Wash water, soap, and disinfectant should be used after all sampling even if the sampled water appears to be uncontaminated.
- Protect feet with waders while in mud or water. Remove waders before washing hands; remember, they may be more contaminated than the current meter or sampler.
- Protect wounds on hands with rubber or plastic gloves.
- Avoid contamination of water, places, or people with your equipment or waders.
- Avoid carrying a pencil in the mouth while sampling or stream gaging.
- Avoid rubbing eyes.

Sampling Wells

There is no single sampling method that will work best for all wells. A number of methods are currently in use for sampling wells. The equipment ranges from simple to refined, including bailers, gas-driven samplers, bladder pumps, syringe devices, electric submersible pumps, suction-lift pumps, air-lift samplers, and gas-driven piston pumps. In selecting a sampling method for a well, a number of details must be considered. Among the considerations are the portability of the equipment, depth to water, well diameter, water volume, ease of cleaning the equipment, method by which the sampling device brings the water to the surface, and reliability of the equipment.

Due to the great variety of physical equipment and field situations in well water sampling, it is impracticable to list a detailed set of safety rules and standards applicable to this activity. Collecting ground-water samples has its own special risks. Follow normal field-safety precautions and procedures for ground-water activities. General guidelines to follow are:

- All routine field safety and equipment and procedures must be followed at all times.
- Know as much as possible about the types of pumps you will be working with.
- Follow specific instructions on instrument operations provided by the manufacturer.
- Make sure all equipment is in good operating condition. Check all equipment and power sources prior to leaving the office.
- Before using any pump, be familiar with its operation, and for installed pumps, review procedures in the field folder for the site.
- Electrical sources are potential hazards. Electrical sources, batteries, generators, or existing AC can cause shocks. Respect the energy source and properly ground all instruments.
- Gasoline is a source of potential contamination, fire, and fumes; gasoline must be stored in approved containers. Pumps and generators must be fueled and oiled away from the area of operation.
- If the site is in a well house or spring house, watch for low doorways and beams inside. As you enter, check for rotten or loose floor boards, slippery floors, snakes, and biting or stinging insects.

- Check for exposed wiring, open electrical panels, and any other possible electrical hazards which might be encountered while working near the pump.

Sample Preservation and Shipment

Chemicals, supplies, and equipment used in the collection and preservation of water-quality samples may be dangerous to both field personnel and to passers-by if precautions are not followed. Most preservatives are either corrosive or poisonous and contact with them must be avoided. Buffers, standards, and filling solutions also are potentially harmful and it is a good general rule to also avoid contact with them. The following safety rules must be practiced when handling preservatives:

- Protective gloves, clothing, and eye wear must be worn when handling hazardous chemicals.
- Carry a sufficient volume of water and antiseptic washes to rinse any accidental spills. Baking soda is a good all purpose substance to absorb acid spills in trucks.
- Avoid spillage and personal contact and have appropriate clean-up kits.
- Wash gloved hands thoroughly with disinfectant soap after sampling and discard gloves properly.
- Be careful when handling acid ampoules to avoid cuts splashes, and breathing fumes. Wear eye protection devices (goggles or face shield).
- Dispose of each empty ampoule and tip immediately following use and before filling a bottle for the next sample. It is recommended that the two parts of the ampoule be placed in either a wide-mouth glass screw jar or a steel disposal can. The disposal container should be filled to 1/4 volume with tap water to minimize shock breakage to the used ampoule.
- Concentrated acid used to preserve samples should be carried in the smallest volumes possible and practicable.
- If ampoules are used, they should be carried in their original shipping container.
- If a larger volume of acid is needed, it should be carried in a container with non-flammable packing which will absorb spills. The container must be secured in the vehicle so that even if the vehicle is involved in an accident or upset, the acid will not leak out of the container and packaging.
- Avoid rapid heating and cooling of glassware, because it can cause breakage. Do not pick up broken glass with hands. Sweep or scoop the glass up.
- Avoid contact with contaminated water. If contact is unavoidable, wash hands and equipment frequently.
- Special care must be used with syringes. The used syringe must be packaged for disposal so that no one handling the wastes will be cut or gouged.
- Alcohol or other flammable chemicals must be transported in the smallest practical volumes and in closed containers that are secured in the vehicles so they will not leak or break.
- Cylinders of compressed gasses must always be tightly secured in a vehicle and while in use. Gas cylinders must never be allowed to stand upright without being secured.

