University of Florida
Department of Civil and Coastal Engineering
Safety Manual

2011

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1. Personal Protective Equipment

(PPE)

1. Personal Protective Equipment (PPE)

A. Eye Protection

I. Standard Duty

Approved safety glasses must be worn whenever there is a risk of flying debris, harmful fumes or vapors, or eye injury of any kind. Safety glasses must be ANSI Z-87 compliant and be made of polycarbonate or similar shatterproof material that cover the eye area completely, front and side. Lab managers and personnel will provide safety glasses upon request.

Prescription glasses may be used as safety glasses provided they are appropriately rated by their manufacturer and add-ons such as polycarbonate side protectors are used to meet the requirements.

II. Heavy Duty

When working in an environment with high volumes of flying debris (i.e., grinding), safety glasses and a full-face shield must be used. Basic safety glasses are only designed to stop errant particles from reaching the eye and are not meant to withstand large amounts of direct contact from flying objects. The face shield protects only the face, not the eyes.

When using an oxy-acetylene torch, plasma cutter, or similar tool producing intense light EXCLUDING ELECTRIC ARC WELDERS, a darkened mask or face shield should be used. These will not only protect from flying debris but also eye damage due to intense light.

III. Welding

The light produced by an electric arc welder is thousands of times brighter than the sun and can cause irreparable eye damage. Arc welders require their own special welding hood to protect against flying metal (spatter) and intense light. A welding hood with a permanent darkened film or an auto-darkening hood may be used. Auto-darkening hoods should be checked for proper function before each use and have their batteries replaced regularly

B. Hearing Protection

Ear plugs or ear muffs must be worn whenever intermittent noise greater than 100dB or prolonged noise greater than 90dB is encountered. They should have noise attenuation high enough to bring the ambient sound within safe limits. Typical hearing protection provides around 30dB of attenuation; refer to the manufacturer for a specific product's rating. Environmental Health and Safety requires hearing protection for exposure to noise above 85 dB.

Noise levels of some common tools:

Tool	Level (dB)
Circular Saw	88
Steel Cutoff Saw	92
Electric Grinder	100
Concrete Mixer (max w/rock only)	114

C. Hand Protection

I. Abrasion

Leather gloves should be used whenever hand injury due to abrasion or cutting is possible. This includes handling sharp machine tools, metal components, rough cut materials, and lumber prone to splintering.

II. Thermal

Thick, elbow-length insulating gloves made of Nomex® or a similar synthetic material must be used when working around ovens, kilns, autoclaves, or other high temperature applications.

III. Chemical

Nitrile, latex, or polyurethane gloves must be used when handling mild skin irritants such as Portland cement, epoxies, resins, solvents, etc.
For specific chemical requirements, see the section on chemicals and hazardous materials.

D. Head Protection

A hard hat must be worn when in the vicinity of overhead loads or hoisting operations. The hard hat helps protect against light falling debris and increase visibility of the person wearing it. Any person near an actively hoisting crane or forklift, or within the area of an overhead (gantry) crane, MUST WEAR A HARD HAT WHILE IT IS OPERATING.

E. Shoes

Closed toe shoes are required for everybody working in a CCE lab. NO EXCEPTIONS! Anyone found in the lab wearing flip-flops or sandals will be asked to leave. Repeat offenders may lose their lab access.

Steel toe or polycarbonate safety toe shoes should be worn when handling heavy objects such as steel pieces, structural components, heavy machinery and tools, and large material specimens such as concrete beams and cylinders. Regular lab staff and students are encouraged to wear safety footwear in the lab at all times.

F. Clothing

I. Standard Duty

Sensible clothing should be worn at all times in CCE laboratories. Long pants are required; shorts and skirts are not appropriate or safe for laboratory work. Natural fiber clothing such as cotton reduces the risk of injury around high temperature machinery or in the event of a fire. Synthetic materials such as polyester have been known to melt at high temperatures.

Clothing should fit properly. Loose, baggy clothing can become caught in machinery and cause injury. Long hair should be contained in a hat, ponytail, or other method.

II. Welding

All skin should be covered when welding due to the intense heat and ultraviolet radiation. Long, fire resistant pants such as denim jeans, a long sleeve, fire resistant welding jacket, and elbow length, leather welding gloves are required. Welding jackets, gloves, and hoods will be stored near each welder.

All students are required to watch the welding videos in the following series and pass the test administered by the laboratory manager prior to welding:

http://www.ehow.com/videos-on_4925_welding-safety_-equipment_-tips-techniques.html

III. Special Clothing

Some special applications, such as fiberglassing, require their own clothing to be performed safely. This can include but is not limited to special aprons, gowns, or vests. Consult a lab manager in these situations.

G. Masks and Respirators

A dust mask should be worn when working in a mild, dusty environment or around dust generating equipment. Cheap paper filters provide little, if any protection. This includes working with cement, dry grinding, steel grinding, or drilling concrete, and sanding. A dust mask would typically not be sufficient protection for silica exposures. Dry grinding or concrete drilling also requires ventilation or wet methods to minimize airborne dust.

A respirator should be worn around harmful vapors and fumes and small airborne particulates that would penetrate a dust mask. This includes some painting and solvent work that may occur in a CCE lab. Respirators must comply with the UF respiratory protection program.

2. First Aid

FIRST AID & CPR MANUAL

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Modified by UF CCE Safety Committee

2. First Aid

A. Emergency Action Principles

These are the steps that you should always follow during an emergency. Each of these steps is explained further as you read through the manual.

- Make sure the area is safe. Failure to do this can lead to you becoming injured.
- Activate the Emergency Medical System. Call 9-1-1.
- Perform the Primary Survey (see Appendix 2A for more detail):
    a. Open the airway.
    b. Check for breathing.
    c. Start CPR (and check for severe bleeding).
- Perform a Secondary Survey: Check for non-life threatening conditions.
- Rest and reassure the casualty.
- Monitor and treat for shock.

B. Your Own Safety

There is no one more important than you. This is something that you must keep in mind when faced with a situation where someone else needs help. This is not a selfish statement; in fact it is a selfless statement. It means that first you need to take care of yourself before you can take care of anyone else. Rushing into a situation without first checking for safety may result in you also becoming injured which means you will not be able to help the other person, and you are now also a casualty.

Before entering a situation you must make sure that there are no dangers that can harm you, other bystanders, or the casualty. Some of the things to check for include:

- Fires or potential fires
- Fumes or smoke
- Falling objects
- Broken glass on the floor where you will be leaning
- Electrical wires/sources
- Oncoming traffic if on the road

If there are dangers you have three possible choices. You can either go and get help immediately and not get any closer. You can move the casualty away from danger, or you can eliminate the danger if you can do so safely (e.g., open windows to expel fumes).

Remember, if you get hurt you are not going to be able to help anyone else.

C. Activating the Emergency Medical System

Do not hesitate to get help when someone is hurt. In most cities the best and fastest way to get help is to call 9-1-1. By calling this number you will be activating the Emergency Medical System, also known as EMS. This service will get you the police, the fire department, and the paramedics. Although the paramedics are the best trained for medical emergencies, all are trained to administer first aid, and can be of assistance.

When activating the EMS stay calm and answer the questions that the dispatcher will ask. They need to know things such as where you are, what happened, how many people are hurt, and who is doing first aid. When they have finished asking you questions then they will tell you to hang up, do not do so until they are done talking to you.

You can call 9-1-1 from any phone that has an outside line, such as a public phone, a cell phone, your home phone, your work phone, etc. If the phone you are using does not have a direct line to the outside then you may have to press a special number first, such as “9” and then dial the emergency number. If you are using a public phone it is free to dial 9-1-1, you do not need a quarter.

When using a regular land line the phone can easily be traced and the paramedics will know where you are calling from. But, just to be safe give them your location anyway. If using a cell phone they may be able to triangulate your location but will probably not know exactly where you are so you will have to provide this information as accurately as you can.

If the area you are in does not have the 9-1-1 service then you should know the emergency number for that area, or dial zero and go through the operator.

Remember, stay calm and answer their questions. The EMS dispatchers are very well trained to handle these kinds of situations.

Sometimes there is a fee for calling 9-1-1. But, this will be between the EMS and the person who was injured. During an emergency you should not be concerned with minor details; your primary concern is to help the injured person.

There is no penalty for you as a rescuer for calling the EMS, as long as you thought it was an emergency. Do not call 9-1-1 for situations which are not an emergency. Some examples of an emergency include:

- Fires
- Thefts in progress
- Vehicular accidents where someone is hurt
- Medical emergencies

ICE: This stands for In Case of Emergency. It is something that has recently begun and many people are doing it. In case you are injured it is really helpful for the police if they know who to contact (e.g., family members). So, on your cell phone you should label a couple of important phone numbers as "ICE" this way the police will know that these are the people are the ones to contact. Otherwise they need to sift, and possible call, many numbers on your contact list.

D. Anatomy & Physiology

I. Respiratory System

This is made up of your mouth, nose, throat, air passages, and lungs. The main purpose of this system is to bring fresh air into your body and the get rid of used up air. The respiratory system can get into trouble if the person cannot breathe properly.

II. Circulatory System

This is made up of your heart and blood vessels. The heart is responsible for pumping blood throughout your body. The blood contains the fresh air which was obtained from your lungs. The blood also brings used air back to the lungs to be breathed out. As you can imagine, the respiratory and the circulatory systems work very closely together. When there is a problem with one it usually causes a problem with the other.

The heart is a very special organ. It has its own electrical system. It is made of a muscle called the myocardium which can transmit electrical signals. Just like any other tissue it requires oxygen to work properly. The heart gets oxygen through its very own circulatory system called the coronary arteries. These arteries intertwine throughout the myocardium to supply the tissue with fresh oxygen. It is when there is a problem with the coronary arteries, or with the electrical system, that a person may have a heart attack.

Some things that can cause a problem with the respiratory and circulatory systems:

- Choking
- Allergies which cause swelling to the throat
- Asthma
- Hyperventilation
- Heart attack
- Suffocation
- Smoke inhalation
- Drowning
- Physical injuries to the airway (mouth, throat, lungs, ribs)

- Heart attack
- Strokes
- Bleeding
- Shock
- Most of these topics will be covered as we go along through the book.

Some of the other body systems include:

- The nervous system, which is responsible for sensing everything around you, controlling all your movements and all your organs.
- The skin, which is your protection from the environment. The skin also helps control your body temperature.
- The immune system which protects your body from harmful pathogens. Occasionally the immune system 'over reacts' which can lead to anaphylactic shock.

Remember, that all systems need to function properly. When there is a problem with one of the system it usually causes problems with the other systems.

E. Clinical & Biological Death

I. Clinical Death

This is when someone's lungs and the heart stop working. Usually the lungs will stop first then shortly after that the heart will stop as well. All living tissue in the body needs oxygen to survive. Because of this treating clinical death is vital to keeping the organs alive.

II. Biological Death

This is when brain cells begin to die because of lack of oxygen. Once the body does not have oxygen it takes about 4–6 minutes until brain cells begin to die. After about 10 minutes without air there is a high chance of irreversible brain damage.

Notes:
Our goal as first aiders is to prevent biological death by getting help for the person as soon as possible, and performing CPR if the casualty becomes unconscious and their breathing stops.

Remember, as first aiders we will not know if they have brain damage so we must do everything we can to help them. We are not allowed to decide if someone is biologically dead or not. Even paramedics will do everything they

can to save someone, until they are told to stop by a medical doctor, who is the only one who can pronounce someone biologically dead.

F. Problems with the Airway and Breathing – Asthma

I. Definition

Asthma is a disease that you can be born with or develop later on in life. Some people outgrow it as they get older. When someone has an asthma attack their air passages become very tight, they spasm, and secrete mucous. This makes it very difficult to breathe. Usually breathing out may be more difficult than breathing in.

II. Causes

Physical exertion, emotional stress, irritants in the air such as dust or smoke, cold dry air, or hot humid air.

III. Warning Signs

The person will be gasping for air, there will be wheezing sounds, they will appear weak and tired, they will be anxious, and will become unconscious if the condition worsens.

IV. Helping

Find out if they are having an asthma attack by asking them. Help them take their medication. But remember that you are not allowed to administer it. All you can do is help them take it. Help them move away from the cause of the asthma attack. Activate the EMS if the medication does not help or they become worst.

Notes:

There are different types of medication but they all involve spraying of the medicine into the mouth. Anyone with asthma should always be wearing their medic alert tag, and should always have their medication with them.

Children may need what is called a spacer to assist them in taking their medication. This is a plastic tube that is attached to their puffer on one end, and a mask on the other end. This is needed because children may not have learned yet how to control their breath, which is needed to inhale directly from the puffer.

G. Problems with the Airway and Breathing – Hyperventilation

I. Definition

Hyperventilation is when someone is taking in more oxygen than they really need. This causes an imbalance of the various gases in your body. Although it may sound good to get in more oxygen, in fact it is not, and can cause havoc with the breathing mechanism.

II. Causes

A person may hyperventilate because of anxiety, emotional stress, or by doing it on purpose by breathing too fast.

III. Warning Signs

The person will be breathing too fast, they will look anxious, weak, tired, and they will become unconscious if the condition continues.

IV. Helping

Help move the person away from the cause (e.g., watching an accident scene), talk and reassure them, have them sit down, ask them to breathe with you so they will slow down their breathing rate. If the condition continues then you need to activate the EMS because this can result in unconsciousness.

Notes:
Do not have them breathe into a paper bag this will only make them much more anxious.

Do not leave them alone as they may become unconscious and stop breathing.

H. Problems with the Airway and Breathing – Anaphylaxis

I. Definition

An over-reaction of the body's immune system, where different chemicals are released to try and destroy the perceived invader.

II. Causes

Medication, foods (e.g., eggs, nuts, kiwis, strawberries, sea food, etc.), perfumes and soaps.

III. Warning Signs

- There will be redness, hives, and itchiness in the area. There will also be swelling which can be life threatening if this is near the throat or face because it can restrict breathing.
- Unconsciousness.

IV. Helping

- Immediately remove the person from the cause. Activate the EMS immediately. Assist them in taking their medication (Epi-Pen).
- The Epi-pen is injected in the upper thigh, where there is plenty of tissue and blood flow. First, the top safety cap needs to be removed which allow the spring inside the tube to work once the Epi-pen is thrust into the leg muscle. Once injected the Epi-pen should be held in place for about 20 seconds to make sure all the medicine enters the tissue.
- This needle is a single dose, meaning you cannot use the same needle more than once.
- If the person has a second Epi-pen, do not use it until the symptoms return.

Notes:
Their medication will help control the swelling. The EMS must be activated even if they have medication because it will only last for about 10–15 minutes. People can develop allergies at any time throughout their lives.

I. Problems with the Airway and Breathing – Choking

I. Definition

This is where something is stuck in your throat and you are having trouble breathing. It can be a partial obstruction where you can still cough and breath, or it can be complete where you cannot breathe at all.

II. Causes

Eating too fast, swallowing without chewing, laughing and talking while eating. For children and infants some other common causes include broken balloon pieces, toys, and other objects that they may find lying around.

III. Warning Signs

If it is a partial obstruction the person will be attempting to remove the object by coughing. If it is a complete obstruction the person will not be able to cough, they will be turning blue, they will look scared.

IV. Helping

- If it is a partial obstruction just stay with the person and encourage them to keep coughing. If you think it is getting worse then get help.
- If it is a complete obstruction then you need to do abdominal thrust (chest thrusts if they are pregnant or too large for you to get your arms around them).
- Continue the thrusts until the objects come out or the person becomes unconscious.

Notes:
The practical components are explained further in Appendix 2A–Unconscious Casualty.

J. Problems With Breathing

The important thing to remember is that any problems with the airway will cause a problem with breathing, and this can become life threatening.

I. Respiratory Distress
This is where the casualty is still able to breathe, but is having problems doing so.

II. Respiratory Arrest
This is where breathing has stopped all together, and it is now an emergency. The casualty may still be conscious or may be unconscious.

III. RESCUE BREATHING
If the casualty has become unconscious then you must begin CPR.
Refer to Appendix 2A–Unconscious Casualty for the detailed steps.

K. Problems with Circulation

Circulation refers to blood circulating throughout the body. The major cause of circulation problems is usually a heart attack, but can also be caused by injury, breathing problems, shock, etc. If the person is not breathing than circulation will also stop, therefore, CPR must be started as soon as possible.

The practical components are explained further in Appendix 2A–Unconscious Casualty.

I. Blood Vessel Disease

This is sometimes referred to as coronary artery disease, cardiovascular disease, heart disease, atherosclerosis, arteriosclerosis. But, the bottom line is that it all means the same thing.

II. Definition

It simply refers to the narrowing of the blood vessels by plaque buildup. This will cause poor blood flow to any part of the body, including the heart which can cause a heart attack, or the brain which can cause a stroke. In the case of a heart attack the blood vessels (coronary arteries) have become blocked and no longer allow blood to flow through to the heart muscle. As a result the heart muscles cannot function properly and will soon die.

III. Causes

The causes are referred to as Risk Factors. There are two categories:

a. Non-Modifiable Risk Factors, meaning you cannot control these. They include:
   - age
   - gender (male or female)
   - type I diabetes
   - heredity/genetics.

b. Modifiable Risk Factors, meaning you can control these. They include:
   - smoking
   - obesity
   - sedentary life style
   - high blood pressure/hypertension
   - diet (e.g., fat/cholesterol intake).

IV. MORE ON RISK FACTORS

Age: As we get older there is a bigger risk of heart disease simply because we have had more time to damage our bodies.

Gender: Men have a higher chance for two main reasons:

- Men carry excess fat higher up in the bodies which affects internal organs. The belief is that this causes higher blood sugar and higher cholesterol.
- Estrogen (which men do not have) has been shown to reduce the chance of heart disease in women.

Diabetes: This disease, over years, will cause damage to small blood vessels which affects circulation. This can lead to heart disease, kidney failure, blindness, and amputations.

Genetics: As unfair as this may seem there are some people genetically predisposed to developing heart disease. If heart disease has been a problem with older family members then this may also be a problem for you.

Smoking: There is no doubt that smoking is harmful. What some people do not realize is that it is not just a risk for lung cancer. The poisonous chemicals in smoking are absorbed by the blood and carried throughout the body. These poisonous chemicals cause high blood pressure, cause your arteries to become very stiff, and cause plaque to build up in the arteries.

Obesity: Having excess fat puts a lot of stress on your body. It also causes high blood pressure, high triglycerides, and is associated with high sugar levels in the blood. Losing excess fat is not easy but following a healthy eating style and being physically active is the best approach.

Sedentary lifestyle: Exercise is one of the best things you can do for your body. It strengthens the heart muscle, lowers blood pressure, controls excess calories from being stored as fat, strengthens bones and muscles, etc. To stay healthy exercise should be done almost daily. So, go for a walk, jog, swim, play tennis, squash, do an aerobics class, etc., whatever you need to do to get your body moving.

High blood pressure (HBP): This is defined as the force the blood is exerting on your arteries as it flows through them. It is also called hypertension. If the pressure is too great the blood vessels stretch beyond their capacity which will lead to small cracks. These small cracks are wounds which must heal. This means that as they heal there may be scar tissue that develops in the area which may impede blood flow. Or, if pressure is too high, the blood vessel may simply burst causing an aneurysm. Despite contrary belief there are no warning signs for HBP except to have it checked by your physician at least once a year.

Poor diet: Most people in North America have poor eating habits, ingesting way too much processed, refined, and high saturated-fat foods, too much sugar, etc., and, not nearly enough fresh fruits and vegetables. Poor diets can easily lead to high cholesterol, obesity, HBP, type 2 diabetes, etc.

The more risk factors you have the higher your chance of developing blood vessel disease. There is no cure for blood vessel disease. That is why it is so important to start regular life style habits early on.

V. CPR

The 2006 guidelines state that if an unconscious person has stopped breathing you must begin CPR. The reason for this is that when breathing stops the heart will also stop soon after. So, CPR is needed to keep the blood moving throughout the body.

Notes:
In 2011, a newer strategy in cardiac resuscitation has found roots. Cardiac Chest Compressions or Continuous Chest Compressions, or CCC, is being offered as an alternative to CPR. There are videos on UTUBE which illustrate how this procedure can and should be performed.

L. Heart Attack

I. Warning Signs

- Pain/tightness/numbness in the shoulders, arms, neck, back, chest.
- Bluish, pale skin.
- Rapid but weak pulse.
- Shallow rapid breathing.
- Nausea or vomiting.
- Unconsciousness (refer to Appendix 2A–Unconscious Casualty for steps to take).

These warning signs may come and go. Even if the warning signs disappear this person may still be having a heart attack and still need immediate help.

II. Helping

- Help them get in a comfortable position, make sure they are resting.
- Activate the EMS.
- Reassure them that help is on the way.
- Check for medical history of a similar problem, ask if they may have medication (but only assist, do not administer medication).
    - > Angina is a condition of partial blockage of the arteries feeding the heart muscle. If they say they have this condition then help them take their medication (nitroglycerin).
    - > This medication will help dilate the blood vessels so more blood can flow through.

- If they have taken any erectile-dysfunction medication within the last 48 hours they should not take nitroglycerin because both medicines have a similar affect (blood vessel dilation) which can lead to very low blood pressure, unconsciousness, and death.
- Ask first!

If they wish, they may take one Bayer Aspirin, as this may prevent further damage to the heart muscle.

Note, if they have asthma they may be allergic to aspirin – ask first!
Do not give them anything to eat or drink.
Stay with them all the time and comfort them.

