Safety Training Manual

Rensselaer Polytechnic Institute
Department of Civil Engineering
Geotechnical Centrifuge Center

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This Safety Manual is provided for the training of:

1) Students and faculty of the Department of Civil Engineering

2) Visitors to the RPI Geotechnical Centrifuge Center

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This manual references publications from the Occupational Safety & Health Administration (OSHA), National Institute for Occupational Safety and Health (NIOSH), and other non-copyrighted sources.

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1. Introduction

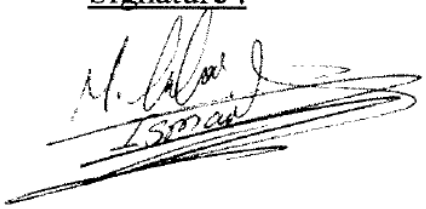
This Safety Manual was developed in order to train students, faculty, staff and visitors of the RPI Geotechnical Centrifuge Center. Included are the procedures for handling equipment and prescribed ways of working so that accidents will be limited. Also included are plans for what to do when accidents do occur. There are also sections of this manual devoted to detailing how to safely use the hand and power tools in this lab. There are some sections included on equipment, such as the forklift, which use of these items is restricted. Only the specifically trained personnel in the lab are able to operate the forklift and other complicated equipment, and unless you are specifically told to do so, do not attempt to use any of these pieces of equipment. Finally, there are also guidelines for typical procedures in the lab involving getting the centrifuge ready for running a test. Readers should take into account general safety provisions whenever performing any of the tasks delineated in this safety manual.

All management and supervisory staff are responsible for keeping the Centrifuge Center a safe environment to work in. The guidelines for what a safe work environment are will be delineated in this Safety Manual.

All employees, students, and visitors are responsible for following the safety and health rules and regulations, reporting hazardous work conditions to their supervisors, wearing prescribed personal protection equipment, immediately reporting any job-related injuries or illnesses, and are restricted to operating equipment in which they are trained and authorized to use.

Safety Officer :
Mohamed Elbibary

Signature :



Date:

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2. General Safety Provisions

- Approximately 6,300 Americans die at work every year
- 33,150 people are injured from falling on stairs a year
- 2,490 eye injuries occur daily
- Injuries occur on average every 20 seconds

These statistics show how hazardous any workplace can be. However, when workplaces set up and follow safety programs, these statistics can be lowered, and in some instances, companies have resulted in zero injuries in their workplaces. The purpose of this Safety Manual is to properly train and advise any personnel in the RPI Geotechnical Centrifuge Center so that the likelihood of injuries occurring is reduced or eliminated.

General Safety Rules

i. Always use proper lifting techniques (bend the knees, not the back)
ii. Do not attempt to lift more than you can
iii. Immediately wipe down and wet or greasy spills
iv. Be cautious when going around corners and through doorways
v. Always report any equipment which is in need of repair which otherwise could cause an accident
vi. Do not place any object such that it creates a falling object hazard
vii. Always use ladders, and not chairs or stools, and be sure to use the ladder in its intended way
viii. Clean any equipment which has been in contact with any hazardous or toxic material before using.
ix. Always wear the PPE provided and never remove it from the laboratory
x. For safety reasons only safety officer and operation manager will be allowed to enforce safety policy and procedures. The safety and health of every employee, students and facility researches is a high priority. Management accepts the responsibility for providing a safe work environment.
Facility users are expected to take responsibility for performing work in accordance with safe standards and practices. Non compliance of any safety policy or procedures will resolve in denial of access to the facility.
xi. Employees and staff discuss safety protocols on a weekly basis or as needed during any research project, all safety topics and concerns are taken into consideration, when reviewing and enforcing lab safety policy and procedures.

3. Hazard Communication Standard (Right to Know Law)

Chemicals present in the laboratory are considered hazardous if they are known to cause health problems, can instantaneously release pressure, if they can catch fire easily or are reactive. These chemicals have many needed uses, but must be handled properly in order to avoid harmful side affects.

The Hazard Communication Standard, or the Right to Know Law, was set for by the Office of Occupational Safety and Health Administration in 1988. This standard requires our institution to create a program which allows facility users to know what the hazards are concerning the materials in the workplace.