Follow established procedures for shipping samples to the laboratory and observe proper lifting procedures when transporting water and ice-filled coolers. It is recommended that shipping containers be lined with appropriate water-proof materials to prevent water leakage from melting ice. Use sufficient packing material in containers to avoid breakage of sample bottles.

Operating Field Parameter Meters

A wide variety of meters are commercially available for measuring water-quality field parameters. Parameters commonly measured in the field include alkalinity, dissolved oxygen, pH, specific conductance, and temperature. A less commonly measured parameter is RP (redox potential). Usually parameters are measured independently using separate meters. However, multi-parameter meters also are available.

Standards are used to calibrate the meters both in the office and in the field. All meters must be recalibrated at each site. This means, if the meter is packed up and moved, it must be recalibrated.

Standards should be at ambient water temperatures for accurate calibration. When the air temperature is radically different from water temperature, standards should be placed in a circulating bath of sample water until they are close to the water temperature. Remember, good field data depends on proper care, calibration, and maintenance of field equipment.

The operation of field meters is generally a relatively safe activity. A few reminders that may prevent accidents or damage to the equipment are:

- Keep meters in good operating condition and routinely clean, repair, or replace dirty or corroded connections, cells, probes, or sensors.
- Read and follow instrument manual and become familiar with its operation.
- Protect yourself from electrical shock. Replace or repair any broke, weak, exposed, or frayed wiring. Replace batteries that show any unusual wear or cracks in housing.
- Store and transport meters, probes, and sensors carefully. Equipment and tools should be kept separate as much as possible and carried in such a manner as to minimize damage from vibrations and jostling.
- Meters and probes should not be stored in vehicle over night, if possible. Return meters and probes to the office or lab at the end of each field day.

Installing and Operating Water-Quality Monitors

In recent years, equipment to record measurements of various water-quality parameters every few minutes has been developed and can be installed on stream banks, bridges, or wells. These data are often needed to determine short term and in some cases real time fluctuations in the concentration of these water quality parameters. In many cases, data are needed at remote sites, which have no electrical utilities.

Personnel who install and operate water-quality monitors must have a thorough understanding of the equipment and its operation. General guidelines to follow are:

- Follow all instructions when operating the equipment.
- Make sure all equipment is in good operating condition. Check all equipment and power sources prior to leaving the office.
- When working on bridges, follow the safety procedures discussed in the section on surface-water procedures.
- Follow all safety precautions in the construction and repair of gage structures that may house the equipment.

Previous--*Ground-Water Activities*
Contents
Next--*References*

A Guide to Safe Field Operations
U.S. Geological Survey Open-File Report 95-777

http://water.er.usgs.gov/pubs/ofr/ofr95777/wq_act.html
Maintainer: h2o Webserver Team
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For additional information please
visit: http://water.USGS.gov/owq/FieldManual/Chap9/chap9.pdf

Field Operations Safety Primers

Compiled the following information, not in any special order:

1. USGS Water Sampling Field Safety Manual – Chapter 9 [this document has the most information, it has duplicate information with some other documents I have collected – we'll just have to deal with that during editing. Also, this document does have some information that probably is not needed, although it may be good to keep that material in our final document].
2. UTK EHS Motor Pool Vehicle Safety, GS-65 [this manual section is listed on the EHS webpage, http://web.utk.edu/~ehss/, but the link is inactive; call them or obtain later].
3. UTK EHS Heat Stress Safety, GS-105 [use as is]
4. UTK EHS Fall Prevention Safety, GS-75 [use as is]
5. Water Safety [some general notes, although this will be covered in the USGS manual]
6. Wader Use Safety [good general document, although focused on use by fisherpersons]
7. Bear Safety [some general notes]
8. Cold Stress/Hypothermia Prevention Safety [some general notes]
9. Dehydration Safety [some general notes]
10. Electrofishing Safety [comprehensive document attached, use as is].
11. Roadside / Traffic Safety [have email to Danny Oliver, I will need to send this section when I obtain it].
12. Battery Use Safety [document provided is okay; although we probably need to add a few field related tips about transport in backpacks]
13. Chemical Use Safety [refer this section to laboratory safety and general use of chemicals; although we probably need to add a few field related tips about transport in backpacks].

Most important safety tip: "don't do anything dumb".

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By: CEE Safety Committee

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.

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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.

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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.

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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.

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By: CEE Safety Committee

Permits

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

Policy Violations

For students not adhering to this policy, the following shall apply:

1. First offense- suspension of work and a mandatory safety review. Penalty to conduct safety review will be charged to your project.

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By: CEE Safety Committee

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):_____