Notes:
It is extremely common for people to ignore the warning signs of a heart attack. Unfortunately, this is one reason why so many people die from this disease – because they do not get help soon enough. As a first responder, it is your job to activate the EMS as soon as possible.

M. Defibrillation (Automated External Defibrillation – AED)

The Department of Civil and Coastal Engineering does not at present have AED's located within its facilities. If this changes in the future, this material will be more important, but it is included here due to the fact that AED's abound across campus, and if the need arises, you will be well versed in their operation.

Fibrillation is what happens in 80% of the cases when someone is unconscious from a heart attack.

This is a condition where there is still electrical activity in the heart, but it is very irregular and erratic.

As a result, the heart is not working properly to create circulation.

An Automated External Defibrillator (AED) is a machine that is designed to administer an electric shock. The concept behind this is that the shock will momentarily cause the heart's electrical system to stop, and then it will begin to work again with a regular rhythm. The main reason this works is because the heart has its own, self-sustaining, electrical system.

A defibrillator can detect electrical signals from the heart and determine if a shock would benefit the person. The main factor is whether or not the heart is fibrillating.

If the electrical rhythm is normal, or there is no electrical activity at all, then the machine will not shock.

AEDs are now becoming more common in our society, as they have been shown to save many lives if they are used on the spot by trained bystanders, before the paramedics arrive. The key to this lifesaving machine is that it must be administered as soon as possible, because the casualty's chance of being saved decreases by about 10% with every minute of delay. CPR is still an important component in helping someone with no signs of circulation.

How to use a defibrillator:

- These machines should only be used on an unconscious non-breathing person. They are designed for adult and children over 25kg in weight.
- Bear the person's chest. Remove all clothing, including bras and jeweler. If needed shave the areas where the pads will be placed.
- Remove the covering from the pads and place one pad on the right hand side between the shoulder and the neck, just over the collarbone. Place the second pad on the left side about 3 inches below the left breast over the ribs. Look at the diagrams on the pads for more info.
- Plug the pads into the machine.
- Turn the machine on.
- Once the machine is on follow the machine's instructions fully. It will tell you exactly what to do.
- First, the machine will analyze the heart's electrical activity. It will do this every two minutes regardless of what happens next.
- If the machine detects a non-shockable rhythm then the machine will tell you to begin CPR. In the meantime it will give you a two minute count down, at which point it will re-analyze.
- If the machine detects a shockable rhythm it will begin to charge. When it is ready it will tell you to deliver a shock. You do this by simply pushing the shock button.
- Before delivering the shock make sure no one, including you, is touching the person, as this is electricity and can be very dangerous.
- After the shock the machine will tell you to begin CPR. In the meantime it will give you a two minute count down, at which point it will re-analyze.
- This process will be repeated to a maximum of 9 times. At which point the machine will not shock again. But, if needed, continue CPR until paramedics arrive.

Notes:
Once the machine is on, do not turn it off.

Machines record voices for learning and statistical purposes.
The battery is lithium and lasts a very long time (usually guaranteed up to 3 years).

Machines do daily, weekly, and monthly self tests. If there is a problem, they will usually emit a beeping noise.

Most machines will have an extra set of electrical pads, a pair of scissors, and a razor.

N. Stroke

I. Warning Signs

- Numbness, tingling, paralysis on one side of the body, extremities, hands, and feet.
- Slurred speech, not making sense.
- Trouble understanding you.
- Uneven pupils.
- Nausea or vomiting.
- Decreased level of consciousness.

II. Helping

- Help them get in a comfortable position on their side, make sure they are resting.
- Activate the EMS.
- Reassure them that help is on the way.
- Keep them warm with a blanket.
- Do not give them anything to eat or drink.
- Stay with them all the time and comfort them.

Notes:
It is extremely common for people to ignore the warning signs of a stroke. Unfortunately, this is one reason why so many people die from this disease – because they do not get help soon enough.

As a first responder, it is your job to activate the EMS as soon as possible. Sometimes a stroke is called Cerebral Vascular Accident (CVA). Mini stroke is

a condition where the casualty experiences similar warning signs as that of a stroke, but these warning signs go away on their own. This is a warning sign that a serious stroke may occur and the person needs medical help immediately. This condition is sometimes called Transient Ischemic Attack (TIA).

O. Shock

I. Definition
Poor circulation to the vital organs.

II. Causes
Dilated blood vessels, bleeding, and severe dehydration, all leading to a drop in blood pressure, which results in poor circulation. These can be caused by severe emotional trauma, physical injury, illness, etc.

III. Warning Signs
Unusual behavior (e.g., very calm or very anxious), lack of pain to an injury, rapid breathing, rapid but weak pulse, bluish skin (cyanosis), unconsciousness.

IV. Helping
Activate the EMS right away. Assist the person to lie on their side to improve circulation, treat any injuries, and help them take any medication for an illness.

Notes:
Shock is very serious and life threatening. The casualty may not know that they are in shock.

Stay calm, make sure they rest, and reassure them that help is on the way.

P. Fainting

I. Definition
This is very similar to shock, except it is a temporary condition.

II. Causes
It usually occurs because of a temporary decrease of blood flow to the brain, which can be caused by not eating properly, standing up too fast, or low blood pressure.

III. Warning Signs

The casualty feels faint, or faints.

IV. Helping

If they feel faint have them lie down which will help with circulation. If they faint they will usually wake up in a few seconds. Encourage the person to stay lying down for a few minutes until they feel better. If they do not wake up within one minute, or they became injured during the fall then activate the EMS, and treat any injuries.

Notes:

If someone has fainted, even if they feel fine afterwards, they should still go see their doctor to rule out any major problems.

Q. External Bleeding

I. Definition

This is where the blood vessels and the skin are cut and blood is escaping the body.

II. Causes

Damage to the skin caused by trauma. Can be a laceration (clean cut), abrasion, or avulsion (with skin still hanging).

III. Helping

- If it is a minor bleed allow some bleeding to take place as this will help clean the wound.
- Then wash with warm water and soap, apply a dressing to keep it clean, change the dressing every few hours, and monitor for signs of infection.
- If the bleeding is severe than apply the RED principle:
    - > *Rest*: Make sure the person is resting so as to decrease the heart rate and blood pressure.
    - > *Elevate*: Raise the injured limb above the heart to slow down the bleeding.
    - > *Direct Pressure*: Put pressure directly over the wound to help control bleeding, tie the dressing in place. But, do not make the dressing too tight so as to restrict blood flow. Do not remove the dressing. Get medical help

Notes:
If there is an impaled object do not remove it as this can cause much more injury and bleeding.

Instead, apply dressing around the object then tie in place to control bleeding. Take extra care not to move the object.

Refer to Appendix 2B for bandaging techniques.

R. Internal Bleeding

I. Definition

This is where the blood vessels are broken but the skin is not, so the person is bleeding under the skin. Injured organs will result in internal bleeding.

II. Causes

Usually physical trauma, being hit, falling. Very common in car accidents.

III. Warning Signs

Bruising, pain, tenderness, mechanism of the injury, blood in spit, vomit, or urine.

IV. Helping

- If it is a minor bruise on the arm or leg then rest the injured part, apply an ice pack for a few minutes, and watch for signs that it is not healing.
- If it is severe internal bleeding in the core of the body then active the EMS, make sure the person is resting, treat for shock, apply an ice pack, but do NOT put pressure over the wound.

Notes:
Internal bleeding is not always obvious, but can be life threatening.

Infection can occur with any would whether internal or external.

If you suspect an infection then seek medical help immediately, as it can become life threatening. Watch out for warning signs such as; the wound is not healing or is getting bigger, discoloration, fluid discharge, and increased pain.

S. Secondary Survey

This involves checking for other non-life threatening injuries. Obviously it is done after the primary survey, which involves looking after the life threatening injuries. It is done by starting from the head and moving down to the toes while checking for bumps, bruises, bone deformity, and minor cuts. If anything is found it is treated and/or reported to the paramedics once they arrive.

- If the person is unconscious you do this by looking and by touching (feeling for bumps and broken bones).
- If the person is conscious you do this by talking to them and asking them questions.
- If you think there is an injury do NOT move that body part.
- Keep in mind that this is secondary to primary. Never ignore breathing problems, or CPR, or severe bleeding in order to do a secondary survey.

T. Diabetes

I. Definition

Diabetes is a disease in which your body cannot properly store and use fuel for energy. The fuel that your body needs is called glucose, a form of sugar. Glucose comes from foods such as breads, cereals, pasta, rice, potatoes, fruits and some vegetables. To use glucose, your body needs insulin. Insulin is made by a gland in your body called the pancreas. There are two major types of diabetes: type 1, and type 2.

- Type 1 diabetes is when the body makes little or no insulin. It used to be called insulin-dependent or juvenile diabetes. This requires daily injections of insulin.
- Type 2 diabetes occurs when your body cannot use the insulin it makes. If you have type 2 diabetes you may be able to keep your blood glucose levels in a target range by healthy eating, exercising, and taking medication.

There are 2 types of diabetic emergencies

- Hyperglycemia (insulin shock): this is where there is too much sugar in the blood, and not enough insulin. It can occur by not taking medication and/or by eating things high in glucose.
- Hypoglycemia (diabetic coma): in this case there is not enough sugar and too much insulin. This can occur if too much insulin is taken or not enough glucose has been consumed.

II. Causes

Hyperglycemia:

- Eating food high in simple sugars.
- Not taking medication (insulin).

Hypoglycemia:

- Not eating at the right times (missing a meal).
- Being over active without having planned for it.
- Taking too much medication.

III. Prevention

- There is no way to prevent type 1.
- Type 2 can be prevented by following a healthy lifestyle of regular physical activity, healthy eating, and controlling obesity.

IV. Warning Signs

- Dizziness, drowsiness, and confusion.
- Rapid breathing.
- Rapid pulse.
- Feeling and looking ill.
- Unconsciousness.

V. Helping

Help the person take a bit of sugar (candy, juice, fruit, etc), however, NutraSweet or aspartame is not effective. Monitor their condition and do not hesitate to call an ambulance if their condition does not improve within a couple of minutes. Do NOT administer medication; this is reserved for medical professionals only.

Notes:
Diabetes is a life-long condition. High blood glucose levels over a long period of time can cause blindness, heart disease, kidney problems, amputations, nerve damage, and erectile dysfunction.

Good diabetes care and management can delay or prevent the onset of these complications.

U. Seizures

I. Definition

Seizures are neurological disorders where the signals in the brain become mixed up.

II. Causes

The most common cause is from the medical condition called epilepsy. However, they can also be caused by concussions, allergic reactions, brain tumors, and high fever in children.

III. Prevention

If someone has epilepsy they may have medication to take which will reduce the chance of seizures. Other causes are hard to prevent because nothing is suspected of being wrong until the seizure.

IV. Warning Signs

Aside from the casualty having some kind of aura, e.g., smelling burnt toast, there are no warning signs that a seizure is about to happen. Once it begins the person may appear totally spaced out, may appear to be sleep walking, or may be on the ground convulsing.

V. Helping

a. Generalized Convulsive Seizures

- Keep calm and let the seizure take its course. Do not try to stop the seizure or revive the person.
- Protect person from further injury by moving hard or sharp objects away, but do not interfere with the person's movements. Place something soft and small, such as a sweater, under their head, and loosen tight clothing around the neck.
- Do not force anything in the person's mouth. This could cause teeth and jaw damage, or choking. The person will not swallow their tongue during a seizure.
- Roll the person on their side as soon as possible, to allow saliva or other fluids to drain away, helping to clear the airway. Do not be frightened if a person having a seizure stops breathing momentarily.
- If a seizure goes on longer than 5 minutes, repeats without full recovery, or the person becomes injured, then call for medical assistance.
- Always be comforting, be gentle, and reassure the person, as it may take some time for them to become re-oriented.

b. Partial Non-Convulsive Seizures (e.g., like sleep walking)
    - Stay with the person and let the seizure take its course. Do not try to stop the seizure or revive the person. The person will be unaware of his or her actions, and may or may not hear you.
    - Gently guide the person away from danger, and move dangerous objects out of the way. Partial seizures may spread to other areas of the brain. Do not be alarmed if a convulsive seizure follows.

Notes:
Always be comforting, be gentle, and reassure the person, as it may take some time for them to become re-oriented.

V. Burns

I. Definition

A burn is damage to the skin or underlying tissue caused by heat. There are 3 levels of severity; 1st, 2nd, 3rd.

II. Causes

There are 5 main sources of burns; electricity, radiation (sun), thermal (something hot), chemical, and friction.

III. Prevention

- Use safety rules.
- Use safety equipment when working with chemicals.
- Hire professionals for work dealing with electricity, for example.
- Avoid sun exposure.
- Keep hot objects away from children.

IV. Warning Signs And Definitions

- 1st degree: red, swollen, pain.
- 2nd degree: red, swollen, blisters.
- 3rd degree: damaged skin to the point where the underlying tissue is visible.

V. Helping

- For 1st and 2nd degree burns you should cool the area immediately with gently running cold water for about 10–15 minutes, or until it has cooled off. Do not break any blisters as this will make the wound worse.

- For 3rd degree burns do not put anything on the burn, seek medical help immediately and treat for shock. 3rd degree is extremely life threatening even when a small body part is affected. If there is clothing on the burn do not remove it as this may also remove skin. There is a very high risk of infection from this kind of burn.

Notes:
As with all other emergencies make sure the area is safe for you first. Watch out for live wires, hot objects, chemical spills, etc.

The severity of a burn can also be increased depending on the sensitivity of the body part that is burnt, or the amount of the body that is burnt.

With electrical burns check for an exit wound as well as treating for the entrance wound.

With chemical burns flush the area with lots of water to get it off the casualty's skin.

Never apply ointments, butter, or other home remedies on burns, as this may make the burn worse, keep the heat trapped in, or cause an infection.

W. Hypothermia

I. Definition

A drop in the core body temperature, even as little as 1 to 2 degrees Celsius, from the normal of 36 degrees Celsius. Sometimes this can happen within minutes, other times it takes a while to take place. It is sometimes accompanied by frost bite.

II. Causes & Prevention

- Exposure to the cold.
- Not being dressed properly.
- Damp weather.
- Being wet.
- Being tired or dehydrated.

III. Warning Signs

- Feeling cold.
- Shivering, which will stop as the condition worsens.
- Becoming confused and disoriented.

- Slow pulse and breathing rates.
- Unconsciousness.

IV. Helping

- Get medical help.
- Get them inside near a heat source.
- Remove wet clothing and replace with dry clothing.
- If conscious give them warm fluids to drink – slowly.
- Avoid alcohol, caffeine, and carbonated drinks.

Notes:
Being wet or submersed in cold water will cause hypothermia much quicker because water is very conductive and draws the heat out of your body faster.

X. Frost Bite

I. Definition

A freezing of a body part, such as the hand, foot, face, etc. Superficial is the surface of the skin, whereas deep frost bite affects the underlying tissues. Sometimes this is accompanied by hypothermia.

II. Causes & Prevention

- Exposure to cold, wind, wet conditions.
- Not wearing protective clothing.

III. Warning Signs

- Cold feeling.
- Numbness.
- Inability to use the body part.
- Tingling, then pain.
- As it gets worse all sensation will disappear.
- The skin will first appear white or yellowish. If the tissue dies it will become black charred color.

IV. Helping

For deep frost bite get medical help. Warm up the body part slowly and gradually by wrapping it in warm clothing and/or submersing it in lukewarm water – not hot water as it will burn the skin.

Notes:
If there is a chance of the body part refreezing then it might be better to get medical help first before allowing it to warm up.

Do not rub or force the body part to bend, this will cause more damage.

Y. Heat Emergencies (Hyperthermia)

I. Definition

Perspiration is the body's main method of regulating its temperature. As sweat evaporates off the skin heat is taken with it, as a result cooling down the body. Without this method the body would quickly over heat and the person would die. Anything that impairs body temperature regulation is hazardous.

There are 3 levels of heat emergencies: Heat cramps, heat exhaustion, and heat stroke.

II. Causes & Prevention

a. Exercising in hot humid and/or polluted weather.
b. Becoming dehydrated.
c. Drinking alcohol, caffeinated, or carbonated drinks (contributes to dehydration).
d. Over using saunas, whirlpools, and warm environments, such as gyms, aerobic classes, and stuffy rooms.

III. Heat Cramps

a. Warning Signs
   - Painful muscular involuntary contraction.
   - Sweating or moist skin.
   - Tired, irritable, and thirsty.

b. Helping
   - Removing them from the source of heat.
   - Gently stretch/massage affected area.
   - Slowly rehydrate with water, juice, or sport drinks.
   - Rest for several minutes or even a couple of hours.
   - Avoid alcohol, caffeinated and/or carbonated drinks as they will only make the condition worse by promoting dehydration.

IV. Heat Exhaustion

a. Warning Signs
- Sweating
- Tired
- Irritable
- Thirsty
- Lethargic
- Slight headache
- Nausea
- Dizzy/weak
- May have slightly elevated body temperature

b. Helping
- Remove from source of heat.
- Slowly rehydrate by drinking water, juice, or sport drinks.
- Rest is very important to prevent a re-occurrence.
- Remove sweaty clothing.
- Fan or gently cool the skin with cool towels or ice packs.
- Avoid alcohol, caffeinated and/or carbonated drinks as they will only make the condition worse by promoting dehydration.
- If vomiting occurs you should activate EMS.

V. Heat Stroke

a. Warning Signs
- Elevated body temperature.
- Very tired/weak.
- Sweating may stop — this is not a good sign.
- Severe headache.
- Red hot dry skin.
- Rapid, weak pulse becoming irregular, rapid breathing, or reduced/absent vital signs (consciousness, breathing, pulse).

b. Helping
- Remove from heat source.
- Place in recovery position.
- Activate 9-1-1 ASAP.
- Monitor/treat ABCs.
- Remove sweaty clothing.
- Fan or gently cool the skin with cool towels or ice packs.
- Do not douse with cold water — this may cause shock.
- At this point it is too late to give fluids by mouth and it may induce vomiting.

Z. Bone and Joint Injuries

I. Definition

This is an injury to a bone, a joint, a ligament, or a tendon.

Bone fractures, if set properly, will heal fully in a few weeks and will be stronger than before. This happens because the area builds up with more calcification than before.

Joint injuries usually involve a dislocation. This is where the bone has popped out of its socket.

This may be accompanied with a fracture, a strain, or a sprain. It may pop back in it may not. Either way seek medical help. Do not push it back into place.

Tendons are strong tissues that connect a muscle onto a bone. When a tendon tears it is called a strain. They become torn they take a very long time to heal, many times never as good as before, and sometimes surgery is required to reattach them.

When a ligament is torn it is called a sprain. Ligaments connect a bone to another bone. These are found around the joints. Ligaments are very strong, but, as with tendons, when they tear they take a long time to heal, never as good as before, and sometimes surgery is required.

II. Causes

Any kind of force that is greater than what the tissue can withhold will cause such an injury. Some common activities include falling, twisting, getting hit, etc.

III. Prevention

- Wear safety equipment and wear it properly.
- Know the safety rules of sports played.
- Use seat belts and car seats.
- Keep joints and bones strong through weight bearing physical activities.

IV. Warning Signs

- A ‘snapping’ noise
- Pain

- Deformity
- Inability to move
- Swelling
- Bruising

V. Helping

- Apply the RICE principle.
  - > **R**est the injured body part and the entire casualty.
  - > **I**mmobilize the injured body part.
  - > **C**old compress over the injury to reduce swelling.
  - > **E**levate the injured body part, if it can be done without causing further injury.
- Seek medical help.
- Do not rub or move the injured body part.
- If there is a protruding bone then bleeding will need to be taken care of by applying indirect pressure.
- Never straighten or realign an injured body part.

Notes:
Refer to Appendix 2B for splinting and bandaging techniques.

AA. Spinal Injuries

I. Definition

An injury to the muscles, bones, or nerves associated with the spine.

II. Causes

Any impact, direct or indirect, to these body parts. Very common in vehicle accidents, diving in shallow water, cycling accidents, sport accidents such as hockey and football, etc.

III. Prevention

- Wear safety equipment and wear it properly.
- Know the safety rules of sports played.
- Use seat belts and car seats.
- Avoid alcohol intake when doing physical activity as it impairs sound judgment.

IV. Warning Signs

- Mechanism of injury (how it occurred).
- Pain, numbness, or paralysis.
- Bleeding, swelling, or bruising around the head, ears, or nose.
- Unconsciousness.

V. Helping

- Make sure the person does not move.
- Hold them still. You need to and explain to them that they may have a serious injury and should not move.
- Activate the EMS right away.
- If they are unconscious, go to your CPR steps. Airway and breathing take priority.

Notes:
Any time there is a spinal injury you should also suspect a concussion, and vice versa.

BB. Concussions

I. Definition
An injury to the head or the brain. Literally bleeding in the brain or the area around the brain.

II. Causes
Any impact, direct or indirect, to the head.
May be associated with a spinal injury.

III. Prevention

- Wear safety equipment and wear it properly.
- Know the safety rules of sports played.
- Use seat belts and car seats.
- Avoid alcohol intake when doing physical activity as it impairs sound judgment.

IV. Warning Signs

- Mechanism of injury.
- Pain or numbness.
- Bleeding, swelling, or bruising.

- Confused.
- Loss of memory.
- Dizzy.
- Ringing in the ears.
- Nausea or vomiting.
- Unconsciousness.