The Hazard Communication Standard dictates that a written Hazard Communication Program must be kept. This program delineates requirements for labels and warnings, material safety data sheets (MSDSs), and general information for training that is set forth in the work environment.

Labels

No labels on containers of hazardous chemicals shall be defaced. In the case that a chemical is transferred from the manufacturer's labeled container, the new container will be labeled using the Hazardous Materials Identification System (HMIS).

Material Safety Data Sheets

The purpose of MSDSs are to keep a record of detailed information on each hazardous chemical present in the laboratory. The information is to include any hazardous effects, physical characteristics, chemical characteristics, and any protective measures necessary for the given material. A MSDS shall be requested from the manufacturer for every hazardous chemical that has been inventoried in the laboratory. All MSDSs are to be compiled and kept available for anyone to review upon request. In the case that a chemical in the laboratory does not have a MSDS associated with it, a supervisor should be contacted, and the chemical should not be used until the proper safety provisions provided in the MSDS have been reviewed. In the case that the MSDS is not available from the manufacturer, other sources for obtaining a MSDS include an internet search or any published safety reference.

Chemical Inventory

A Chemical Inventory shall be compiled and maintained for all chemicals and materials present in the work area. This shall be updated annually or sooner if need be. The Chemical Inventory shall be made available for review to anyone upon request. In

addition, all facility users should be advised as to what chemicals they will be working with or be exposed to in the work environment.

Training

The department shall develop an employee and student training program for specific chemicals in their department. Anyone that may be subject to exposure to a hazardous chemical(s) under typical working conditions shall be provided with educational training on the safe handling of such chemical(s). This training shall occur initially and at the minimum of once a year. In addition, anyone who works with any hazardous chemicals in the course of their lab work or research products shall be provided with training. This training will include the locations of the chemicals in the laboratory and the known effects of these chemicals along with information on the MSDS.

The MSDS will be located in the Room 1321.

4. Hazardous Waste

Used hydraulic should be filtered and used again by the attached filtering system to the main pump reservoir in Room 1321, if used oil cannot be recycled again it should dumped in one of the designated drums for hazardous materials in Room 1321 , drums are then picked up by contacting the RPI Environmental Safety Department.
Oil spill pads soaked with oil should not be thrown in garbage and should be thrown in a hazardous waste labeled drum. Oil spill pads are located in Room 1321.
All hazardous wastes are handled in compliance with federal and state EPA compliance guidelines, Hazardous waste is disposed of by certified hazardous waste contractor approved by RPI.

xii. 5. Housekeeping

Good housekeeping is essential not only for efficiency in the work place, but for keeping the work place a safe place to work. It is the responsibility of all employees, students, and faculty in the laboratory to keep the lab a clean and safe place to work. It is important to remove falling object, slip and trip hazards from the workplace before they can cause an accident.

General Guidelines

i. Always put away tools or materials where they belong in Room 1318.
ii. Never leave any equipment on the floor to create a trip hazard
iii. Immediately clean up any spill that causes a slip hazard
iv. Never leave drawers and cabinets open
v. Always keep stairways, hallways, and doorways clear, to prevent fire hazards.
vi. Clean up machinery when done with it
vii. Store chemicals in their proper place with their labels intact , chemical storage is found in Room 1321.

By adhering to these guidelines, many problems caused by carelessness can be avoided, and the workplace will become a much safer place to work in.

We routinely inspect our lab facility on a monthly basis, all formal inspections and members of the management team take responsibility for safety and conduct safety inspections to determine unsafe conditions, any items noted on the inspection report are referred to the safety director, the documented inspections help us to maintain compliance with safety related activities.

xiii. 6. First Aid

In the event an accident does occur in the work place, it is important that any other employee, student, or faculty member on-hand knows what do to in the situation. The knowledge of First Aid can prevent accidents from getting worse, and is important for the safety and well being of everybody in the laboratory. The following will outline what to do in certain situations; however it is important that whenever a serious injury does occur, the proper medical attention needs to be called for right away. However, it is important to not try to perform any advanced procedures that you are not specifically trained in. Doing so runs the risk of injuring the person further and it is necessary to stick to the simpler procedures outlined here, and always call for professional help as quickly as possible.

Wounds

Wounds have two major threats associated with them, bleeding and infections. When dealing with wounds it is important to act as quickly as possible. In order to stop the bleeding, apply pressure to the area, and elevate it as long as no bones have been fractured. Apply a pad bigger than the wound to the area, and reapply new pads until bleeding is under control.

Always thoroughly wash hands with soap and water before treating any wounds in order to prevent infection. Also, only use sterile pads and bandages when treating wounds. Clean the infected area with potable water and dry it with sterile pads or gauze. After this has been done, bandage the wound to prevent future bleeding. Be extremely careful when bandaging an open wound, as using anything but a sterile pad can complicate the situation even more due to the risk of infection. Always take the time to find a sterile bandage to use in this case.

Burns and Scalds

Burns are typically put into three different categories:

i. 1st Degree Burn - The skin appears reddened
ii. 2nd Degree Burn - The skin is blistered
iii. 3rd Degree Burn - Deep tissue is destroyed along with scarring

Burns can cause severe pain, put the subject at risk of infection, and can cause a loss of body fluids. If a severe burn does occur, it is important to try to keep the subject calm. Elevate the affected area, and cover it with dressing and bandages. Do not attempt to remove any charred particles sticking to the burned area or try to pop any blisters. Watch the subject for any signs of trouble breathing, and always maintain an open respiratory passage way.

For treating of minor burns, gently clean the burned area with water, followed by submerging the area in cold water. Apply clean bandages and dressing to the area, but never apply cotton or any greasy substance to the burned area.

In the case of a chemical burn, immediately douse the area with water, as this will wash most of the chemicals off. Cut off and clothing that has also been contaminated. Never touch the burned area, and treat the burn depending upon the severity of the burn, as stated above. It is important to contact medical professionals as quickly as possible, even if the burn appears to be only minor.
Refer to layout

Fractures

Fractures can be put into three different categories

Simple - Broken bone(s) but the skin has not been cut
Compound – Broken bone may be in contact with air
Complicated – Broken bone along with injury to an internal organ

Signs of a fracture include severe pain and discomfort, swelling and discoloration, loss of movement to the affected area and any crackling or unfamiliar noise associated with the movement of the area. (This severe a fracture shouldn't be treated by the provider) The goal of First Aid when dealing with fractures is to reduce the subject's pain and make them as comfortable as possible. Prevention of further injury to the subject can be accomplished by proper First Aid techniques while waiting for the proper attention to arrive.
If a fracture does occur, all unnecessary movement should be avoided, and the affected bones should not be tampered with or tried to bring back together. If bleeding is occurring, prevention of loss of blood should take priority over care for the fracture. Try to immobilize the area to prevent any further movement of the bones in the area. If the bones appear above the skin, the wound shall not be washed or treated with antiseptics. Always be sure to get in contact with the correct medical professionals as quickly as possible.

Electrical Injuries

When part of the body comes in contact with an exposed wire or cable which current is leaking from, the person will receive an electric shock. This can only occur when the person and the wire form a complete circuit, meaning the person in contact with the earth, causing a ground. In addition, any wet conditions can increase the dangers of electric shock, and cause low amounts of electricity to become dangerous. Depending on the shock, complications include: fatal stoppage of the heart, stoppage of breathing, and superficial or deep burns.

It is important for the rescuer to act carefully in this situation; otherwise the rescuer can easily suffer from a shock and put themselves in the same situation as the person they are trying to save. The first step is to switch off the current if the person is still in contact Breakers are found in Rooms 13031318 and 1321

with the electric current. The safest way to do so would be wearing rubber gloves and hitting the switch with a wooden board. Never attempt to cut the wire using a knife or scissors. Never directly contact the victim while he is in contact with the source of electricity. This will result in yourself also being shocked, and will make the situation much worse. Treat the victim for any burns and if the victim has stopped breathing artificial respiration should be given. The victim should be transferred to the proper medical facilities as soon as possible.