V. Helping

- Make sure the person does not move.
- Hold them still if you need to and explain to them that they may have a serious injury and should not move.
- Activate the EMS right away.
- If they are unconscious to your CPR steps but open the airway with a modified jaw thrusts, as opposed to a head tilt.

Notes:
Any time there is a spinal injury you should also suspect a concussion, and vice versa.

Anyone with a suspected concussion should seek medical help as soon as possible.

If they have become unconscious from the concussion, then activate the EMS right away.

Many athletes will not admit to having had a concussion because then they cannot play anymore. Unfortunately, that is why the condition becomes worse. Concussions are very life threatening.

There is a condition called Baby Shaken Syndrome, where babies are injured by violent shaking.

- **Never shake a baby – on purpose, by accident, or when angry.**
- **Never throw them up in the air – no matter how much they enjoy it.**
- **Never twirl them around while holding them by their feet.**
- **These activities can cause brain injuries, sometimes minor sometimes serious.**

CC. Poisons

I. Definition

A poison is a substance which enters the body and can cause illness or death. It may act within a matter of seconds (e.g., carbon monoxide) or a matter of years (car pollution). There are four basic ways in which poison can enter the body; by swallowing, breathing, injecting, or absorbing.

II. Ingested Poisons

Some examples can include bad food, household cleaners, perfumes, nail polish remover, etc. If the person is having trouble breathing, is convulsing, is unconscious, or is in pain, call the EMS immediately. If the person appears to be fine but you want to make sure call the poison control center. For your area this number can be found at the front of your local telephone directory. In order for them to help you they need to know what the person took, how much, their age and weight, and their present condition. They will either tell you to seek medical help immediately, give them something to drink, or to monitor them to make sure they do not get worse. Make sure you do not induce vomiting unless you are told to do so by the poison control center as some substances are corrosive and may burn on the way up. Also, do not give anything to drink unless instructed by the poison control center as some substances may react more with drinks. Always keep cleaners and chemicals high up so children cannot access them.

III. Breathed/Inhaled Poisons

This can include fumes from household cleaners, industrial products, smoke, etc. Fresh air is the immediate first aid treatment. But first make sure you are not putting yourself in danger. Seek medical help for the person immediately. Never mix cleaners unless it specifies on the container. Never use chemicals in poorly ventilated areas.

Be aware of carbon monoxide as it cannot be smelled, has no taste, and cannot be seen. It can be produced by any engine (e.g., house furnace, car), or even a fireplace with poor ventilation. Every home should have a carbon monoxide detector. If the detector begins to sound you need to leave the house immediately and call the fire department from the neighbor's house. Carbon monoxide poisoning makes you feel sleepy and drowsy and can have an effect in a matter of minutes so you are not aware of what is happening.

IV. Injected Poisons

Some examples include needles, broken glass, mosquitoes, spider bites, bee stings, etc. As soon as possible remove the object from the skin. Clean the area thoroughly with soap and water. If an allergic reaction occurs, or you believe there is a risk of infection, seek medical help.

V. Absorbed Poisons

These are poisons which enter the body through the skin, but do not cause a puncture. Some examples are household cleaners, industrial products, poisonous plants, etc. Remove the substance as soon as possible by using large amounts of running water. Do your best not to contaminate other body parts. There are some chemicals that will react more with water, but if you leave them on the skin they will react anyway with the skin moisture. Seek medical help. If you work with chemicals make sure you know how to do the job safely and always use safety equipment.

WHMIS: Workplace Hazardous Material Information System is government regulated training that anyone working with chemicals needs to take. This is mandatory on many jobs and it is the responsibility of the employer to assure all employees are properly trained. In addition, it is the responsibility of the employer to make sure all employees have the proper equipment to perform their jobs properly and safely.

MSDS: Material Safety Data Sheet is written information on various products. Any workplace which deals with chemicals needs to have this information readily available.

DD. Rabies

I. Definition

This is a virus that can be transmitted to/from any warm blooded animal, including rodents, birds, bats, and humans. The rabies virus attacks the nervous system, and, depending on how much is transmitted, and where in the body it enters, will cause death within 3 days to about 4 weeks, if the vaccine is not administered soon enough. If one contracts rabies they must get the vaccine before they experience secondary warning signs. If not, death is imminent.

II. Warning Signs

The primary warning signs:

- Getting bitten or scratched by a rabid animal. Of course, one will not know for sure if the animal is rabid, so the safest thing is to assume that it is and seek medical help.

The secondary warning signs:

- trouble swallowing
- saliva building up in the mouth
- aggressive or irregular behavior
- dizziness
- loss of balance
- memory loss

These warning signs are the same for animals and humans.

III. Prevention

- Stay away from wild animals.
- If you see an animal that has wound marks, or is portraying warning signs listed above, call the animal control center.
- Never try and catch a wild animal, you will get bitten for sure.

IV. Helping

Treat the wound for bleeding and seek medical help immediately.

Notes:
Even household pets, if allowed to roam outside, can contract rabies and bring it back in the home.

The only way to test for rabies is by killing the animal and testing its nervous system.

If treatment is not sought quickly enough, death is the only outcome.

EE. Ticks

I. Definition

These are tiny insect-like bugs that live in the woods and can easily fall on you as you walk by. They are very small, you do not feel them, and they are very hard to see. They burrow slightly under the first layer of the skin and

stay there. The biggest problem is that many times they carry diseases such as Rocky Mountain Fever, or Lyme disease.

II. Warning Signs

- Red, itchy hives.
- Swelling.
- Numbness or pain in muscles and joints.
- Flu-like symptoms.
- Heart palpitations.

III. Treatment

- Remove the tick using tweezers. Make sure you get all of it.
- Wash the area with soap and water.
- Seek medical help (family doctor) to obtain antibiotics.

IV. Prevention

When doing outdoor activities wear long sleeve clothing, a cap, and long pants. After the activity take a few minutes and examine self or each other for ticks, they usually end up on the scalp, shoulders, or upper back.

FF. Snake Bites

I. Definition

Not all snakes are poisonous, but if you get bitten by a poisonous one you had better rush to medical help, immediately. If you can, remember the color and pattern of the snake, so they can identify it and give you the correct anti-venom.

II. Helping

Have the person rest with the bitten body part lower than the heart. Seek medical help as soon as possible.

If the person becomes unconscious begin the Primary Survey.

Notes:

Unless you want poison in your mouth do NOT cut the bite site and suck the blood out.

Do not try to catch the snake, it will bite again.

There are many snake bite kits on the market, all designed to suck the poison out. However, blood flows very quickly. Within a matter of a few seconds, the poison will spread and this will have no effect.

GG. Emergency Child Birth

I. Definition

Emergency child birth is defined as a situation where the expecting mother-to-be cannot reach medical facilities in time and needs to give birth on the spot.

II. Causes

Being away from medical facilities and not having transportation is the most common cause for this situation.

III. Warning Signs

If the mother says, "the baby is coming," or the baby's head is showing, or the contractions are less than two minutes apart, then it is time to deliver the baby on the spot.

IV. Helping

Although it is very easy to panic in such a situation keep in mind that giving birth is natural and has been done for thousands of years, even before hospitals were created.

As a rescuer, here is what you should do:

- Make sure the EMS has been called.
- Make the mother comfortable on her back. Remove any necessary clothing but keep her covered to protect her privacy. Put some clean towels under her.
- As a rescuer all you have to do is support the baby as it comes out. Hold the head as it is heavy compared to the rest of the baby.
- As soon as you can see the baby's throat make sure the umbilical cord is not wrapped around it. If it is use your finger to loosen it and pass it over the head. This is easy to do.
- Once the baby comes out wrap it in a clean towel.
- Clean its mouth and nose.
- If it is not breathing massage its back and tickly its feet. This should help stimulate the breathing mechanism.
- If it is still not breathing begin rescue breathing and CPR.

- Never hold the baby upside down and slap it. This is a TV thing, and if you should drop the baby, you will be in trouble.
- If the baby is fine, give it to the mother to hold.
- The other end of the umbilical cord will be attached to the placenta which will still be inside the mother. Do not pull, it will come out on its own in a few minutes in another set of contractions.
- Do not cut the cord. Simply wrap the placenta in a towel and keep with the baby.
- Never put the placenta lower than the baby as blood may drain from the baby back into the placenta. If you wish you may tie something around the umbilical cord a few centimeters away from the baby and from the placenta. But do not cut it.
- If the baby begins to come out feet first it is a complication but there is nothing you can do.
- Instruct the mother not to push. Do not try to push the baby back in. Simply support it any way it comes out.

APPENDIX 2A

FIRST AID – Unconscious Casualty

1. Safety

- Make sure there are no dangers, so you do not get hurt.
- If it is dangerous: Call for help; make the area safer; or move the person from danger.

2. Wake Them Up

- Gently try to see if they can respond by calling out to them and gently tapping their shoulders.

3. 9-1-1 / EMS

- If they do not wake up (or if they are injured), you or someone else must activate the EMS.

4. Airway

- Place them on their backs, carefully so as to not cause any injury.
- Open their airway by tilting their head back and lifting their chin upwards. This will remove the tongue from blocking the airway. Keep the airway open.

5. Breathing

- Check for Breathing by looking, listening, and feeling for air (10 seconds).
- If they are breathing then monitor and put them in the recovery position until the paramedics arrive.
- If they are not breathing give them 2 breaths, allowing the air to come out in between.
- If the air goes in then go to “Circulation.”
- If the air does not go in, re-position the head-tilt/chin-lift a bit further back and try blowing again.
- If the air still does not go in then go to “Circulation” but check the mouth for the food after doing CPR.

6. Circulation

- Start CPR if needed (compressions and breaths).
- It is 30 compressions to 2 breaths. Continue until paramedics arrive or until something changes with the person (reassess at this point).
- If the air was not going in make sure you check the mouth, to see if the food came out, after each set of compressions. If you see the object in their mouth, take it out and reassess breathing.

7. Conscious, Choking Adult or Child

- Ask them if they are choking.
- Ask them if you can help.
- Step behind them and do abdominal thrusts (chest thrusts if they are big or pregnant).
- Continue until the food comes out or until they become unconscious.
- If the food comes out make them comfortable and activate 9-1-1 if they need it.
- If they become unconscious;
- Lay them down.
- Activate 9-1-1.
- Check their mouth for the food.
- Follow the ABC steps above.

8. Conscious, Choking Infant

- Lay them on your arm face down and give 5 back blows.
- Turn them over face up and give 5 chest compressions.
- Continue until the food comes out or until they become unconscious.
- If the food comes out make them comfortable and activate 9-1-1 if they need it.
- If they become unconscious;
- Lay them down.
- Activate 9-1-1.
- Check their mouth for the food.
- Follow the “Unconscious Casualty” steps above.

9. Head/Tilt–Chin/Lift

- This is done so as to lift the tongue off the throat to open the airway. It is done by placing one hand on the forehead and pushing the head back, and by placing one finger on the underside of the chin and lifting the chin upwards.
- If you suspect a neck injury then you should open the airway using the modified jaw thrust, without the head tilt.

10. Tongue–Jaw Lift

- This is done when you want to see if there is food inside an unconscious person's mouth.
- It is done by opening their mouth and grabbing their tongue (like a tongue depressor) with your thumb. Now you can see inside their mouth.
- If you see an object, then use the other hand to pull it out.
- Never put any foreign objects, e.g., tweezers, inside their mouth to pull out the object.
- If the object is liquid or hard to get out, turn the person on their side and try scooping it out from this position.

APPENDIX 2B
FIRST AID – Bandaging

A. When to Bandage

Bandaging is something you would do to control severe bleeding. Ideally you want to use sterile dressing; however, when someone is bleeding severely you may have to use whatever you have near you (e.g., towels, clothing). The idea is to put pressure over the cut, with a dressing, to control bleeding, and tying the dressing in place. You want to tie with enough pressure to control the bleeding but not so much so that blood does not get through to the remainder of the limb. If you restrict blood flow that area may die and may require amputation, so be very careful. As you are tying the dressing ask the injured person to make sure you are not making it to tight. Once you have tied the dressing you need to check to make sure you did not make it too tight, and check this every couple of minutes.

For example, if you have bandaged a forearm, here is how you check for circulation:

- Compare both hands to make sure they are similar in temperature and color.
- Check the hand to make sure it is not swelling or turning blue.
- Ask the person if the hand feels numb or tingly.

If they lose sensation, then it is too tight. Do not remove the bandage, but loosen it a bit. If the first dressing becomes soaked with blood, then simply put another one on top. Do not remove the original one as you will be reopening the wound.

Notes:
Always use caution when dealing with bodily fluids — Wear gloves and wash your hands immediately after.

Keep in mind that the injured person may go into shock.

B. Sling

A sling is something you use to keep the hand/arm elevated above the heart and to make it more secure and comfortable for the injured person. It should only be used if it does not cause more pain or discomfort.

C. Splints

The main purpose of a splint is to keep an injured body part immobilized (e.g., a broken leg). It should only be done if paramedics are going to take a long time arriving, or if you have to move the person. Never move or try to realign the injured body part. Always splint in the position found.

There are three main types of splints:

1. *Anatomical*: This means using a non-injured body part to immobilize an injured body part, e.g., to splint a broken left lower leg you would tie both legs together so the good leg provides support to the injured leg.
2. *Soft*: This means using something like a thick sweat shirt, a jacket, a towel, or a blanket to wrap around and immobilize. This kind of splint works very well with hand or ankle/foot injuries.
3. *Rigid*: This refers to using a firm object, such as a piece of wood, to immobilize. There are many types of rigid splints you can purchase or you can use whatever you see around you, e.g., magazines, newspapers, umbrellas, etc.

3. Tools

3. Tools

A. Hand Tools

I. Impact Tools

Hammers, mallets, punches, and chisels are common impact tools encountered in a CCE laboratory. All impact tools may fragment violently when struck if they are not inspected for cracks and other such damage before use. For safe use, operators should wear basic safety glasses or face shields where applicable, keep a tidy work area, minimize distractions, and avoid using these tools when they appear damaged or inoperable.

Removal from service: Any impact tool exhibiting significant cracks or flaws of any kind should be immediately removed from service and taken to the lab manager. This includes loose handles or cracked heads on hammers, cracked or dull chisels, etc.

II. Cutting Tools

Scrapers, rasps, hand saws, hack saws, and utility knives all possess sharp edges which can injure an operator if appropriate precautions are not taken. Operators should be aware of the location of the cutting edge of any such tool at all times and should never attempt to use a cutting tool that has become dull or fallen into disuse.

Removal from service: The most dangerous cutting tool is a dull cutting tool. Saw blades with dull or broken teeth should be taken to the lab manager to be removed from service. Dull hacksaw blades are disposable and can be thrown away and replaced when necessary. Utility knives have disposable razor blades and usually store a few blades in the handle of the knife. Care should be taken when changing a blade. Old blades should be disposed of in a special razor blade container or have their cutting edges covered in tape and paper before disposal to prevent damage or injury to other workers.

B. Basic Power Tools

I. Drills

Power handheld drills and drill presses are common tools used in the lab. Handheld drills may be cordless/rechargeable or corded. Drill presses consist of a powerhead on a stand with a movable table below the drill chuck and are capable of making very precise perpendicular holes in many different materials. Guards installed on power tools must not be disabled or removed.

When using any drill, a drilling and cutting guide should be consulted to determine optimal drilling speed for the task based on hole diameter and material to be drilled. Drill bits should be inspected before use for cracking, chipping, and general wear and tear.

Always choose the appropriate style of drill bit for the material to be drilled. Spade bits should be used for only for wood and soft plastics. Masonry bits should be used only on concrete, mortar, or brick and used only in a hammer drill. Hole saws will say specifically what material they are for and should be used with caution as they are prone to overheating. Twist drills are appropriate for most materials provided they are made of the correct alloy for the material. Lubrication with a light oil may also be required. Consult a guide for choosing drill bit alloys and lubricants.

Removal from service: Drills and drill bits should be inspected before or after each use. Dull drill bits should be taken to the lab manager for refurbishing or disposal. Drills exhibiting strong electrical smells, abnormal grinding sounds, sparking, electrical cord damage, etc., should be removed from service immediately and taken to the lab manager.

II. Saws

Power cutting tools are used extensively in the lab and come in three basic categories with many different flavors: circular saws, band saws, and reciprocating saws.

Circular saws may be handheld, embedded vertically in a table (table saws) or mounted on a pivoting arm (chop, miter, radial arm saws). They all use a circular blade of varying diameters. Make sure the correct blade type and diameter is chosen for the task and that the blade is properly mounted to the tool. Note that most circular saw blade arbors are <u>left-hand threaded</u>**.** When using any of these tools, the material to be cut should stable and secure and should be cut in such a way as to minimize side load on the rotating blade. This will help prevent a very dangerous situation known as “kickback.” Chop, miter, radial arm, and handheld circular saws should only be used on clamped work pieces supported at a comfortable height for the operator. When using sawhorses, ensure the cut line does not intersect a support or clamp. Be sure to keep the power cord away from the blade at all times.

Band saws may be handheld (Portaband) or stationary in a vertical or horizontal position. They use a long, continuous blade which rotates around two pulleys some distance apart. Band saws are highly sensitive to cutting speed and blade tension; both of which are easily adjusted by the user. Consult a cutting guide for appropriate choices of these settings and choice

of the blade itself. Changing the blade is a sometimes difficult task and should be done with supervision until familiar with the particular saw.

Reciprocating saws use a disposable blade in a back-and-forth cutting motion, much like a power hand saw. These can be jigsaws, scroll saws, saber saws, and multipurpose reciprocating saws commonly referred to as a popular Milwaukee® model called a SawZall™. Blades come in wide varieties and should be chosen based on the material to be cut. Most saws have a different way of changing blades, but usually require no tools. The operator should be familiar with the tool before use.

Removal from service Every saw should be inspected before and after use. Check all blades for worn or missing teeth and remove from service if necessary. Disposable reciprocating saw blades need not be brought to the lab manager before replacement. As with all power tools, unusual smells, sounds, behavior, or damage to the power cord should be reported to the lab manager and the tool should be removed from service.

III. Rotating Tools

Rotating tools include grinders, cut off tools, Dremel® tools, and any other tool that rotates at high speed. These can be electric or pneumatic. Cut off tools produce large amounts of high velocity debris and should always be used in conjunction with a face mask and appropriate clothing. Thin cut-off wheels are prone to breaking in use, especially if subjected to side loads or rough surfaces. Guards should always be in place to help deflect flying debris from the workpiece or a broken blade away from the operator.

Removal from service: Grinding wheels and cut off wheels are disposable and should be replaced when worn or damaged. As with all power tools, unusual smells, sounds, behavior, or damage to the power cord should be reported to the lab manager and the tool should be removed from service.

C. Large Power Tools

ALL tools in this section require lab manager approval before use

I. Lathes and Mills

Safe use of lathes and mills requires proper training beforehand. This section is merely a reminder of basic safety practices when using the machine

Lathes and mills typically have machine guards in place to prevent injury to the operator and any bystanders. These should be inspected before use and not removed for any reason.

Cutting depth and speed are critical to safe use of lathes, mills, and all machine tools. Training is critical for these settings. Machining guides should be consulted for each task performed on a machine tool.

Machine tools generate large amounts of material waste (chips) that must be removed regularly to maintain a safe environment. The chips are sharp, irregular, and usually coated in cutting oil. Chips should be removed from the machine regularly and safely during use and the machine should be cleaned thoroughly after each use. Do NOT attempt to remove chips from around a workpiece while the machine is running!

Cutting tools should be inspected for damage and wear and removed from use if deficient. Damaged cutting tools may break and fragment.

The area around the machine tool and the machine itself should be cleaned of oil residue and chips after each use. Remember: a messy machine shop is a dangerous machine shop.

Training videos are available on UTUBE from MIT TechTV, Machine Shop 1-10 for Lathes and Milling Machines.
Example Link: http://techtv.mit.edu/videos/142-machine-shop-1

II. Gas Welding/Cutting

Welding: All students are required to watch the welding videos in the following series and pass the test administered by Dr. Ferraro prior to welding: http://www.ehow.com/videos-on_4925_welding-safety_-equipment_-tips-techniques.html

The use of flammable gases to heat, join, and cut metals is a common technique that has been used for many decades. Each task requires appropriate training and significant practice to be performed safely. The most common welding and cutting gas used in CCE laboratories is Oxy-acetylene, which burns highly flammable acetylene gas with pure oxygen to increase flame heat. Oxy-acetylene torches can reach temperatures of over 3000 degrees F and pose significant burning and explosion hazards.

Operators should wear full coverage, burn resistant clothing and tinted eye and face protection. See the PPE section for more information.

The work area should be cleared of debris and obstacles and surrounded by screens to block the intense light from passers-by. The area should be appropriately ventilated and free of flammable materials. The workpiece should be supported and secured at a comfortable level and the floor

beneath the workpiece should be protected from the falling molten metal (slag).

The area between the tanks and the operator where the gas hoses run is a **"NO-Zone"** for any observers and assistants. One of the greatest hazards for a torch operator is a careless person tripping on the gas hoses, causing the still-burning torch to fly wildly. *Anyone violating this rule will be removed from the area and barred from torch use*.

When lighting the torch, the oxygen tank should be open to around 60psi and the acetylene should be open to about 10 psi. The oxygen should be OFF at the torch handle and the acetylene should be only slightly open. NEVER light a torch when oxygen is being introduced, this can cause an explosion. Acetylene and oxygen should then be introduced *SLOWLY* until the desired flame is achieved.

III. Arc Welders

Welding: All students are required to watch the welding videos in the following series and pass the test administered by Dr. Ferraro prior to welding: http://www.ehow.com/videos-on_4925_welding-safety_-equipment_-tips-techniques.html

Arc-welding is a safe occupation when sufficient measures are taken to protect the welder from potential hazards. Arc welding is most commonly performed with a Stick, MiG, or TiG type welding machine and process. Each type of welding process has its own techniques and safety hazards the operator should study carefully before use. The three main safety hazards in all arc welding processes are harmful fumes and gases, high voltages needed to generate the electric arc, and intense light and UV radiation from the arc itself.

Arc rays – It is essential that your **eyes are protected** from radiation exposure. An electric arc produces large amounts of infrared (IR) and ultraviolet (UV) radiation as well as visible light many times brighter than the sun. IR radiation has been known to cause retinal burning and cataracts and even a brief exposure to UV radiation can cause an eye burn known as "welder's flash." While this condition is not always apparent until several hours after exposure, it causes extreme discomfort, and can result in swelling, fluid excretion, and temporary blindness. Normally, welder's flash is temporary, but repeated or prolonged exposure can lead to permanent injury of the eyes. Refer to the welding subsection in the PPE section of this manual for appropriate welding clothing, gloves, and masks.

Work area – Keeping the area around your work neat is as important as maintaining your equipment; perhaps even more so as the risk of injury is amplified by the larger group of people involved. You may have already inspected your equipment and found it to be satisfactory, but all your caution will not matter when, for example, a coworker trips over your cable, causing you, and/or the people around you, to be injured by shock, hot metal, or from falling. Welding areas should *always* be neat and orderly, with ample open space, well ventilated, and surrounded by arc light intercepting welding screens to protect other people in the area.

Risk of electric shock — The primary voltage shock is very hazardous because it is much greater voltage than the welder secondary voltage. You can receive a shock from the primary (input) voltage if you touch a lead inside the welder with the power to the welder "on" while you have your body or hand on the welder case or other grounded metal. Remember that turning the welder power switch "off" does not turn the power off inside the welder. To turn the power inside the welder "off," the input power cord must be unplugged or the power disconnect switch turned off. You should never remove fixed panels from your welder; in fact, always have a qualified technician repair your welder if it is not working properly. Also, your welder should be installed by a qualified electrician so it will be correctly wired for the primary voltage which supplies it power and so the case will be connected to an earth ground.

ELECTRIC SHOCK CAN KILL

- **Do not operate with covers removed.**
- **Disconnect input power before servicing**
- **Do not touch electrically live parts**
- **Insulate yourself from the work and the ground**
- **Do not touch electrically live parts or electrode with skin or clothing**
- **DO NOT weld anything in or near wet conditions**

Fire Hazards – Because of the extreme temperatures associated with any arc welding process, you should always be aware of fire hazards. The heat of the welding arc can reach temperatures of 10,000°F, but this heat in itself is not generally a fire hazard. The danger of fire actually results from the effects of this intense heat upon your work and in the form of sparks and molten metal. Because these can spray up to 35 feet from your work, you must recognize and protect combustible materials from the welding arc, sparks and spatter. It is also important to be sure the work is not in contact with any combustible which it may ignite when heated. These materials fall into three categories: liquid (gasoline, oil, paints, and thinners); solid (wood, cardboard, and paper); and gaseous (acetylene and hydrogen).

4. Materials Handling

4. Materials Handling

A. Lifting

I. General Lifting Procedures

a. Determine if you need help—consider the distance and the object's weight.
b. Look over the pick-up and delivery area for (1) tripping hazards, (2) slippery spots, (3) small doors, (4) sharp corners, (5) blind spots, etc.
c. Inspect the object for sharp corners, wet surfaces, slivers, etc.
d. Place feet correctly—one foot close to the side of the object to provide stability—and one directly behind the object to provide lift or thrust.
e. Keep the object close to your body.
f. Get a correct grip or hold on the object by using a full grip—not just your fingers.
g. Keep your back straight—this does not mean vertical—just aligned from head to pelvis.
h. You should tuck in your chin when lifting to ensure alignment from head to pelvis.
i. Do the actual lifting with your legs only.
j. Just as important as lifting correctly is the ACT OF LOWERING CORRECTLY. You should lower objects in the same manner as you lifted them. *This is essential!*
    - The body should never be turned or twisted while under the stress of heavy weight. Instead, you should turn your whole body if you desire to change your position after you have made the lift.
    - When team-lifting large, awkward, or heavy loads, one person should inform all others—prior to lifting—of the safe, correct method of lifting and transportation to be used.
    - Only one pre-designated person shall give commands.

II. Pallet Jack Procedures

a. Do NOT operate Pallet Jack (Manual or Electric) until trained and authorized by your supervisor.
b. Always check Pallet Jack (Manual or Electric) to see that it is in good working order before attempting to handle a load.
c. Notify your supervisor about any faulty equipment immediately.
d. Always examine pallet before attempting to move it. Determine that load is not severely shifted or too tall to go through doorways.
e. When pulling loads always be watchful for any overhead obstructions.
f. Make sure Jack is in pallet straight and in the center of the pallet.

g. Never attempt to lift load with one fork.
h. Use both hands when jacking up a manual Pallet Jack to prevent muscle strain.
i. When pulling Pallet Jack, make sure it is in the neutral position. This will reduce fatigue.
j. When pulling heavy pallets, pulling on wet floor, or on a grade, have someone assist by pushing pallet or holding back on pallet, whichever is needed.
k. Swing wide on corners to avoid hitting door frames, merchandise, and wing displays.
l. Use Extra caution when operating jack on a grade. Never turn sharp on a grade.
m. Use wall of truck bed as a brake along with helper to keep heavy loads at a controlled speed.
n. Always let Jack down when stocking on the sales floor or anytime the Jack is left unattended.
o. Do not bump or hit walls or counters when parking pallets. This can damage walls, knock counters out of alignment, and damage product with a only a slight bump.
p. Make sure Pallet Jack is at a complete stop and in down position before releasing handle.
q. Keep all body parts (hands, arms, feet, etc) from getting underneath a pallet when it is in a raised position.
r. Pallet Jacks are for work only. Horseplay, including riding the jacks, is strictly prohibited.

III. Hydraulic Floor Jack Procedures

Floor jacks enable the safe lifting of vehicles for maintenance work. They are sturdier and safer choice over the standard scissor jacks that most vehicles are equipped with for emergency use. Floor jacks are available in several different capacities, and low-profile models are common.

a. *Capacity:* Floor jacks are available with capacity ratings from one to five or more tons. It is very important to know the weight of the vehicle being lifted and to ensure the jack capacity is at least twice the total vehicle weight.

b. *Work Surface:* The work area must be a level, hard surface. Using a floor jack on uneven or soft ground would cause the jack to shift and the vehicle to fall off of the jack, resulting in serious injury and vehicle damage.

c. *Wheels:* Chock the wheels of the vehicle that are not being lifted. If lifting the rear, chock the front wheels, if lifting one side, chock the other side wheels to help prevent the vehicle from rolling.

d. *Lifting Points:* The point on the vehicle that is being lifted must be carefully considered before lifting. Never place the floor jack lifting plate on the engine oil pan, transmission pan, or other material that could be damaged from lifting.

e. *Work Safety:* Never allow people under a lifted vehicle that is solely supported by a floor jack. The floor jack could have a slow hydraulic oil leak that could cause the jack to fall prematurely, causing serious injury.

IV. Forklift Procedures

A forklift or powered industrial truck can be dangerous if operated by untrained workers. The driver or bystanders can be seriously injured or killed if an accident should occur. Forklifts can also cause damage to the employer's property. Good safety procedures for operating a forklift should be followed at all times.

a. *Safety — Before Operating:*
   - Do not operate a forklift if you have not been properly trained in all operations and safety procedures.
   - Never operate a forklift without permission from a supervisor.
   - Check brakes, steering, controls, forks, hoist, fire extinguisher, warning devices, and lights at the beginning and end of each shift. Do not operate a forklift if any item on the checklist fails inspection. Report all problems to your supervisor.
   - Pay attention to maximum load limits. Never overload.
   - All forklifts should be equipped with a multi-purpose dry chemical fire extinguisher.

b. *Safety — During Transport:*
   - No riders on forklifts!
   - Make sure the load is balanced before and during transport.
   - Check the ground or floor for uneven areas and debris.
   - Always travel at a safe speed.
   - Tilt the forklift masts back when driving the forklift. This will lessen the chance of the load becoming unbalanced.
   - Never reach through the mast for any reason. If a load has shifted, stop the forklift, lower the forks, put the forklift into park, and set the brake. If necessary, have another worker help you reposition the load.
   - Keep the forks about 4 to 6 inches above the ground when moving a load.

- If you cannot see because of the size of the load, drive in reverse slowly. If necessary, have another worker guide you and serve as a lookout.
- Use standard hand signals for communication. For details, see the Tailgate Safety Training module Hand Signals for Vehicle Safety.
- Do not speed. The forklift should be driven at about 5 miles per hour. This speed is the same as a normal walk.
- Watch out for other forklifts and workers.
- Always back the forklift down a ramp. Keep the load in front when going uphill.
- Always keep your head, arms, and legs inside the driving compartment.
- Operators should always wear hard hats in high lift areas.
- Never lift people.
- Never lift a load above workers. Never allow workers to stand under a raised load.
- Sound the horn when approaching a corner.
- Remember that when you turn a corner, the rear of the forklift makes a wide swing. Watch for clearance on both sides of the aisle.
- Check side and overhead clearances when loading and unloading.
- Watch for water, oil, or other liquids on the floor. Report any wet surface to your supervisor.
- Watch out for overhead hazards such as pipes, beams, lights, sprinklers, door casings, cable wires, and signs.
- Always be careful around loading docks. Do not operate the forklift too close to the edge of the dock.
- Many forklift accidents occur when a forklift backs off a dock. For more details, see the Tailgate Safety Training module Loading Docks and Warehouses.
- Do not turn the wheels too fast. This can cause the forklift to overturn.

c. *Safety — Stacking Materials:*
   - Always stack materials so they are tied in. For example, if you have six loads to stack, put three on the floor, two on the second tier, and one on the top. This forms a pyramid and lessens the possibility of materials falling.
   - Do not stack materials too high. This can cause materials to fall.
   - Make sure that stacked materials do not block the building's sprinkler system.

d. *Review:*
   - All employees need to be properly trained before operating a forklift.
   - Do a forklift safety check before and after each shift.
   - Do not overload the forklift.
   - Check all clearances while operating a forklift.
   - Watch out for other forklifts and workers while operating a forklift.
   - Never allow anyone to ride on the forklift.
   - Use caution when turning corners.
   - Never speed while operating a forklift.
   - Always be alert around loading docks.

V. Overhead Cranes

a. *Operations & Use:*
   Using an overhead crane is a responsibility that you must be approved to hold. There are rules you must obey and responsibilities you must accept.

   ***Any Time Operating a Crane*:**

   - **You MUST have direct supervision of the Supervisor of the facility.**
   - **Hard hats and steel toe shoes MUST be worn at all times.**
   - **Student MUST be examined for the qualifications below upon accepting responsibility to use the crane and every 3 years after.**

b. *Qualifications:*
   - Have corrected vision that meets the same requirements as vision for a valid Florida driver's license.
   - Have effective use of all 4 limbs.
   - Be of sufficient height to operate the controls and to have an unobstructed view over the controls into the work area.
   - Have coordination between eyes, hands, and feet.
   - Be free of known convulsive disorders and episodes of unconsciousness.
   - Ability to understand signs, labels, and instructions.

c. *Training:*
   You must be trained and tested before you can operate an overhead crane. Upon passing this test and meeting other operator requirements (including demonstrating proficiency in running the crane), you will be allowed to operate the overhead cranes.

- Capacities of equipment and attachments.
- Purpose, use and limitation of controls.
- How to make daily checks.
- The energizing sequences, including pneumatic, hydraulic, and electrical sequences.
- Start-up and shutdown procedures.
- Emergency shutdown procedures.
- General operating procedures.
- All basic signaling procedures, including hand, radio, or telephone signals, where required.
- Practice in operating the assigned equipment through the mechanical functions necessary to perform the required task.
- Maximum rated capacity of the crane.
- Rigging procedures.
- Company rules and regulations.

d. *Safety Check:* At the beginning of each shift during which a crane is used, a visual inspection must be made in accordance with Table 1 below. A visual inspection is limited to that which can be made from a catwalk or other safe observation point. Any defects must be reported to a supervisor.

TABLE 1. Shift/Operator Inspection Checks

Inspection Item	Description of Inspection Check Points
Tagged Crane or Hoist	Check that crane or hoist is not tagged with an out-of-order sign.
Control Devices	Test run that all motions agree with control device markings.
Brakes	Check that all motions do not have excessive drift and that stopping distances are normal.
Hook	Check for damage, cracks, nicks, gouges, deformations of the throat opening, wear on saddle or load bearing point, and twist. Refer to the manual furnished by the original manufacturer of the crane.
Hook Latch	If a hook latch is required, check for proper operation.
Wire Rope	Check for broken wires, broken strands, kinks, and any deformation or damage to the rope structure.
Reeving	Check that the wire rope is properly reeved and that rope parts are not twisted about each other.
Limit Switches	Check that the upper limit device stops lifting motion of the hoist load block before striking any part of the hoist or crane.
Oil Leakage	Check for any sign of oil leakage on the crane and on the floor area beneath the crane.
Unusual Sounds	Check for any unusual sounds from the crane or hoist mechanism while operating the crane or hoist.
Warning and Safety Labels	Check that warning and other safety labels are not missing and that they are legible.
Housekeeping and Lighting	Check area for accumulation of material, trip or slip hazards, and poor lighting.

e. *Rules:*
   - A hoisting limit switch on a crane or hoisting device must not be used as an operating control, unless the crane is also equipped with a backup limit switch.
   - A load must not be lowered below a point where less than 2 full wraps of wire rope remain on the hoisting drum. If there is doubt concerning the safety of a crane or hoisting means, the operator must immediately stop the crane, and report the condition creating the doubt to the supervisor.
   - In the event of power failure, the operator must place all controllers in the "off" position.
   - When an operator leaves a crane unattended he or she must land any attached load, place the controllers in the "off" position, and open the main switch. Before closing a main switch the operator must make sure all controllers are in the "off" position. The main switch does not need to be opened on a pendant-controlled crane if the crane is left unattended for short periods.
   - An operator must not carry a load over another person.
   - A crane must not be used to make a side pull (except where it has been specifically authorized by a qualified person after making specific determinations).
   - Compressed gases can only be lifted by a cradle or enclosed platform.
   - An employee cannot ride a hoisting device, such as a magnet, hook, ball, or load.
   - An operator must only respond to signals from the employee directing the lift. Except for an emergency stop signal, this must be obeyed when given from any employee. The signals given to an operator must conform to Figure 1 on the following page.

f. *Attaching or moving a load:*
   - The hoisting rope or chain is free of kinks or twist and not wrapped around the load.
   - The load is attached to the load block hook by means of a sling or other approved device.
   - The sling and load will clear all obstacles or obstructions.
   - The load is balanced and secured before lifting the load more than a few inches.
   - Multiple lines are not twisted around each other.
   - The hook is brought over the load in a manner to prevent swinging.
   - There is no sudden acceleration or deceleration of the moving load.

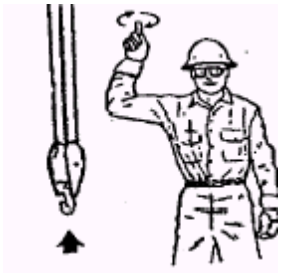
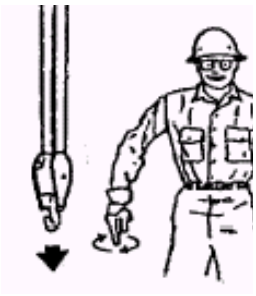
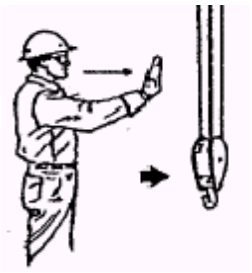
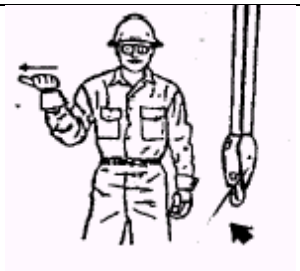
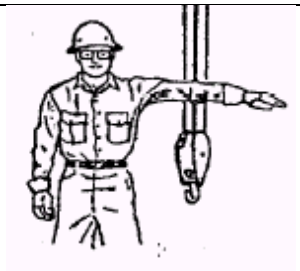
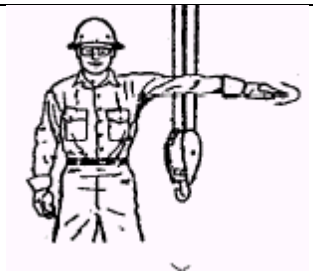
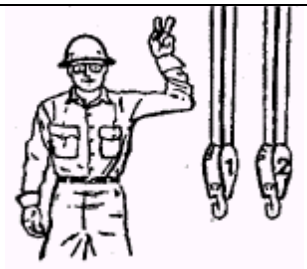
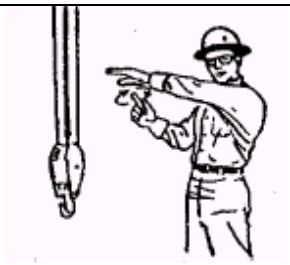
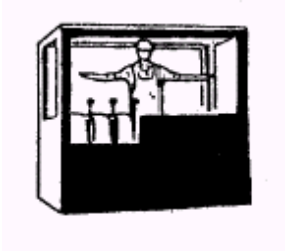
 HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circle.	 LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circle.	 BRIDGE TRAVEL. Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.
 TROLLEY TRAVEL. Palm up, fingers closed, thumb pointing in direction of motion, jerk hand horizontally.	 STOP. Arm extended, palm down, hold position rigidly.	 EMERGENCY STOP. Arm extended, palm down, move hand rapidly right and left.
 MULTIPLE TROLLEYS. Hold up one finger for block marked “1” and two fingers for block marked “2”. Regular signals follow.	 MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (“Hoist slowly” shown as an example.)	 MAGNET IS DISCONNECTED. Crane operator spreads both hands apart – palms up.

FIGURE 1. Standard hand signals for controlling overhead and Gantry cranes.

B. Storage

I. General Materials

Non-hazardous materials for research projects or other work projects must be stored in a proper area when not in active use. Project materials specific to the project such as cut pieces of lumber or specially ordered fasteners should be stored in a common area assigned to the project by the laboratory manager. Communal (shared) materials such as common fasteners and scrap lumber are to be kept in designated, easily accessible areas so all laboratory students and staff can access them. “Hoarding” of laboratory resources will not be tolerated. Laboratory resources may be allocated to a specific project only with approval from the laboratory manager.

Certain materials such as aggregates and Portland cement have designated storage areas (i.e. bins and hoppers) and should be stored only in those areas. Do not store shared materials such as these in separate areas unless approved by the laboratory manager.

II. Tools

Laboratory tools are, in general, shared among all people working in the laboratory. All tools are to be returned to their designated tool box, cabinet, tool room, or other such storage area when they are not in use. Lost and missing tools are always a major frustration in the laboratory that can easily be prevented by responsible users.

Tools that are to remain with a specific project need to be purchased for the project and stored with the project materials. Communal tools are not to be removed from the laboratory or stored outside of the communal tool area without specific approval by the laboratory manager.

III. Gas Cylinders

Pressurized gas cylinders such as shielding gas, oxygen, and acetylene tanks must be closed and secured when not in use. “Active” cylinders—those cylinders connected to the equipment they are used with—are permitted to be left in a secured to the equipment with the regulator connected. Cylinders held in reserve must have a valve protecting cap in place be stored secured to a wall or in a designated storage area. Refer to OSHA requirements for proper gas cylinder storage

IV. Hazardous and Flammable Materials

Laboratories containing hazardous and flammable materials have designated safety cabinets specifically for their storage. All flammable materials must be stored in a flammable cabinet when not in active use. For storage of specific chemicals and materials, refer to the Chemical and Hazardous Material section.

5. Chemicals and Hazardous Materials

5. Chemicals and Hazardous Materials

A. Introduction

A Chemical Hygiene Plan (see Figure 2 on the following page) has been developed by the University of Florida Division of Environmental Health and Safety (EH&S) to assist University of Florida (UF) departments in the recognition, evaluation and control of hazards associated with UF laboratory chemical operations and is intended to meet the requirements of the OSHA Laboratory Standard, 29CFR1910.1450.

The primary focus of this core Chemical Hygiene Plan (CHP) is to provide guidance to the laboratory staff to safely use chemicals in the laboratory. The plan shall be made site specific for each laboratory to ensure that compliance with this regulation is maintained. To make this CHP site specific, each individual lab must perform a "Hazard Assessment" of the lab and of the procedures involved with the storage, use and disposal of chemicals.

These Hazard Assessments shall be used to develop Standard Operating Procedures (SOPs) for each chemical use process in the lab. The SOPs will provide specific information on how to handle, use, store or dispose of each potentially hazardous chemical found in the laboratory. The site specific Hazard Assessment and SOP must be attached to this core CHP and used in: identifying potential chemical hazards, instructing laboratory personnel the potential hazards, training employees in safe practices, correcting work errors or dangerous conditions and requiring the proper personal protective equipment.