Whenever dealing with an injury in the lab, stick to the procedures laid out previously, and do not attempt to perform any procedure which you are not trained in. This will prevent any further complications caused to the person by not performing an advanced complicated procedure properly. It is always best to contact the medical professionals as quickly as possible, since they are trained in dealing with first aid, and know how to properly care for an injured person.

xiv. 7. Bloodborne Pathogen Exposure Policy

This policy is meant to protect the users of the RPI Centrifuge lab from exposure to bloodborne pathogens that may result from coming in contact with any of the following items:

- Plasma
- Sera
- Semen
- Vaginal secretions
- Synovial fluid
- Pericardial fluid
- Cerebrospinal fluid
- Peritoneal fluid
- Amniotic fluid
- Saliva (in dental procedures)

Also included are any other body fluids that are contaminated with blood, and any human tissues that do not include intact skin. The following guidelines are in compliance with the OSHA Bloodborne Pathogen Standard, and adhering to them will reduce the risk of exposure to Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), and other bloodborne pathogens.

Everybody is responsible for safety in regards to bloodborne pathogens. All levels, from senior directors, to student workers, must keep in mind how dangerous it is to come in contact with any of the previously stated bodily fluids, and limit their contact with said fluids at all times. It is necessary that all body fluids, from any person, be treated as hazardous, and the upmost care must be taken to minimize your risk of exposure.

Any employees that, by the nature of their job responsibilities, may potentially be exposed to blood or other potentially infectious materials, are required to attend the 1 hour Environmental Health & Safety course on Bloodborne Pathogens. This course is to be taken prior to completing any job tasks in which exposure to blood or other potentially infectious materials is reasonably possible, and the course must be repeated annually, so long as the risk of the job continues. The following is the description of the course from the EHS department themselves:

“This session provides an explanation of the epidemiology and symptoms of bloodborne diseases, modes of transmission, hazard recognition and exposure control techniques including work practice controls and personal protective equipment. In addition, procedures for post exposure reporting and medical treatment as well as labeling information and the disposal of regulated medical waste are discussed. Employees who successfully complete this session, and as a result of their job function have “occupational exposure”, will be offered the Hepatitis-B vaccine series free of charge.

Information is made available regarding the vaccine's efficacy, safety and method of inoculation."

Any resulting exposure to bodily fluids should be immediately reported to the public safety office or by calling the paramedics [518-276-6611] if severe enough. It is important to adhere to the guidelines in the course when working in a position that involves these high risks of exposure. Always limit your exposure to any bodily fluids, as the lower your exposure to these fluids is, the lower your risk is to become susceptible to any bloodborne pathogens.
Location of safety supplies refer to lab layout.

xv. 8. Personal Protective Equipment

The purpose of using personal protective equipment is to prevent hazards from the work environment from entering the eyes, mouth, nose, or other areas of the body put in danger by a certain task. This equipment includes protective clothing, safety glasses, respirators, protective shields, and various other equipment designed to protect the user. The Occupational Health and Safety Act requires that every worker shall wear the necessary protection clothing, equipment, or devices in order to provide protection from the hazards that the worker is exposed to.

Hazard Assessment

Each department shall assess their work areas including the use of all machines in order to determine if there are hazards in the area and which PPE shall be worn when working in that particular area in order to prevent injury due to those hazards. Any time the work area changes, the department shall make a new assessment of the area in order to see if any changes in the policy need to be made. This means any time a new machine or new equipment is brought into the area.

It is the responsibility of the students and employees to wear any associated PPE when working in the area's that have been designated as PPE areas. It is the responsibility of the department to inform the students and employees on the proper use of PPE and the proper maintenance of the PPE. Anytime a piece of PPE is noticed to be damaged it should no longer be used and should be reported to the proper person in the department.

It is also important to remember that the wearing of PPE is to prevent accidents and hazards. Wearing this equipment doesn't grant the user the extra flexibility to take risks that he or she would not take if they were not wearing the PPE. The hazard and risk will always still exist, even while wearing the PPE, so this should be treated as a last resort risk mitigation.