This Chemical Hygiene Plan minimally addresses the use of biological or radioactive materials or the disposal of chemical, biological or radioactive wastes. Individuals having questions are urged to call EH&S for assistance, 352-392-1591. For more information on these topics, please consult the:

Biological Safety Manual	http://www.ehs.ufl.edu/Bio/Files/bsm2.pdf
Radiation Control Guide	http://www.ehs.ufl.edu/Rad/RCGuide/rcgcon.htm
Chemical Waste Policy	http://www.ehs.ufl.edu/HMM/HWguide.pdf

The CHP must be made readily available to all employees, their designated representatives and regulatory officials. The core CHP will be reviewed annually by EH&S, and will be revised as necessary. Records of the review will be kept on file at EH&S. Notice of any revisions will be sent to each UF department using chemicals for distribution to laboratories and staff. Lab staff shall review the Hazard Assessments and SOPs as needed, for each lab. The lab shall retain records of this review and revision.

Chemical Hygiene Plan for University of Florida Laboratories

This is a site specific Chemical Hygiene Plan for:

Laboratory or Room number(s): _____

Building: _____

Principal Investigator/Lab Manager: _____

Department: _____

ENVIRONMENTAL HEALTH AND SAFETY DIVISION

P.O. Box 112190, Building 179

University of Florida

Gainesville, FL 32611

REVIEWED: August 2007

REVISED: August 2007

FIGURE 2. University of Florida Chemical Hygiene Plan form.

B. Assignment of Responsibility

I. **Chemical Hygiene Officers** (CHO) are individuals who can provide technical guidance in the implementation of this CHP. The EH&S Coordinator for Laboratory Safety will act as the Chemical Hygiene Officer for the main University of Florida campus. Each off-campus research facility will designate an individual to act as a CHO for the lab. This individual will be the PI of the lab unless delegated. This CHO must be identified to EH&S using the form found in *Appendix 5A of the UF Chemical Hygiene Plan* (retrieve form at http://www.ehs.ufl.edu/Lab/CHP/appa.pdf.)

II. **Individual laboratory workers** are responsible for their own safety and the safety of their co-workers and visitors to their laboratories. All staff must demonstrate this responsibility in their actions and attitudes. It will be each laboratory worker's responsibility to wear appropriate personal protective equipment (PPE), ensure that hazards are minimized and controlled, adhere to prescribed safety rules and regulations, and to know and follow all recommended procedures. All lab staff must pre-plan their work to ensure their safety and the safety of those individuals who work around them.

III. **The principal investigator (P.I.), laboratory supervisor, or manager** has the responsibility for controlling hazards in her/his laboratory. This shall include:
    - Completing a hazard assessment for each procedure
    - Instructing laboratory personnel on potential hazards
    - Training employees in safe practices
    - Correcting work errors and dangerous conditions
    - Encouraging a positive attitude towards safety
    - Selecting the proper personal protective equipment (PPE)
    - Ensuring that the PPE is worn
    - Maintaining a complete chemical inventory
    - Investigating the circumstances surrounding a laboratory accident and taking steps to avoid recurrence
    - All UF and UF affiliate labs will also maintain compliance with the "Minors in Research Laboratories or Animal Facilities" policy

IV. **The research department** shall be responsible for supporting the PI and research staff with all resources necessary to ensure safety compliance. This will include providing training to PI and staff members and allowing for time away from work for training.

    Research Laboratories on non-UF property, but associated with UF, must comply with all safety and health regulations of UF and site specific policies of property or facility.

V. **Environmental Health and Safety (EH&S)** shall be responsible for monitoring compliance and implementation of all safety and environmental regulations. This will include, but is not limited to, regulation interpretation, implementation of programs, planning reviews, facility surveys, and training and educational services. EH&S shall have enforcement authority when dealing with unsafe or illegal situations.

VI. **The University of Florida** will provide assistance for the compliance efforts of all staff and researchers. It will foster an attitude that safety is of the utmost importance.

C. Protecting Laboratory Staff and Reducing Potential Exposure to Hazards

I. Hazard Identification

a. *Notice Boards*: Laboratories, chemical storage areas and other potentially hazardous work areas will have a notice board at all doors leading into the workspace. These notice boards shall have stickers identifying the categories of potentially hazardous materials found in the lab and be considered a warning of the potential hazards.

   An emergency contact information sticker shall also be attached and completed to identify whom to contact in case of emergency. This Emergency Call List shall provide the names and after hours phone numbers of those individuals who will know the chemicals, gases and other hazards that may be affected by an emergency in the laboratory.

b. *Labels*: All chemical containers shall be labeled with the full chemical or trade name of the contents. The manufacturer's label will provide personnel with specific information regarding the physical and health hazards of the substance. Directions found on the label shall be followed.

   All substances transferred from an original container to a secondary container shall be labeled with the full trade or chemical name of the contents, any dilution of the chemical, the date of the transfer, appropriate physical and health hazards. No abbreviations or codes of the chemical name are acceptable, unless they are referenced on a placard prominently displayed in the work area. Chemical symbols are allowable only if the compound is a product of the research and referenced in research notebooks or similar documents.

c. *Chemical Inventory*: A complete chemical inventory of all chemicals found at the worksite is required to be maintained at all times. This

shall be updated annually, made available for staff or compliance officer review and provided to EH&S when requested.

This inventory form is found in Appendix 5B http://www.ehs.ufl.edu/Lab/CHP/appb.pdf or use ChemSwap http://www.ehs.ufl.edu/HMM/chemswap.htm

d. *Material Safety Data Sheets* (MSDSs): As required by the Hazard Communications Standard and Right-to-Know Laws, an MSDS must be available for each chemical used in the laboratory. These must be available in the workplace for laboratory staff review. The MSDSs for all hazardous chemicals should be used during the SOP training of lab staff.

   Links to MSDSs may be found at http://www.ehs.ufl.edu/HAZCOM/msds.htm

II. **Hazard Assessment**

a. *Hazard Assessment*: Each Laboratory PI will be responsible for assessing the hazardous situations, chemicals, biological materials, energy sources (including radioactive and laser), equipment, etc., that may cause potential exposure or injury to staff members working in the lab. The Hazard Assessment will identify the potential hazardous material, equipment or processes. It will also identify the methods used to mitigate the hazard, such as procedures for safe handling or personal protective equipment that will need to be worn.

   Each hazard assessment must be recorded on the attached template "PPE Certification of Hazard Assessment," found in Appendix 5E, (Section 1) http://www.ehs.ufl.edu/Lab/CHP/CHPAppE_ppe.htm. These must be completed, attached to this document and kept on file in each lab. The Hazard Assessment will be used to develop the SOPs for each hazardous material or procedure found in the lab. The Hazard Assessments and SOPs must be reviewed with staff at the time of their initial assignment to the lab, whenever the processes or procedures using the hazardous material or equipment is changed or modified.

   Any new potential hazards associated with any change of procedures, new equipment, new chemicals to be used, etc., must be assessed and documented prior to being used by the lab staff.

   The attached "Guidelines for Hazard Assessment and PPE Selection" (Appendix 5E) will aid the PI and lab staff in understanding the Hazard Assessment and completing the assessment form.

b. *Laboratory Safety Survey*: EH&S will conduct an annual Laboratory Safety Survey (LSS) of each research laboratory. The survey will concentrate on lab safety issues, such as chemical, physical, radiological, biological and general safety. The laboratory's complete chemical inventory will be required for review at the time of the survey.

   During this survey, any safety deficiencies will be noted by the surveyor and explained to lab staff. A summary letter will be sent to each P.I. to identify these concerns and to offer recommendations to correct the issues. Follow-up surveys may be performed to ensure compliance. These safety issues must be corrected to ensure compliance. These issues may need to be included in the Hazard Assessment and the SOPs of the lab.

III. **Standard Operating Procedures**

To ensure that lab staff are provided a safe workplace, each PI and lab must document hazardous chemical use and the procedures used during each hazardous process.

The lab or process specific SOPs shall be:

- Procedure or process specific (ex: distillations, reactions, synthesis)
- Chemical specific (ex: hydrofluoric acid, formaldehyde, benzene)
- Hazard class specific (ex: acids, bases, flammables, reactives)
- Applicable so that it will address the health and safety concerns of the procedure or process

The SOPs must include the following elements:

- Procedure or process: List the procedures or processes that will include the use of the hazardous chemicals.
- Hazardous chemicals: List the hazards associated with the chemicals or by-products used or produced.
- PPE: List the PPE required to be worn during the procedure.
- Engineering Controls: List the use of required fume hoods, glove boxes, point source ventilation, shields, etc. required to be used to minimize staff exposures.
- Emergency Equipment: List the equipment and its location that may be needed in case of an emergency.
- Transporting and storage requirements of chemicals to be used: Describe specific, safe handling requirements for the chemicals to be used.
- Accident, spill control and decontamination procedures: Describe specific procedures to be followed in case of an exposure, spill and

the clean-up of a contaminated area. List the individuals responsible for these procedures.

- Waste disposal: List who is responsible for waste handling and disposal.

The following are required using "highly toxic" materials:

- Required approval: Indicate if and under what circumstances prior approval is required and who will provide and document it.
- Designated chemical work areas: List the designated work area(s) where the procedure will be performed.

A template of the SOP is included in Appendix 5C http://www.ehs.ufl.edu/Lab/CHP/appc.pdf. This must be completed and attached to this document and kept on file for review and use in staff training.

IV. **Training**

All employees of labs will be trained by the P.I. or other designated and knowledgeable individual, regarding the UF policies of chemical hazards. Each employee shall receive this training at the time of initial assignment to the lab and prior to assignments involving new exposure situations. This training shall include, but not be limited to:

- the contents of the OSHA Laboratory Standard, availability of the CHP
- the hazards identified in the Hazard Assessment
- the specific SOPs involving hazardous materials or situations
- the methods of detecting the presence of chemicals
- physical and health hazards of the chemicals in the lab this will also include: a discussion about the Permissible Exposure Limits (PELs)
- an explanation of the symptoms of exposure
- measures that employees must follow to protect themselves from exposure to these hazards
- availability of reference materials, such as Material Safety Data Sheets

All training shall be recorded on the form found in Appendix 5D. http://www.ehs.ufl.edu/Lab/CHP/appd.pdf

V. **Chemical Usage**

a. *Obtaining chemicals for laboratory use*: EH&S will require the review of the lab's Hazard Assessments and SOPs for the proposed use of hazardous chemicals prior to the original purchase of the chemical. This would include, but is not limited to: toxins, carcinogens, toxic gases, etc.

b. *Designated chemical use areas*: Each lab or worksite where chemicals will be used must be assessed and designated as a chemical work zones. No chemicals will be used in areas where staff will be working at desks, in areas where staff may be eating or drinking, etc.

c. *Each hazardous procedure or process to be undertaken in the lab shall have prior approval to be done*: The PI in charge of the lab should grant prior approval. In some cases EH&S may be requested to grant approval for the procedure.

   Criteria for this approval will be a review of the lab's Hazard Assessments and SOPs for the procedure. Once it is assured that the procedure can be undertaken safety, staff will be trained in the SOPs and approval granted.

d. *Engineering Controls*: Physical barriers placed between the staff member and the hazard, known as "engineering controls," will be employed to minimize or eliminate potential hazards in all labs. These may include fume hoods, biological safety cabinets, glove boxes, shields, increased ventilation, point source vapor collection, etc.

   Fume hoods shall be used anytime staff are using any hazardous chemical or gas. All work shall be performed a minimum of 4 inches from the front edge of the hood. The sash should be lowered to the prescribed height as designated on the EH&S hood profile sticker attached to the face of the hood.

   EH&S will profile all fume hoods at least annually to ensure that the required face velocity and airflow are functioning as required. If, for any reason, the hood is not working correctly, all work in the hood must cease until the hood has been repaired. If the hood is not functioning properly, a work order shall be submitted to Physical Plant Division or IFAS Facilities. The lab staff will be responsible for clearing of all chemicals and equipment from the hood and cleaning any contamination from the hood's surfaces.

e. *Personal Protective Equipment*: Personal protective equipment (PPE) shall be used by staff members as a final means of barrier protection against hazards. The PPE shall be fit to the individual and be specific for the hazard. Staff members must be trained in the use and wearing of the PPE. PPE may include gloves, safety glasses, gowns and under special conditions, respirators.

   Manufacturer's Glove Compatibility Charts should be consulted to ensure that the gloves that are intended to be worn would protect the wearer. Links to these charts are found at http://www.ehs.ufl.edu/Lab/CHP/gloves.htm

If there are any concerns about the need for a respirator, please contact EH&S so an evaluation may be made. If there is a need for a respirator, the individual(s) will be placed into the Respiratory Protection Program. This will require a medical evaluation, proper fit testing of the respirator and training on use, care and maintenance of the respirator.

f. *Chemical waste disposal and spill control*: EH&S will dispose of chemical and radioactive waste. A pick-up request must be submitted, with a listing of the substances to be disposed of.

Spills and contaminated areas should be cleaned by lab staff if they have the correct spill control material, have been trained in proper and safe handling of the spilled material and can perform the clean up safely. If there is any concern about the spill clean-up, the lab staff should call EH&S to have the spill and area cleaned.

VI. **Monitoring of Hazardous Exposures**

Personnel monitoring shall be performed if there is reason to believe that the exposure level of any chemical that may exceed the action level or Permissible Exposure Limit (PEL). Monitoring will be performed by EH&S staff or a designee. Results of the monitoring will be discussed with the affected employee(s).

VII. **Medical Consultation and Examinations**

The opportunity to receive medical attention is available to all employees who work with hazardous chemicals in the laboratory, under the following circumstances:

- whenever an employee develops signs or symptoms associated with exposure to a hazardous substance
- when exposure monitoring reveals an exposure level above the action level for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements
- whenever an event takes place where employees are exposed to hazardous substances (i.e., chemical spill, release, explosion, etc.).
- whenever an eyewash or safety has been used as the result of a spill or splash.

The medical consultations and examinations will be provided at no charge to the employee, without loss of pay and at a reasonable time and place.

Any staff member requiring medical attention should report to the UF Student Health Care Center during working hours or Shands Hospital Emergency Room after hours. Any UF staff working at an off-campus facility

should seek medical attention from the nearest emergency health care provider.

VIII. **Accident Reporting**

All accidents involving employees, students, visitors or patients must be reported using the UF http://www.ehs.ufl.edu/RiskMgmt/IIIRpt.pdf

IX. **Record Keeping**

Accident forms shall be completed and filed after any accident or chemical exposure. EH&S will maintain all records of exposure monitoring. The health care provider will maintain medical records.

Training records shall be kept by the lab, department or facility.

EH&S does not require copies of the SOPSs, training or hazard determination forms, but will monitor and review them in the lab as needed.

X. **OSHA Laboratory Standard — 29 CFR1910.1450**

The OSHA Laboratory Standard is available at the UF Environmental Health and Safety Laboratory Safety Program Office. It can also be found at: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106

A general overview of the Laboratory Standard is available at: http://www.osha.gov/SLTC/laboratories/index.html

D. Types of Chemicals and Hazardous Materials

I. Types of Hazardous Materials

The U.S. Department of Transportation in its code of federal regulations defines nine classes of hazardous materials:

- *Class 1— Explosives*: Materials in this category include projectiles as well as sensitive and insensitive explosives. All must be handled with extreme caution. They should never be shaken or dropped and should be kept away from open flames.
- *Class 2— Hazardous Gases*: This class includes flammable and nonflammable compressed gasses as well as poisonous gases.
- *Class 3— Flammable Liquids*: This class includes both flammable liquids with a flashpoint below 140 degrees F and combustible liquids with a flashpoint between 141 and 200 degrees F.
- *Class 4— Flammable Solids*: This includes spontaneously combustible and "dangerous when wet" solids that become combustible when brought into contact with water.

- *Class 5— Oxidizers*: This class includes organic peroxide. These substances can become catalysts for fire hazards.
- *Class 6— Toxic Materials*: This includes inhalation hazards, other poisons, and infectious substances. Swallowing, bodily contact, or inhalation of gases released by toxic substances may cause irritation of skin and mucous membranes, or in more severe cases, serious illness. Contact a physician immediately if exposed.
- *Class 7— Radioactive Materials*
- *Class 8— Corrosive Materials*: Corrosive materials can harm living tissue and nonliving matter, such as steel, on contact.
- *Class 9— Miscellaneous*: This is a catchall category for any other materials that could present a hazard during shipment.

II. Types of Chemicals

The University of Florida categorizes chemicals into the following four types: a) reactivity; b) flammable; c) corrosive; and d) toxic.

a. *Reactivity*:

Chemical reactivity is the tendency of a substance to undergo chemical changes in a system. The chemical reactivity worksheet offers an excellent database of reactivity for over 4,000 common hazardous chemicals. The database includes information about chemical reactivity's towards air, water, etc. However, the reactivity may also mean chemical properties. An internet search using the key word "chemical reactivity" also gives databases for health and safety, which is hyperlinked to many sites.

A chemist or engineer not only wants to know the reactivity of chemicals, but also the extent of the reaction. When reactants are put together, how far will the reaction go? How long will it take to reach an equilibrium state? In dealing with these concerns, the concept of **equilibrium constant** is devised. In order to get a good approximation for the prediction of a system, we use *concentrations* or *activities* to evaluate the equilibrium constant.

b. *Flammable*:

Liquids – Flammable and combustible liquids are liquids that can burn. They are classified, or grouped, as either flammable or combustible by their flashpoints. Generally speaking, flammable liquids will ignite (catch on fire) and burn easily at normal working temperatures. Combustible liquids have the ability to burn at temperatures that are usually above working temperatures.

There are several specific technical criteria and test methods for identifying flammable and combustible liquids. Under the Workplace Hazardous Materials Information System (WHMIS), flammable liquids have a flashpoint below 37.8°C (100°F). Combustible liquids have a flashpoint at or above 37.8°C (100°F) and below 93.3°C (200°F).

Flammable and combustible liquids are present in almost every workplace. Fuels and many common products like solvents, thinners, cleaners, adhesives, paints, waxes and polishes may be flammable or combustible liquids. Everyone who works with these liquids must be aware of their hazards and how to work safely with them.

Solids – Flammable solids are any materials in the solid phase of matter that can readily undergo combustion in the presence of a source of ignition under standard circumstances, i.e., without:

> Artificially changing variables such as pressure or density; or

> Adding accelerants.

Flammable solids can also be divided into the following four categories (courtesy of Wikipedia):

> *Desensitized Explosives*: Explosives that, when dry, are Explosives of Class 1 other than those of compatibility group A, which are wetted with sufficient water, alcohol, or plasticizer to suppress explosive properties; and are specifically authorized by name either in the 49CFR 172.101 Table or have been assigned a shipping name and hazard class by the Associate Administrator for Hazardous Materials Safety.

> *Self-Reactive Materials*: Materials that are thermally unstable and that can undergo a strongly exothermic decomposition even without participation of oxygen (air). Certain exclusions to this group do apply under 49 CFR.

> *Generic Types*: Division 4.1 self-reactive materials are assigned to a generic system consisting of seven types. A self-reactive substance identified by technical name in the Self-Reactive Materials Table in 49CFR 173.224 is assigned to a generic type in accordance with that Table. Self-reactive materials not identified in the Self-Reactive Materials Table in 49CFR 173.224 are assigned to generic types under the procedures of paragraph (a)(2)(iii) of this section.

> *Readily Combustible Solids*: Materials that are solids which may cause a fire through friction, such as matches; show a burning rate faster than 2.2 mm (0.087 inches) per second

when tested in accordance with UN Manual of Tests and Criteria; or are any metal powders that can be ignited and react over the whole length of a sample in 10 minutes or less, when tested in accordance with UN Manual of Tests and Criteria.

Special Solids

- *Spontaneously Combustible***:** Spontaneously combustible material is:
  - Pyrophoric Material – A pyrophoric material is a liquid or solid that, even in small quantities and without an external ignition source, can ignite within five (5) minutes after coming in contact with air when tested according to the UN Manual of Tests and Criteria.
  - Self-Heating Material – A self-heating material is a material that, when in contact with air and without an energy supply, is liable to self-heat.
- *Dangerous When Wet*: Dangerous when wet material is material that, by contact with water, is liable to become spontaneously flammable or to give off flammable or toxic gas at a rate greater than 1 liter per kilogram of the material, per hour, when tested in accordance with the UN Manual of Tests and Criteria.

c. *Corrosive*:

Chemicals that cause severe local injury to living tissue are called corrosive chemicals. Accidents involving splashes of corrosive chemicals are very common in the work place. Damage to the skin, respiratory system, digestive system and the eyes may result from contact with these substances or their vapors. The seriousness of the damage depends on the type and concentration of corrosive material, length of the exposure, the body part contacted, and first aid measures taken.

Usually minor exposure to corrosive materials is reversible and healing is normal. However, severe exposure may cause permanent damage. Depending on the severity of the exposure, damage to the skin may range from redness and peeling to severe burns and blistering. Chronic exposure may result in dermatitis. Exposure to the respiratory system may range from mild irritation, to inflammation, chest pain, difficulty in breathing, pulmonary edema, and death. Mild exposure to the eyes may cause pain, tearing, and irritation. Severe exposure may cause ulcerations, burns and blindness. Ingestion of

corrosive chemicals may cause immediate pain and burning in the mouth, throat, and stomach followed by vomiting and diarrhea. Perforation of the esophagus and stomach is possible.

The concentration of a corrosive material also determines the extent of damage to the tissues. For example, a weak solution of acetic acid (vinegar) can be ingested and contact the skin without any harmful effects. However, concentrated acetic acid is highly corrosive and can cause serious burns to the tissues.

First aid measures must be taken immediately if corrosive chemicals contact the tissues. Corrosive chemicals that contact the skin or eyes should be immediately washed off with water for at least fifteen minutes. Inhalation victims should be moved to fresh air and artificial respiration started if breathing has stopped. If a corrosive material has been ingested, 2-4 glasses of water should be administered to the victim and the poison control center called immediately.

If mixed or stored incorrectly corrosive chemicals can generate excessive heat, pressure, flammable, and toxic gases that can damage equipment, ignite combustibles, and lead to injury. During a fire, highly toxic gases may be released. Many corrosive chemicals have other serious hazards and may be classified as flammables, reactives, or toxins.

Classes:

> *Strong Acids* **–** All concentrated strong acids can attack the skin and permanently damage the eyes. Acids usually cause irritation and pain immediately. Adding water to acids can cause the contents to be violently ejected. Burns from acids are typically more painful, though less destructive than alkaline burns. The vapors from many acids such as hydrochloric acid are soluble in water and cause irritation of the nose and upper respiratory tract. Vapors from other acids, however, are not soluble in water and do not cause irritation. For example, vapors from nitric acid may travel deep into the lungs and cause permanent damage and not be immediately noticed.

  Strong acids are also hazardous because they can combine with other chemicals in storage and cause fires and explosions. Common strong acids include hydrochloric, nitric, and sulfuric.

> *Strong Alkalis* – The metal hydroxides, especially the alkali metal hydroxides, are extremely hazardous to the skin and the eyes. In contact with water considerable heat can be generated that can cause splattering of the material. Burns from alkaline

substances are less painful than acid burns but possibly more damaging. The healing of serious alkaline burns is extremely difficult. Concentrated alkaline gases such as ammonia can cause severe damage to the skin, eyes, and respiratory tract. Dry bases can react with the moisture on the skin, eyes, and mucous membranes, causing serious burns. Examples of strong alkalis include sodium hydroxide, potassium hydroxide, and ammonia.

> *Halogens*. The halogens are toxic and corrosive to the skin, mucous membranes, and the eyes. Fluorine gas is highly reactive with organic matter and will cause deep penetrating burns on contact with the skin. Chlorine is less reactive but still extremely hazardous. Bromine is a common source of eye damage because of its use as a pool disinfectant. In contact with the skin it can also cause severe, long lasting burns. Iodine vapor is irritating to the eyes and respiratory tract and may cause pulmonary edema. Skin contact may produce burns.

> *Oxidizing agents*. Besides being corrosive to the skin, mucous membranes, and eyes, oxidizing agents are also fire and explosion hazards. Oxidizing agents readily release oxygen, increasing the ease of ignition of flammable and combustible materials and increasing the intensity of burning. Some compounds give up their oxygen at room temperatures while others require the application of heat. Powerful oxidizers such as nitric and sulfuric acids may react with organic compounds and readily oxidizable materials causing fires and explosions. Oxidizers include chlorates, perchlorates, bromates, peroxides, and nitrates. The halogens are also considered oxidizing agents because they react the same as oxygen under some conditions.

d *Toxic*:

A **toxic chemical** is any chemical which, through its chemical action on life processes, can cause death, temporary incapacitation, or permanent harm to humans or animals. This includes all such chemicals, regardless of their origin or of their method of production, and regardless of whether they are produced in facilities, in munitions or elsewhere.

These substances also include dusts, mixtures, and common materials such as paints, fuels, and solvents. OSHA currently regulates exposure to approximately 400 substances. The OSHA Chemical Sampling Information (CSI) file contains listings for approximately 1500 substances; the Environmental Protection Agency's (EPA's) Toxic

Substance Control Act (TSCA) Chemical Substances Inventory lists information on more than 62,000 chemicals or chemical substances; some libraries maintain files of material safety data sheets (MSDS) for more than 100,000 substances.

It is not possible to address the hazards associated with each of these chemicals in this safety and health topics page, however, the University of Florida, Department of Environmental Health and Safety, maintains a list of the toxic materials or substances to our workplace.

Exposures to hazardous and toxic substances are addressed in specific standards for the general industry, and are easily located on-line.

III. NFPA (National Fire Protection Association) Chemical Hazard Labels

The National Fire Protection Association (NFPA) has developed a color coded, numerical system for indicating the health, flammability and reactivity hazards of chemicals (see Figures 3 and 4). In addition, a special precaution symbol may be used, if necessary.

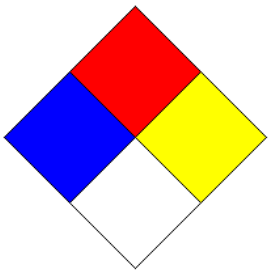


FIGURE 3. NFPA chemical hazard label (unmarked).

NFPA labels are ***required*** on all chemicals in the laboratory. Some chemicals that we purchase already have these markings (or their equivalents) on the container. Other ones do not have such markings and should have a NFPA label put on them ***immediately***.

To assist you in assessing the degree and type of hazard associated with a particular substance, these guidelines have been provided for you to follow.

The diamond is subdivided into four general categories by color:

1. Health (blue)
2. Flammability (red)
3. Reactivity (yellow)
4. Special (white)

Each of the three colored areas in the NFPA fire diamond has a box in which the degree of hazard can be written (see Figure 4).

FIGURE 4. NFPA chemical hazard label with hazard ratings.

The degree of hazard is assigned using the following number codes listed in Table 2 with description expanded in Figure 5:

TABLE 2. Hazard Ratings for NFPA Hazard Label

Number	Degree of Hazard
4	Extreme
3	Serious
2	Moderate
1	Slight
0	Minimal

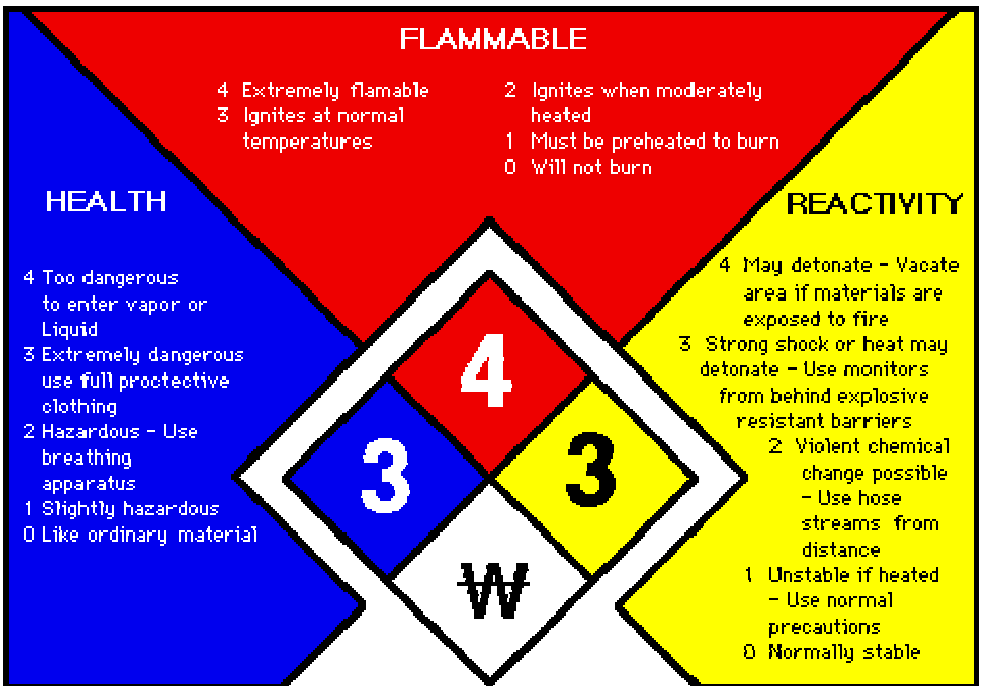


FIGURE 5. NFPA chemical hazard label with expanded ratings descriptions.

For each class of materials, there are further guidelines and examples to help assign or understand a hazard rating (Tables 3 through 6):

TABLE 3. Rating Descriptions of Health Hazards for NFPA Chemical Hazard Label

Rating	Description of Degree of Health Hazard
4 Extreme	Highly toxic material. Will have one or more of the following characteristics: • On very short exposure could cause death or major residual injury even though prompt medical treatment is given. • A known or suspected **human** carcinogen, mutagen or teratogen.
3 Serious	Toxic material. Will have one or more of the following characteristics: • May cause serious temporary or residual injury on short term exposure even though prompt medical attention is given. • A known or suspected **small animal** carcinogen, mutagen or teratogen.
2 Moderate	Moderately toxic material. Will have one or both of the following characteristics: • Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment is given.
1 Slight	Slightly toxic material. Will have one or more of the following characteristics: • May cause irritation but only minor residual injury even without treatment. • Recognized innocuous material when used with responsible care.
0 Minimal	No chemical is without some degree of toxicity.

TABLE 4. Rating Descriptions of Flammable Hazards for NFPA Chemical Hazard Label

Rating	Description of Degree of Flammable Hazard
4 Extreme	Extremely flammable. Flash point below 73 F (22.8 C)
3 Serious	Flammable. Will have one or more of the following characteristics: • Vaporizes readily and can be ignited under almost all ambient conditions. • May form explosive mixtures with or burn rapidly in air. • May burn rapidly due to self-contained oxygen. • May ignite spontaneously in air • Flash point at or above 73 F (22.8 C) but less than 100 F (37.8 C).
2 Moderate	Combustible. Will have one or more of the following characteristics: • Must be moderately heated or exposed to relatively high temperatures for ignition to occur. • Solids which readily give off flammable vapors. • Flash point at or above 100 F (37.8 C) but less than 200 F (93.4 C).
1 Slight	Slightly combustible. Will have one or more of the following characteristics: • Must be preheated for ignition to occur. • Will burn in air when exposed at 1500 F (815.5 C) for 5 minutes. • Flash point at or above 200 F (93.4 C).
0 Minimal	Will have one or more of the following characteristics: • Will not burn. • Will not exhibit a flash point. • Will not burn in air when exposed at 1500 F (815.5 C) for 5 minutes.

TABLE 5. Rating Descriptions of Reactivity Hazards for NFPA Chemical Hazard Label

Rating	Description of Degree of Reactivity Hazard
4 Extreme	Will have one or more of the following characteristics • Can explode or decompose violently at normal temperature and pressure. • Can undergo a violent self-accelerating exothermic reaction with common materials or by itself. • May be sensitive to mechanical or local thermal shock at normal temperature and pressure.
3 Serious	Will have one or more of the following characteristics: • Can detonate or explode but requires a strong initiating force or confined heating before initiation. • Readily promotes oxidation with combustible materials and may cause fires. • Is sensitive to thermal or mechanical shock at elevated temperatures. • May react explosively with water without requiring heat or confinement.
2 Moderate	Will have one or more of the following characteristics: • Normally unstable and readily undergoes violent change but does not detonate. • May undergo chemical change with rapid release of energy at normal temperature and pressure. • May react violently with water. • Forms potentially explosive mixtures with water.
1 Slight	Will have one or more of the following characteristics: • Normally stable material which can become unstable at high temperature and pressure.
0 Minimal	Normally stable material which is not reactive with water.

TABLE 6. Rating Descriptions of Special Hazards for NFPA Chemical Hazard Label

Rating	Description of Special Hazard
	Water Reactive
Ox	Oxidizing Agent
	Radioactive
	Poison

IV. Storage

Storage of any *Chemicals* and *Hazardous Materials* must be in compliance with University policies.

V. MSDS

Material Safety Data Sheets (MSDS's) are required as part of the University and Department Safety Program to meet compliance with the both federal and state regulatory standards.

MSDS sheets must be contained in a marked Yellow Binder, and located in the laboratory in a most conspicuous location openly visible to all. A duplicate of these MSDS sheets may be available from the lab supervisor. Whenever, a new Hazardous Material or Chemical is received from a supplier or source, it must arrive with its MSDS and this sheet must be immediately integrated into the lab's MSDS library. This may also be done electronically, if available.

If you cannot locate the manufacturer-specific MSDS, you can contact EH&S to assist you in obtaining the information.

MSDS can be obtained by clicking on the website link below:
http://jr.chemwatch.net/chemffx/

VI. Compressed Gas Cylinders

Those individuals working with compressed gas cylinders should request a copy of the UF Safety Rules for Storage and Use of Compressed Gas Cylinders. These rules must be posted in a prominent place wherever compressed gases are used and stored.

All cylinders owned by the department or the University must be registered with EH&S to ensure that they will be periodically tested for internal integrity. This hydrostatic testing is mandated for all cylinders and will be the responsibility of the department. If a cylinder has past the deadline for hydrostatic testing, it must be taken out of service until it has been tested and recertified for use. It is important that caps are not misplaced. Cylinders cannot be transported or returned to the vendor without a valve cap.

The use of medical grade gases will require registration. Contact EH&S for assistance.

a. Cylinder Safety

The following rules are intended to highlight and summarize the most common safety concerns regarding the handling and storage of compressed gas cylinders. Please consult the UF Safety Rules for Storage and Use of Compressed Gas Cylinders or MSDS for specific information on the gases used in your lab.

1) Know the chemical and physical properties of the gases.
2) Cylinders must be secured by use of chains, straps, racks, base plates or carts (regardless of cylinder size) anytime they are in use, being moved or stored. Securing straps must be used in the upper 1/3rd of the cylinder.
3) All cylinders must be labeled with contents (do not rely on color codes) and stage of use (e.g., "full," "in use," "empty").
4) Store and use in well ventilated areas, away from heat or ignition sources.
5) Store oxygen away from flammable gases. Reactive gases should be stored separately
6) The use and storage of flammable gases must be minimized. Please contact EH&S for a consultation.
7) Do not strike or allow cylinders to strike against one another.
8) Metal cylinder caps for valve protection should be kept on at all times when the cylinders are not in use.
9) A proper pressure regulator is required during use; improvised adapters are not allowed
10) Use regulators specific for the type of gas contained in a cylinder; they are not interchangeable.
11) Do not use Teflon tape or lubricants on regulators.
12) Release pressure and close valve at the end of the day's use; do not rely on a regulator to stop the gas flow.
13) Handle empty cylinders with the same care as full cylinders.
14) Transport cylinders only on a hand truck or other cart designed for such purpose; cap valve must be in place when transporting cylinders.
15) Do not handle more than one cylinder at a time unless a cart designed for such purpose is utilized.
16) Store full cylinders in a cool, well ventilated and protected area, away from emergency exits
17) Cylinders should never be stored horizontally.
18) Do not let the temperature of the cylinders exceed 38° C (100° F).
19) Do not store corrosive gases for more than 6 months.
20) Never attempt to refill a cylinder.
21) Do not put cylinders into freezers.
22) Report all cylinders found in a questionable condition to the lab supervisor or EH&S.

b. Toxic Gases

The use of highly toxic gases (i.e.: arsine, fluorine, phosphine, etc.) will require containment in a vented gas cabinet. These cabinets must be vented from the building through a dedicated exhaust, monitored and alarmed for leakage and have an emergency power back-up system for the fan motor. Other gases such as carbon monoxide may require a monitoring system or device. Please call EH&S for consultation.

c. Cylinder Disposal

It is highly recommended that the lab, or department, establish an account with suppliers who allow the return of unused gas and empty cylinders. Abandoned and aging cylinders must be picked up by EH&S before the integrity of the cylinder is compromised. This may incur cost to the department. Call EH&S Hazardous Materials Management at 392-8400 for information on cylinder disposal.

Appendix 5A of the UF Chemical Hygiene Plan

Identification of Chemical Hygiene Officer for Off-Campus Facilities (not located within UF Campus in Gainesville, Florida)

Off-campus facility _____

Address _____

Department _____

Director _____
Printed name Signature Date

The following person shall serve as Chemical Hygiene Officer for this facility:

_____
Printed name Phone number

_____
Work address Email address

_____
Signature Date

Please return form to:

Lab Safety Coordinator
UF EH&S
Box 112190
Gainesville, FL 32611

Laboratory Chemical Inventory

DATE	Building #	Room #	Name of Principal Investigator (last name then first name)	Primary Chemical Name	CAS Number [a,b]	Quantity	Unit [c]	Link to MSDS

[a] Unique numerical identifiers for chemical compounds, polymers, biological sequences, mixtures and alloys
[b] http://en.wikipedia.org/wiki/CAS_registry_number
[c] mg, g, mL, L / oz. pt. qt. gal / lb.

Appendix 5C of the UF Chemical Hygiene Plan

Standard Operating Procedures

Principal Investigator: _____ Dept.: _____

Building: _____ Room(s): _____

This SOP must be kept on file for lab staff training and review. It will be reviewed annually for accuracy.

Date: _____ Review date(s): _____ Revision date(s): _____

By: _____

The individual responsible for the Chemical Hygiene Plan in this area is:

_____

Chemicals are stored in:

_____

_____

Chemicals are safely transported by the following means:

_____

_____

In the event of an accident or other emergency, the following shall be done:

_____

_____

This is a list of our emergency equipment:

_____

_____

The following are the spill control and decontamination procedures:

_____

_____

The following are the waste disposal procedures:

_____

_____

Standard Operating Procedures

1. Standard Operating Procedure for the activity: _____

2. Chemical(s) Used	3. Hazard Class	4. Health Hazards

5. Personal Protective Equipment required for this activity:

_____

_____

_____

_____

6. Engineering Controls required for this activity:

_____

_____

_____

_____

7. Other precautions required for this activity:

_____

_____

_____

_____

Approval for use of highly toxic chemicals provided by: _____

Printed Name and Signature Date

Designated work areas for this procedure will be: _____

Appendix 5D of the UF Chemical Hygiene Plan

Documentation of Training

This form must be completed and saved as a record of the training provided to the laboratory staff as required by the UF Chemical Hygiene Plan.

Principal Investigator _____ Department _____

Building _____ Rooms _____ Phone _____

Training provided by _____ Date training was provided: _____

Procedure and chemical(s) covered by this training _____

_____

Topics cover by training: (Please check)

_____	Hazard Assessment review	_____	PPE selection
_____	Standard Operating Procedure review	_____	PPE Use
_____	Chemical Hygiene Plan review	_____	Fume hood required
_____	OSHA Laboratory Standard review	_____	Biological Safety Cabinet req
_____	Procedure or process review	_____	Other exhaust systems require
_____	Chemicals to be used		_____
_____	Chemical hazard review	_____	Shielding
_____	MSDS review (including exposure limits)	_____	Other requirements: _____
_____	Symptoms of exposure		_____

This training was provided by _____

Printed name

_____

Signature

Appendix 5D of the UF Chemical Hygiene Plan — continued

NAME	SIGNATURE	UF ID Number

UF Chemical Hygiene Plan

Personal Protective Equipment

General

This section addresses **eye**, face, head, hand and foot protection. Separate programs exist for respiratory and hearing protection.

Employees will be provided personal protective equipment (PPE) and will use them whenever doing so will reduce the likelihood of an injury and/or illness. PPE is not a substitute for engineering or administrative controls, or good work practices, but should be used in conjunction with these controls.

Responsibilities

PIs have the primary responsibility for implementation of the PPE Program in their work area. This includes:

- Conducting a hazard assessment in their work area.
- Determining what type of PPE is required.
- Ordering the necessary equipment.
- Ensuring the employees are trained on the proper use, care and cleaning of PPE.
- Ensuring the employees are wearing the PPE.
- Seeking assistance from EH&S to evaluate hazards.
- Maintaining records on hazard assessments.
- Replacing defective or damaged equipment immediately.

Employees have the primary responsibility for wearing and cleaning the assigned PPE in accordance with the training received.

Departments have the primary responsibility for purchasing PPE for employees.

Environmental Health and Safety (EH&S) has the primary responsibility for the development, implementation and administration of the PPE Program. This includes:

- Assisting in conducting hazard assessments.
- Providing training and technical assistance to supervisors on the proper use, care, and cleaning of approved PPE.
- Providing guidance to the supervisor for the selection and purchase of approved PPE.

Hazard Assessment and PPE Selection

PIs will conduct a walk-through survey of each work area to identify potential hazards. Each survey will be documented using the Hazard Assessment Form (Appendix E-Section 1). A guideline for filling out the assessment follows the actual form. The hazard assessment should be dated and signed as the written certification and maintained for inspection and training with the department. Additional assistance may be obtained by calling EH&S at 2-1591.

Protective Devices

All PPE will be appropriate for the work to be performed and maintained in a clean condition. Equipment must meet American National Standards Institute (ANSI) standards. Gloves must be selected based on style, size and performance characteristics of the glove in relation to the hazards encountered.

Training

Employees who wear PPE shall be trained in the following:

- Which PPE is necessary
- When PPE is necessary
- How to properly adjust and wear their PPE
- The limitations of the PPE
- The proper care, decontamination and maintenance of PPE
- The proper disposal of the PPE

Training will be provided prior to the employee working in an area requiring the use of PPE. Additional training is needed when:

- Changes in the employee's job duties require different PPE.
- Changes in the style or type of PPE used renders the previous training obsolete.
- An event has occurred which indicates the affected employee has not retained the training on the proper use of the PPE.
- The employee is observed incorrectly using the assigned PPE.

A training certificate will be kept for each employee. The certificate will contain the name of the employee trained, date of training and identify the PPE covered in the training. Appendix E (Section 2) contains a certification form. These certificates should be kept in the employee's training file.

Eye and Face Protection

Employees must use appropriate eye or face protection when exposed to hazards from flying particles, liquid chemicals, acids or caustics, chemical gases or vapors, or injurious light radiation. Eyewear shall comply with ANSI Z87.1 as indicated by labels on the PPE. When there is a hazard from flying objects, side protectors meeting ANSI standards must be used. Those employees wearing prescription glasses need to wear approved safety glasses that incorporate the prescription into the glasses or wear goggles over the prescription glasses.

Visitors, contractors, or others passing through an identified eye hazard area need to wear appropriate eyewear also. An ample supply of visitor safety glasses should be available for use.

Occupational Foot Protection

Employees working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole shall wear protective footwear. All safety footwear shall comply with ANSI Z41-1991.

Head Protection

All employees must wear a hard hat when there is a danger from impact and/or penetration from falling objects in any work location. Where there is a possibility of hitting the head on protruding objects or pipes, a bump hat may be worn.

Hand Protection

Employees must use appropriate hand protection when exposed to hazards from skin absorption of harmful substances, severe cuts or lacerations, abrasions, punctures, chemical burns, or temperature extremes. A careful evaluation of the hazard must be made due to the enormous variety of gloves on the market. Glove selection will be based on performance characteristics of the gloves, conditions, duration of use, and hazards present. One type of glove will not work in all situations. No glove will protect the wearer from all hazards. Even if a glove will protect the wearer, it will not last forever and must be changed regularly, as chemicals eventually permeate all glove materials.

In selecting gloves for use against chemicals, the exact chemicals encountered need to be determined. Labels and MSDSs can provide this information. Recommended glove types are often listed in the section for PPE on the MSDS. A manufacturer's glove selection guide or compatibility chart must be consulted when selecting gloves. EH&S can assist in determining the specific type of glove material that should be worn for particular chemicals. Links to glove compatibility charts can be found at http://www.ehs.ufl.edu/Lab/CHP/gloves.htm

Latex gloves should be avoided due to the possibility of latex allergies. Studies have revealed that 8 to 12 percent of health-care workers regularly exposed to latex are sensitized. The National Institute for Occupational Safety and Health (NIOSH) recommends the selection of products that reduce the risk of allergic reactions. For general laboratory use, disposable nitrile gloves are an excellent latex substitute. In addition to reducing the risk of sensitization, nitrile gloves offer superior chemical resistance over latex to many chemical substances.

Once gloves are removed, hands should be washed thoroughly. Gloves should not be worn out of the lab or when shared lab equipment is handled.

Additional PPE

Guidelines for the selection and use of respirators and hearing protectors are available from those specific UF policies. Cool vests and cooling scarves may be indicated for those jobs in hot environments. This includes outdoor jobs in the summer such as grounds and agricultural positions.

Cleaning and Maintenance

It is the employee's responsibility to ensure their PPE is clean and properly maintained. Cleaning is particularly important for eye and face protection where dirty or fogged lenses could impair vision. PPE should be inspected, cleaned and maintained at regular intervals as instructed by the supervisor.

It is also important to ensure that contaminated PPE, which cannot be decontaminated, is disposed of in a manner that protects employees from exposure to hazards.

PPE Certification of Hazard Assessment

Dept:	**Area:**	**Job Classification/Task:**
HAZARDS (Circle Hazards)	**Describe Specific Hazards**	**Identify Type of PPE Required for the Hazards**
Eye Hazard Impact Penetration Dust Chemical Radiation Heat Bioaerosols Projectiles		
Head Hazard Burn Electric Shock Impact Penetration Chemical Overhead loads Overhead beams	**Describe Specific Hazards**	**PPE Required**
Foot Hazard Chemical Impact Electrical Sharp Objects (puncture risk) Wet Conditions Construction	**Describe Specific Hazards**	**PPE Required**
Hand Hazard Burn Electric Shock Impact Penetration Chemical Sharp Edges Biological Agents	**Describe Specific Hazards**	**PPE Required**
Other Safety/Health Hazards	**Describe Specific Hazards**	
Falls Guarding Heat Electrical Storage Lockout Noise Respiratory Clothing		

I, _____, conducted the above evaluation of the identified work area on _____
Printed Name Date

_____
Signature

Appendix 5E (Section 2) of the UF Chemical Hygiene Plan – continued

Personal Protective Equipment Training Certification

_____, has received and demonstrated
Printed Name of Employee

understanding of the PPE training given by _____.
Name of Trainer

_____ _____
Signature of Trainer Date

The following personal protective equipment are available and have been assigned for use	
Check applicable boxes	Identify specific assigned PPE
{ } Eye and Face Protection	
{ } Head Protection	
{ } Foot Protection	
{ } Hand Protection	
{ } Respiratory Protection	
{ } Hearing Protection	
{ } Other Protection	

_____
Employee Signature

_____
Date

6. Housekeeping

(Parts from OSHA Standard 1910.22)

6. Housekeeping

A. Housekeeping Fundamentals

An uncluttered workplace is fundamental to any laboratory safety program. But, housekeeping is not just cleanliness. It includes keeping work areas neat and orderly; maintaining halls and floors free of slip and trip hazards; and removing of waste materials (e.g., concrete, aggregates, steel, etc.) and fire hazards (paper, cardboard, wood, etc.) from work areas. It also requires paying attention to important details such as the layout of the whole workplace, aisle marking, the adequacy of storage facilities, and maintenance. Good housekeeping is also a basic part of accident and fire prevention.

Effective housekeeping is an ongoing operation: it is not a hit-and-miss cleanup done occasionally. Periodic "panic" cleanups are costly and ineffective in reducing accidents.

Why? Simply put, poor housekeeping **CAUSES ACCIDENTS**, such as:

- tripping over loose debris or objects on floors, stairs and platforms
- being hit by falling objects
- slipping on greasy, wet or dirty surfaces
- striking against projecting, poorly stacked items or misplaced material
- cutting, puncturing, or tearing the skin of hands or other parts of the body , or worse

To avoid these hazards, a workplace must be "maintained" in order throughout the workday. Although this effort requires a great deal of management and planning, the benefits are many, and include:

- reduced handling to ease the flow of materials
- fewer tripping and slipping accidents in clutter-free and spill-free work areas
- decreased fire hazards
- lower worker exposures to hazardous substances (e.g., dusts, chemicals)
- better control of tools and materials, including inventory and supplies
- more efficient equipment cleanup and maintenance
- better hygienic conditions leading to improved health
- more effective use of space
- reduced property damage by improving preventive maintenance
- less janitorial work
- improves morale (you feel better working in a clean environment)
- improves productivity (tools and materials will be easy to find)
- proves image (you are proud to showcase YOUR laboratory)

B. Debris and Collection

The regular collection, grading and sorting of scrap contribute to good housekeeping practices. It also makes it possible to separate materials that can be recycled from those going to waste disposal facilities.

Allowing material to build up on the floor wastes time and energy since additional time is required for cleaning it up. Placing scrap containers near where the waste is produced encourages orderly waste disposal and makes collection easier. Some waste receptacles, either inside or outside the CCE lab areas, are clearly labeled for particular materials (e.g., aggregate, concrete, recyclable glass, plastic, scrap metal, etc.). It is inappropriate to mix waste from different sources in these containers. It makes disposal of these materials difficult and problematic.

C. Wet versus Dry

Laboratories within Civil and Coastal Engineering can produce both wet and dry waste. Wet waste solids (e.g., concrete, asphalt and cement slurries, etc.) should be allowed to dry or complete their reactions (hydration) prior to disposal.

*The practice of disposing of wet materials into street drains is **PROHIBITED**!*

Any wet waste which would be considered a hazardous material (petroleum-based, or chemical in nature) must be properly labeled and disposed of through EH&S.

D. Area Policing

The responsibility for policing and maintaining the workplace are in an orderly manner lies with all personnel; faculty, staff, and student alike. If every individual lives by the rule of "leave your workplace cleaner than you found it," all spaces and laboratories within CCE should be properly maintained.

The ultimate responsibility for the proper housekeeping in each CCE laboratory falls to the faculty or staff member assigned to the area. That person is considered the final word with regards to issues regarding this topic, and directs any and all housekeeping efforts within their laboratory areas.

E. Order and Organization

Good organization of stored materials is essential for overcoming material storage problems whether on a temporary or permanent basis. There will also be fewer strain injuries if the amount of handling is reduced, especially if less manual materials handling is required. The location of the stockpiles should not interfere

with work but they should still be readily available when required. Stored materials should allow at least one meter (or about three feet) of clear space under areas covered by, or with, sprinkler heads.

The stacking of cartons, drums, or pallets should be on a firm foundation, to reduce the chance of their movement, or shifting loads. Stored materials should not obstruct aisles, stairs, exits, fire equipment, emergency eyewash stations, emergency showers, or first aid stations. All storage areas should be clearly marked.

Materials stored on industrial shelving must not exceed their load capacity, and should be stacked as to not interfere with the work area.

Flammable, combustible, toxic and other hazardous materials should be stored in approved cabinets and/or containers in designated areas that are appropriate for the different hazards that they pose. Storage of materials should meet all requirements specified in fire codes and regulations of EH&S, State or Federal environmental and occupational health and safety agencies.

F. Basic Housekeeping Rules

- Walking and working surfaces should be clean, dry and unobstructed.
- Aisles and exits should be clearly marked and unobstructed.
- Approved trash receptacles should be provided to assure proper waste disposal.
- Splash guards and oil pans should be available for machinery as needed.
- Work area floors should be kept free of pallets, parts, equipment, extension cords and hoses.
- Floors, platforms and stairways should be kept in good repair.
- Walls and ceilings should be free of hangings and temporary wiring.
- Materials should be stacked in a stable manner; limit height as necessary to maintain stability.
- Overhanging or protruding storage should be eliminated.
- Storage areas in and around buildings should be free of garbage and debris.
- Materials should be stored in a manner that will not obstruct sprinklers (18-inch clearance for ordinary combustibles, 36-inch clearance for flammable liquids).
- Combustible materials will be stored in approved containers and cabinets.
- Production equipment should be arranged to prevent overcrowding.
- Adequate lighting, both natural and artificial, should be provided to assure good visibility for work activities and to reveal dirt, obstructions and poor housekeeping conditions.
- Leaks from hoses, pipelines and valves should be repaired immediately.
- Racks, shelves and lockers should be maintained for tools, and PPE.
- No eating in the laboratories to avoid contamination of your foodstuffs.

7. Emergency Procedures

7. Emergency Procedures

A. Emergency Management Plan

- In the case of an Emergency which requires a University-wide response, please refer to this link: http://www.ehs.ufl.edu/disasterplan/UFEMP.pdf

- In the event of a major disaster affecting the campus, the UF Homepage is the official source of UF emergency related information.

B. Emergency Phone Numbers

Emergency	Normal Business Hours	Evenings & Weekends
Fire/Medical Emergency	**911**	**911**
Police	**392-1111**	**392-1111**
Florida Poison Information Center	1-800-222-1222	1-800-222-1222
Suspected Gas Leak	911	911
Unusual Odor	392-1121	392-1121
Chemical Spill	392-8400 or 1591	392-1111
Radiation Spill	392-7359 or 1589	Call List
Biological Spill	392-1591	392-1111
Physical Plant Trouble Desk*	392-1121	392-1121
Health Science Ctr. Maintenance	392-1121	392-1121
IFAS Facilities Operations	392-1984	392-1121

*24-hour building/maintenance repair hotline

C. Reporting Occupational Injuries or Illness

I. Policy:

Employees of the University of Florida are required to immediately report all work related accidents to the Division of Workers' Compensation. Failure to comply with this policy and procedure on the part of the injured or ill employee or on the part of the appropriate supervisor may be cause for disciplinary action.

II. **Date:** February 1, 1997, revised July 26, 2001

III. Referenced Documents:

a. Occupational Injury Investigation Report Form
b. UF Workers' Compensation Website

IV. Procedure:

All work-related accidents are immediately, or as soon as possible, reported to the University's Office of Workers' Compensation (352-392-4940) (see Figure 6 on following page for procedure to follow when an injury occurs).

v. In the event of an injury while outside the immediate area, while on authorized official business or professional development travel, seek the necessary medical care at the nearest facility or if it merits, call 911. You or the medical provider, however, must notify the University's Workers' Compensation Office as soon as possible.

vi. When an accident occurs on campus the supervisor, or attending appropriate staff, must take action to determine if medical attention is necessary. Even if you do not think you need medical attention you should contact the Workers' Comp office to complete the First Report of Injury or Illness Form.

1) In the case of a severe injury or illness do not move the victim. Dial 911 for immediate assistance. Call the Office of Workers' Compensation during normal working hours at 392-4940. If after normal working hours (after 5:00 or weekends and University observed holidays) call the next business day. Call the Libraries' Facilities Office and the Library Personnel Office to report an accident.

2) In less severe cases, the injured or ill employee should immediately report to their supervisor. The supervisor and the injured employee should call the Office of Workers' Compensation. If the injury occurs after business hours, call the next day. Call the Libraries' Facilities Office and the Library Personnel Office to report the accident.

What to do if an Injury Occurs (*IN ALL CASES, DELIVER FIRST AID WHEN & IF POSSIBLE*)

SUPERVISOR:

_____ call 911 for a serious medical emergency

_____ call the Workers' Compensation Office at 392-4940 during work hours to report the injury and receive medical directions and complete the First Report of Injury form with the injured employee and the assistance of Workers Compensation staff.

_____complete the EH& S Occupational Injury Investigation Report form and deliver it to the Library Personnel Office

INJURED STUDENT OR EMPLOYEE:

_____ call 911 for a serious medical emergency

_____ report injury to the Lab Supervisor and/or your Faculty Advisor

_____ call the Workers' Compensation Office at 392-4940 during work hours to report the injury and receive medical direction. and complete the with the help of your supervisor and Workers Compensation staff . Get your copy from the Library Personnel Office

_____ complete the Occupational Injury Investigation Report form and deliver it to the Library Personnel Office. Keep your copy.

_____ keep your supervisor informed of your progress

IF INJURED WHILE ON PROFESSIONAL/BUSINESS TRAVEL:

_____ call 911 for a serious medical emergency

_____ seek medical attention at the nearest facility as needed

_____ call the Workers' Compensation Office at 392-4940 during work hours to report the injury and receive further medical direction as soon as possible. Complete the First Report of Injury form with the help of the Workers Compensation staff. Get your copy from the Library Personnel Office

_____ report the injury to your supervisor as soon as possible

_____ complete the Occupational Injury Investigation Report form and deliver it to the Library Personnel Office. Keep your copy.

_____ keep your supervisor informed of your progress

FIGURE 6. Procedure to follow when an injury occurs.

vii. The Office of Workers' Compensation will complete the First Report of Injury or Illness over the phone. You will need to provide the following information:

1) The employee's name, class title/code, date first employed by the University, complete mailing address, home telephone number including area code, work telephone number, date of birth, gender, and social security number.

2) The date, time and location of the injury or illness.

3) The date the injury or illness was reported to the supervisor, if different from the date of the accident.

4) An accurate description of the accident including an explanation of what happened and the cause of the accident.

5) A description of the injury or illness.

viii. The University's Office of Workers' Compensation will advise the supervisor and injured or ill employee as to where medical attention should be sought in accordance with standard operating procedures.

1) The University's Office of Workers' Compensation will fax the First Report of Injury or Illness (FRII) Form to the Library Personnel Office.

2) The Library Personnel Office will have the supervisor and injured or ill employee sign the form.

3) The Library Personnel Office will:

- Place a copy is in the employee file.
- Ensure a copy is returned to the employee.

e. The injured or ill employee and the appropriate supervisor should complete the University of Florida, Environmental Health and Safety Occupational Injury Investigation Report, and then forward it to the Library Personnel Office. (These forms may be found in the Library Personnel Office.)

The Library Personnel Office places a photocopy in the injured employee's file and forwards the form to the Libraries' Facilities Planning Office for distribution as instructed by the Environmental Health and Safety Division.

1) The original is sent to the Environmental Health and Safety, Occupational Research Safety Office, P.O. Box 112190, Gainesville, Florida 32611.

2) The canary copy is filed in the employee's personnel file in the Library Personnel Office.

3) The pink copy is sent to the injured employee.

4) A copy is sent the Libraries Facilities Planning Officer.

V. Responsibility:

v. It is the responsibility of an injured or ill employee to report an accident to the appropriate supervisor as quickly as possible.

vi. It is the responsibility of the supervisor to ensure that an accident is reported immediately or as soon as possible, in accordance with this procedure.

vii. It is the responsibility of the Library Personnel Office to maintain and update this procedure as necessary.

8. Fire

8. Fire

A. In case of a fire emergency:

Remember the acronym ***R A C E***

R	Rescue	Rescue and remove all individuals from the area.
A	Alarm	Alarms need to be activated.
C	Confine	All doors, windows and access to the affected area must be closed to confine spread of the fire and smoke. All access must then be restricted to emergency response personnel only.
E	Evacuate or Extinguish	Evacuate the area to allow the emergency response crews to fight the fire. Report to the predetermined rally point for a head count, **OR** attempt to extinguish the fire only if all the following criteria can or have been met: • both the 911 response and building alarm have been activated, • training has been received on how to use a fire extinguisher, • the proper extinguisher is available, • the fire has not spread from its point of origin, • the fire is still small enough to be handled by the fire extinguisher to be used, and • the fire can be fought with your back to the exit to ensure there is a means of escape in the event that the attempt to extinguish the fire fails.

B. Fire In the Workplace

The risk of fire at the University of Florida in the Department of Civil and Coastal Engineering is a very serious concern, from both the standpoint of property loss and personal injury. Even if a fire injures no students, employees or building occupants, the disruption to the Department, College and University can be considerable and much can be lost, in the form of time and information. Great care must be taken to reduce our risk to fire.

C. Common Fire Hazards and Their Control

I. Heating Equipment: Improperly installed, operated, or maintained ovens (including environmental chambers) and other heat producing equipment can lead to a fire.

a. Ovens should be installed and serviced as needed, or recommended, by a licensed technician.

b. Every oven, hot plate, or heater has required minimum clearance distances on all four sides and above. Material and building components must be kept out of this area.

c. Combustible material must never be stored in near heat sources

d. Portable heating units should generally not be used inside buildings. If they must be used, they should be UL listed, equipped with tip-over protection and the manufacturer's recommendations for use strictly followed- especially clearances around the unit! Electric heaters can easily overload electrical branch circuits, causing another fire hazard. An electrician should be consulted to ensure that current amperage limits are not being exceeded.

II. Electrical: Misused, overloaded, damaged, or improperly maintained electrical equipment is a very common cause of workplace fires.

a. Extension cords should only be used for temporary power to "in hand" equipment that is in use by someone "NOW". They should never be used:

- To power equipment on a permanent or semi-permanent basis, in lieu of plugging the equipment directly into a proper outlet.
- Run through walls, above ceilings, etc.
- Attached to building surfaces.
- Where subject to crushing or pinching.

b. Cords should never be left coiled up while plugged in. This can cause inductive heating that will damage the insulation and can cause fires.

c. Multiple outlet strips should be used only where equipped with a surge suppressor and used to power only computer equipment. They must never be used to power appliances or other electric equipment. Doing so can overload outlets and branch circuits. Extension cord and multiple outlet strip misuse is the most common cause of office fires!

d. Circuits must not be overloaded. Warm or hot circuit breakers indicate an overloaded circuit and a serious fire hazard.

e. Romex type wiring must be properly secured and supported. It should never be used as flexible temporary wiring. Damaged conduit, wires,

junction boxes, outlets and switches must be de-energized and repaired by a qualified electrician immediately.

f. Air vents on electrical and electronic equipment must never be blocked and should be kept clear of dust and lint.
g. Circuit breakers should be "exercised" every six months, by turning them off and on, to ensure proper function.

III. **Conventional Cooking**: Microwave ovens, coffee makers and stoves used for food warming can cause fires if misused.
    a. NEVER leave cooking unattended.
    b. All break/kitchen rooms should be equipped with smoke detectors.
    c. Combustible material must be kept away from stovetops.
    d. Follow microwave container recommendations and popcorn instructions carefully.

IV. **Mechanical Friction:** Improperly maintained or cleaned mechanical equipment can lead to fires.
    a. NEVER leave cooking unattended. Bearings on ventilation equipment and conveyors should be kept properly lubricated and aligned
    b. Conveyors and mobile equipment such as loaders and forklifts should be kept cleaned and free of accumulations of combustible material.

V. **Housekeeping:** Poor housekeeping can lead to fires and increase the severity of fires from other causes.
    a. Excessive storage of boxes and other combustible material increases fuel loading that can increase fire severity and decrease the time occupants have to let out in the event of a fire.
    b. Stored material must not obstruct exits, walkways, electrical panels, or emergency equipment.
    c. Combustibles should not be stored close to heat sources.
    d. Stored material must not be within 18" of the level of sprinkler heads.

VI. **Proximity Hazards:** Hazards outside of buildings can expose them to the risk of fire.
    a. Other buildings within 100' pose a risk and should be evaluated for fire risk and considered in emergency plans.
    b. Fuel tanks near buildings should be installed to current codes and protected from vehicle collisions by barricades.
    c. Dumpsters should be at least 30' from buildings to prevent dumpster fires from exposing a structure.

d. Weeds/grass/brush should be kept mowed back at least 30 feet from buildings to avoid fire exposure during the spring wildfire season.

VII. Smoking: Unauthorized smoking or poor setup of smoking areas can cause fires.

a. Starting July 1, 2010, smoking the University of Florida began its tobacco-free campus policy.

b. UF-owned locations included in the policy:
   - UF Main Campus
   - Norman Hall
   - UF Eastside Campus, Waldo Road
   - PK Yonge Developmental Research School
   - UF Human Resource Services Building, University Avenue
   - UF Cultural Plaza on Hull Road
   - UF Milton Campus and Jay Research Facility in West Florida
   - UF-owned properties in Jacksonville

c. Visit: www.tobaccofree.ufl.edu.

d. Unauthorized smoking in buildings must be addressed and stopped if it exists.

e. When available, outside smoking areas must be kept away from fuel tanks, landscaping that has chips or mulch, dumpsters and building air intakes.

f. Butt cans should be of the self-extinguishing type.

D. Special Fire Hazards

"Special" fire hazards are special because of the severe risk of fire loss that they present, the special or unusual safety controls required to effectively prevent severe fires from them, and the fact that they usually are not common in office or residential occupancies.

I. UF Hot Work Safety Program

Improperly installed, operated, or maintained ovens (including environmental chambers) and other heat producing equipment can lead to a fire.

Scope and Application:

This program is designed to prevent injury and loss of property from fire or explosion as a result of hot work in all UF spaces and activities.

It covers: welding, brazing, soldering, heat treating, grinding, powder-actuated tools, hot riveting and all other similar applications producing a spark, flame, or heat.

This program does not cover use of: candles, laboratory activities, pyrotechnics or special effects, cooking equipment, electric soldering irons or torch-applied roofing (See NFPA 241).

All hot work performed by outside contractors shall be in conformance with NFPA 51B at a minimum.

Hot work operations in confined spaces require additional safeguards and are addressed in the UF Confined Spaces Policy (UFEH&S-SAFE-3/30/2001).

Hot work on and near building systems and piping may require additional safeguards and are addressed in EH&S Control of Hazardous Energy - Lockout/Tagout Policy UFEHS-SAFE1-01/04/2002.

II. Definitions:

a. Competent Hot Work Supervisor (CHWS) - For UF employees the CHWS shall have successfully completed competent person training and examination to be considered competent. For outside contractors the hot work supervisor shall be identified and the name provided to the project manager. The CHWS cannot be the hot work operator. Failure to properly adhere to UF Hot Work Procedures shall result in suspension of competent person authority and possible disciplinary action.

b. Designated Area - Permanent location designed for or approved by a CHWS for hot work operations to be performed regularly.

c. Hot Work - Any work involving welding, brazing, soldering, heat treating, grinding, powder-actuated tools, hot riveting and all other similar applications producing a spark, flame, or heat, or similar operations that is capable of initiating fires or explosions.

d. Hot Work Permit - A document issued by the CHWS for the purpose of authorizing a specified activity.

e. Hot Work Operator - An individual designated by UF to perform hot work under the authorization of a CHWS.

f. Welding and Allied Processes - Processes such as arc welding, oxy-fuel gas welding, open-flame soldering, brazing, thermal spraying, oxygen cutting, and arc cutting.

III. Specific Responsibilities:

a. Competent Hot Work Supervisor (CHWS) — The CHWS is responsible for the safe operations of hot work activity under their supervision. These duties include:

- Establish permissible areas for hot work.

- Ensure that only approved apparatus, such as torches, manifolds, regulators and pressure reducing valves, are used.
- Ensure that all individuals involved in the hot work operations are familiar with UF Hot Work requirements.
- Ensure that all individuals involved in the hot work operations are trained in the safe operation of their equipment and the safe use of the process. These individuals must have an awareness of the risks involved and understand the emergency procedures in the event of a fire.
- Determine site-specific flammable materials, hazardous processes, or other potential fire hazards present or likely to be present in the work location.
- Ensure combustibles are protected from ignition by the following means:
    - > Move the work to a location free from combustibles.
    - > If the work cannot be moved, ensure the combustibles are moved to a safe distance or have the combustibles properly shielded against ignition.
    - > Ensure hot work is scheduled such that operations that could expose flammables or combustibles to ignition do not occur during hot work operations.
    - > If any of these conditions cannot be met, then hot work must not be performed.
- Determine that fire protection and extinguishing equipment are properly located and readily available.
- Ensure sufficient local exhaust ventilation is provided to prevent accumulation of any smoke and fume.
- Ensure that a fire watch is posted at the site when:
    - > Hot work is performed in a location where other than a minor fire might develop, or where the following conditions exist.
    - > Combustible materials in building construction or contents are closer than 35 ft to the point of hot work.
    - > Combustible materials are more than 35 ft away but are easily ignited by sparks.
    - > Wall or floor openings are within 35 feet and expose combustible materials in adjacent areas. This includes combustible materials concealed in walls or floors.

> Combustible materials are adjacent to the opposite side of partitions, walls, ceilings, or roofs and are likely to be ignited.

Where a fire watch is not required, the CHWS shall make a final inspection 1/2 hour after the completion of hot work operations to detect and extinguish possible smoldering fires.

b. Hot Work Operator (HWO) — The hot work operator shall handle the equipment safely and perform work so as not to endanger lives and property. The HWO must know that:
   - No hot work shall be conducted without specific written authorization from the CHWS via completion of the Hot Work Permit
   - The operator must cease hot work operations if unsafe conditions develop.
   - The operator must notify the CHWS for reassessment of the situation in the event of suspected unsafe conditions or concerns expressed by affected persons.

c. Fire Watch — The fire watch is an individual posted in specific circumstances, as described above. The function of the fire watch is to observe the hot work and monitor conditions to ensure that a fire or explosion does not occur as a result of the work performed. The fire watch is authorized to stop any unsafe operation or activity. Specific duties and responsibilities include:
   - Watch for fires, smoldering material or other signs of combustion.
   - Be aware of the inherent hazards of the work site and of the hot work.
   - Ensure that safe conditions are maintained during hot work operations and stop the hot work operations if unsafe conditions develop.
   - Have fire-extinguishing equipment readily available and be trained in its use.
   - Extinguish fires when the fires are obviously within the capacity of the equipment available. If the fire is beyond the capacity of the equipment, sound the alarm immediately.
   - Be familiar with the facilities and procedures for sounding an alarm in the event of a fire.
   - A fire watch shall be maintained for at least 1/2 hour after completion of hot work operations in order to detect and extinguish smoldering fires.

- More than one fire watch shall be required if combustible materials that could be ignited by the hot work operation cannot be directly observed by a single fire watch (e.g., in adjacent rooms where hot work is done on a common wall).

IV. Hot Work Operational Requirements:

Hot work is allowed only in areas that are or have been made fire-safe. Hot work may only be performed in either designated areas or permit-required areas.

A designated area is a specific area designed or approved for such work, such as a maintenance shop or a detached outside location that is of noncombustible or fire-resistive construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas.

A permit-required area is an area made fire-safe by removing or protecting combustibles from ignition sources.

Hot work is not allowed:

- In sprinklered buildings, if the fire protection system is impaired.
- In the presence of explosive atmospheres or potentially explosive atmospheres (e.g., on drums previously containing solvents).
- In explosive atmospheres that can develop in areas with an accumulation of combustible dusts (e.g., grain silos).

V. Hot Work Permit:

Before hot work operations begin in a non-designated location, a completed hot work permit prepared by the CHWS is required. Based on local conditions, the CHWS must determine the length of the period, not to exceed 24 hours, for which the hot work permit is valid.

The following conditions must be confirmed by the CHWS before permitting the hot work to commence:

- Equipment to be used (e.g., welding equipment, shields, personal protective equipment, fire extinguishers) must be in satisfactory operating condition and in good repair.
- The floor must be swept clean for a radius of 35 ft if combustible materials, such as paper or wood shavings are on the floor,
- Combustible floors (except wood on concrete) must be:
  - > kept wet or be covered with damp sand (note: where floors have been wet down, personnel operating arc welding or cutting equipment shall be protected from possible shock)., or
  - > be protected by noncombustible or fire-retardant shields.

- All combustible materials must be moved at least 35 ft away from the hot work operation. If relocation is impractical, combustibles must be protected with fire-retardant covers, shields or curtains. Edges of covers at the floor must be tight to prevent sparks from going under them, including where several covers overlap when protecting a large pile.
- Openings or cracks in walls, floors, or ducts within 35 ft of the site must be tightly covered with fire-retardant or noncombustible material to prevent the passage of sparks to adjacent areas.
- If hot work is done near walls, partitions, ceilings, or roofs of combustible construction, fire-retardant shields or guards must be provided to prevent ignition.
- If hot work is to be done on a wall, partition, ceiling, or roof, precautions shall be taken to prevent ignition of combustibles on the other side by relocating combustibles. If it is impractical to relocate combustibles, a fire watch on the opposite side from the work must be posted.
- Hot work must not be attempted on a partition, wall, ceiling, or roof that has a combustible covering or insulation, or on walls or partitions of combustible sandwich-type panel construction.
- Hot work that is performed on pipes or other metal that is in contact with combustible walls, partitions, ceilings, roofs, or other combustibles must not be undertaken if the work is close enough to cause ignition by conduction.
- Fully charged and operable fire extinguishers that are appropriate for the type of possible fire shall be available immediately at the work area. These extinguishers should be supplied by the group performing the hot work. The fire extinguishers normally located in a building are not considered to fulfill this requirement.
- If hot work is done in proximity to a sprinkler head, a wet rag shall be laid over the head and then removed at the conclusion of the welding or cutting operation. During hot work, special precautions shall be taken to avoid accidental operation of automatic fire detection or suppression systems (for example, special extinguishing systems or sprinklers).
- Nearby personnel must be suitably protected against heat, sparks, and slag.

VI. Work Closeout:

a. A fire watch shall be maintained for at least 30 minutes after completion of hot work operations in order to detect and extinguish smoldering fires.

b. The CHWS shall inspect the job site 30 minutes following completion of hot work and close out the permit with the time and date of the final check.

c. The completed Hot Work Permit shall be retained for 6 months following completion of the project.

E. Flammable Liquid Storage and Handling

Improper handling and storage of flammable liquids, such as gasoline and solvents, can lead to dangerous “flash” fires.

I. Flammable liquids should not be used or stored inside buildings unless it is absolutely necessary to operations. If it is necessary to store flammable liquids inside buildings, the quantity should be limited to the minimum necessary.

II. DO NOT store flammable liquids in furnace/boiler rooms.

III. If 25 or more gallons of flammable liquids must be stored in one building, a UL listed flammable liquid cabinet should be used. An alternative is a separate storage shed at least 30 feet from the main building.

IV. Gasoline should only be stored in UL Type I or Type II safety cans.

V. If flammable liquids are dispensed from drums or portable tanks, proper bonding and grounding techniques must be used. Always set portable containers on the ground before filling.

VI. Parts washer covers must rest on their fusible link when open.

F. Spontaneous Combustion

Improper storage of oily rags, chemicals, hay, straw, leaves, or coal can result in a fire.

I. Oily rags should be disposed of in an airtight metal container, which is regularly emptied to an outside container at least 30 feet from buildings. Plant based oils such as linseed oil and wood stains are the most hazardous.

II. D Oxidizers, such as pool treatments, tile cleaners, and disinfection/fluoridation chemicals should not be stored near combustible or flammable liquids. If they mix, a fire can result.

III. Damp hay, straw, or leaves can spontaneously ignite. Store only in outside structures at least 30 feet from main buildings. Never allow hay/straw bales as decorations inside buildings.

G. LPG (“Propane”) and Natural Gas

Improper use of portable gas fueled equipment and inadequate maintenance of piped in gas equipment and systems can lead to serious fires and facility threatening explosions.

I. Only gas fired portable equipment that is approved for indoor use should be used indoors. The use of portable gas fired equipment indoors should be limited to essential operations only.

II. All gas fired equipment and fuel systems should be serviced annually by a qualified technician.

III. Regulators must be kept clear of ice, spider webs, etc.

IV. Inside storage or gas cylinders should be kept to the minimum needed. An approved cabinet or storage room should be used. Gas cylinders must never be stored within 50′ of exits.

V. The emergency plan should clearly require immediate evacuation in the event of a suspected leak. All evacuated personnel should be moved at least 100′ from the building ASAP.

H. Being Prepared for Workplace Fires

Despite all prevention efforts, fires can still occur in the workplace. It may occur because of an equipment failure, an unanticipated hazard, an act of violence, or due to a violation of a fire safety rule. If a fire does occur in your workplace, how well you have prepared will determine the chances of everyone getting out safely and the loss kept to a minimum. Readiness for a fire emergency is referred to as the “Fire Defense Triad,” (see UF’s **RACE** policy in the beginning of this section):

I. **Detection/Notification** — Finding out that there is a fire, as early as possible, letting all building occupants know about it, and notifying emergency services to respond.

II. **Emergency Egress** — Having a way to exit the building safely and to make sure everyone is out.

III. **Incipient Suppression** — Automatic sprinkler systems, fire hoses, and portable fire extinguishers that can put the fire out in its early stages.

I. Detection/Notification

In a small building or office, this may be as simple as someone yelling “fire!” and having an agreed upon meeting place outside. Most UF buildings have complete fire

alarm systems with Detectors; Pull Stations, and Audible/Visual Alarms. Know where your local Pull Stations is located. It or they should be clear and unobstructed. Even though the notification of emergency responders is automatic, someone should still be designated to call 911 from a safe location, in case any of the systems fail. A 9-1-1 call also gives the responders more information.

J. Emergency Egress (Exit)

An "EXIT" is actually made up of three equally important components:

I. An EXIT ACCESS- A clear path through the building to an EXIT DOOR.

II. An EXIT PROPER or EXIT DOOR leading outside.

III. An EXIT DISCHARGE- A safe, clear path from the exit door to a "public way" such as a street or parking lot.

NFPA Standard 101, the "Life Safety Code" sets the actual egress system requirements for any building. While the code requirements vary from occupancy to occupancy, and are beyond the scope of this manual, a few requirements that are applicable to most public buildings are:

I. EXIT signs are required along exit access and at exits unless they are "obvious". Exit signs must have letters at least 6" tall with ¾" strokes. 7. Exit signs must be self illuminated or illuminated by emergency light units.

II. Emergency lighting is required unless there is no occupancy during dark hour.

III. Self-closing fire doors must never be blocked open (Example: the Door on the first flood middle building stairwell).

K. Incipient Suppression

Incipient suppression in UF buildings is limited to portable fire extinguishers. Some buildings have automatic sprinkler protection and/or automatic suppression systems on special hazards. Faculty, Staff and Students who operate equipment with automatic suppression systems should be trained in their purpose, automatic activation methods, and how to manually activate them. If fixed extinguishers are present, and individuals are not specifically prohibited by the emergency plan from using them, special training should be provided in their proper operation.

L. Portable Fire Extinguishers

Portable fire extinguishers are located throughout UF buildings and are regularly maintained by the university. The selection and placement of extinguishers is based

on the types of fire hazards present in the work area. Fire extinguisher types are designated by letter:

- Class A hazards are ordinary combustibles such as wood, paper, and plastics.
- Class B hazards are flammable/combustible liquids such as gasoline, fuel oil, solvents, as well as flammable gases such as LPG and acetylene.
- Class C hazards are any type of fire in the presence of energized electrical equipment.
- Class D hazards are combustible metals such as magnesium, titanium and aluminum.
- Combination types ABC, BC, etc.

Placement of extinguishers should be as follows:

- Class A fire hazards (most areas of most buildings) should be protected by a Class A rated extinguisher within 75′.
- Class B fire hazards should be protected by a properly sized Class B rated extinguisher within 50′.
- Class C rated extinguishers should be installed in areas where fires involving electrical equipment are likely or in any area where an untrained member of the public might grab an extinguisher in an emergency.
- Class D rated extinguishers, approved for the specific metals present, should be installed where combustible metals are worked in a manner creating a hazard. In most cases, this involves handling powdered metals, grinding or machining.

Maintenance and inspection of all fire extinguishers is performed by the University of Florida must be properly to ensure proper operation in the event of an emergency. The requirements are:

- Maintenance — A qualified fire equipment specialist conducts annual maintenance of each extinguisher. This must be documented, usually by attaching a tag.
- Inspection — UF conducts visual inspections (“quick checks”) of all extinguishers in the workplace. This is documented on attached tags or in a logbook. A monthly inspection includes ensuring that: the unit is mounted in its place and not blocked, the gauge (if so equipped) is in the “green,” the pin seal is intact, and the unit appears overall ready for use.

The Department of Civil and Coastal Engineering is committed to the highest possible fire safety standards. Annual or semi-annual fire safety courses instruct Faculty, Staff, and Students alike, in the proper use of fire extinguishers and basic fire safety. Check with your laboratory supervisor, or the department’s main office, for the next available fire safety class.

9. Ladders, Portable Stairs, and Saw Horses

9. Ladders and Portable Stairs

A. A-Frame and Extension Ladders

All ladders should be inspected for damage prior to use. Any ladders that are found to be damaged or broken must be removed from service immediately. Use caution when using an aluminum or other metal ladder around electrical equipment.

When setting up an A-frame ladder, ensure the locking supports are secure and the ladder is rigid before climbing. Check that all four legs are in contact with the ground and will not slide or wobble. Never leave tools or other items on top of the ladder as they may inadvertently fall on a worker when the ladder is moved or folded up.

When setting up an extension ladder, make sure the locking stops are completely engaged and the ladder will not slide when climbed. Place the ladder against a sturdy, vertical surface with both feet in contact with solid level ground at least ¼ the height of the ladder away from the surface upon which it is leaning. Refer to OSHA standards for more details.

B. Portable Stairs and Scaffolding

Portable stairs and scaffolding are a more secure way of working at an elevated position than common ladders. These devices usually have caster wheels for mobility and must be secured before climbing. Refer to the manufacturer's instructions for proper use of these devices.

Industrial scaffolding must be assembled by a qualified technician and inspected prior to use. Workers must wear fall arresting gear when working at heights greater than 6 feet above ground.

10. Electrical

10. Electrical

A. OSHA (Occupational Safety & Health Administration) Tips

OSHA, the Occupational Safety & Health Administration of the United States Department of Labor, offers these basic Electrical Safety Quick Card™ tips.

Electrical hazards can cause burns, shocks and electrocution (death).

- **Assume that all overhead wires are energized at lethal voltages. Never assume that a wire is safe to touch even if it is down or appears to be insulated.**
- **Never touch a fallen overhead power line. Call the electric utility company to report fallen electrical lines.**
- **Stay at least 10 feet (3 meters) away from overhead wires during cleanup and other activities. If working at heights or handling long objects, survey the area before starting work for the presence of overhead wires.**
- **If an overhead wire falls across your vehicle while you are driving, stay inside the vehicle and continue to drive away from the line. If the engine stalls, do not leave your vehicle. Warn people not to touch the vehicle or the wire. Call or ask someone to call the local electric utility company and emergency services.**
- **Never operate electrical equipment while you are standing in water.**
- **Never repair electrical cords or equipment unless qualified and authorized.**
- **Have a qualified electrician inspect electrical equipment that has gotten wet before energizing it.**
- **If working in damp locations, inspect electric cords and equipment to ensure that they are in good condition and free of defects, and use a ground-fault circuit interrupter (GFCI).**
- **Always use caution when working near electricity.**

B. Electrical Safety

The electrical demand in laboratories has grown tremendously since most buildings and labs were designed. It is imperative that the electrical systems in these buildings are not abused or overloaded. Lab staff cannot modify, install or remove electrical systems. Contact the Physical Plant Division or IFAS Facilities Operations to assess or modify the lab's electrical requirements.

C. Electrical Cords

Electrical cords and plugs must be inspected routinely to identify cracked insulation or broken plugs. Any equipment found with damaged cords or plugs must be

removed from service until it is repaired. Wrapping broken insulation with electrical tape is not an acceptable repair method. Electrical cords cannot be run across floors, under rugs, through walls, doors, windows, over ceiling tile or around sharp edges and corners where they can be damaged or cannot be inspected for damage.

D. Extension Cords

Extension cords are intended only for temporary use with portable equipment. Permanent use of extension cords is prohibited. Shop made cords with receptacle boxes may not be used, as they do not meet electrical codes. The use of multi plug electrical boxes is acceptable only if they have an internal fuse. These may not be plugged into one another in series. These should be attached to a solid surface such as a wall or table.

E. Surge Protection

The use of surge protection is recommended for all electrical equipment in all labs. These should have internal fuses and cannot be plugged into one another in series. These should be attached to a solid surface such as a wall or table.

F. Ground Fault Circuit Interrupters (GFCI)

A GFCI should be installed on all outlets located near wet areas such sinks, showers, wash down areas, etc. A GFCI is a fast acting device that interrupts current to protect against shocks and electrocution. GFCI's sense very small current leakages to ground and will shut off the electricity to that outlet. Freezers, refrigerators, and other important lab equipment that requires continuous power should not be plugged into GFCI outlets.

For more information on GFCI's see:
http://www.ul.com/media/newsrel/nr_spr02_gfci.html.

G. Safety Resources

Occupational Safety & Health Administration

University of Florida Laboratory Safety Manual

University of Florida Chemical Waste Management Guide

Electrical Safety Foundation

Fire Safety

U.S. Fire Administration