Types of Personal Protective Equipment

There are 6 different types of PPE:

i. Hand Protection
ii. Foot Protection
iii. Eye Protection
iv. Ear Protection
v. Respiratory Protection

Hand Protection

Hand protection mostly involves wearing gloves. There are different types of gloves that offer protection from different hazards. Leather gloves protect against sparks, mild heat, blows, chips and other rough objects. Aluminized gloves are used in welding and other

heat intensive work, as they are well insulated and provide heat protection. Metal-Mesh gloves protect against cuts, scrapes and sharp object hazards. Finally, chemical and liquid resistant gloves are coated in a non-porous substance to keep the liquid and chemicals off of the user's hands.
When working with hydraulic oil, non-porous gloves are required to be used.

Foot Protection

The most common injury that can occur to the foot occurs when a heavy weight falls on top of the toe, or a sharp object pierces the bottom of the shoe. It is important to wear shoes that protect against both of these hazards. This means choosing a shoe with steel reinforced sole and puncture resistant sole. However, if you are working around electrical cables, wearing rubber sole shoes, that don't contain any metal, are important. Also, if working around chemicals, rubber shoes should also be worn as chemicals can eat through leather much faster than they can rubber.
For Lab operation team, steel toes shoes are required, for lab users and visitors, closed shoes are required.

Eye Protection

The department shall make available and require the use of eye protection equipment for any work involving possible risk of injury to the eye. Eye protection shall be worn in any place that involves:

- Machines that involve the risk of flying objects, liquids, glare, or injurious radiation
- Sawing, milling cutting, grinding, or stamping of a solid material
- Heat treating or tampering of any metal or other material
- Gas or electric arc welding
- Repair to any vehicle or machine
- Corrosive or toxic material
- UV lights or lasers (unless where exempted)
- Any other activity that provides a potentially dangerous activity to the eye

All persons shall wear the proper eye equipment when participating in or observing any of the above activities. Also, chemical goggles or safety goggles are to be worn over the top of regular glasses and contact lenses.
Safety glassed are required, when working with hydraulics and pneumatics systems in the lab and all the machinery that requires eye protection such as grinding wheels and drills.

Ear Protection

There are two main types of ear protection, ear plugs and ear muffs. It is very important to use ear protection when working with equipment and machines. It is very important to protect your hearing, because many of these machines were designed based upon the

assumption that the user would be wearing ear protection. Any time the noise level in the area is above 80 dBA, it is necessary to wear hearing protection.

Ear plugs can either be disposable, and made of compressive foam meant to contour to the ear, or reusable, in which case they need to be individually fitted by a professional, and cleaned after each use. Ear muffs simply fit over the user's entire ear, but they need to fit well in order to create a good seal. Objects such as beards or glasses can create a problem with the seal, but there are special ear muffs designed to deal with these problems.
Ear protection is required when working on shaker calibration. Ear plugs and ear muffs are found in Room 1303.

Respiratory Protection

We supply N95 respirators (dust masks) at Room 1303. Dust masks are supplied upon request when operating soil mixer or working with sand that creates dust. Respirators provide protection against substances that might enter our bodies through our repertory system, we require compliance with OSHA 29CFR1910.134 .

xvi. 9. Electrical Hazards

Whenever work is done with power tools or work is done on an electrical circuit, there is a risk of electrical shock. Many tools that pose a threat of electric shock are used everyday and are often overlooked, but death or serious injury can result from electric shock. Refer to section 13

The severity of the injury caused by an electric shock depends on the amount of current that passes through the body and the amount of time the current passes through. A person can take up to 10 milliamps of electric current and still have control over their muscles, any more than this and a “freeze” or paralysis of the muscles will incur. When this freeze happens, the person is no longer able to let go of the wire or tool which is introducing the current into their body, and the result is often holding tighter and a longer exposure to the electricity. A severe shock can cause much more damage to the body than is visible, internal bleeding and destruction of tissue and muscle can occur. Shock can sometimes cause a delayed death. Even if the current of the shock is too small to cause injury, the shock can still leave the person susceptible to a fall, which may cause bruising, broken bones or burns. Factors such as broken skin and wetness will greatly increase the chance of the body receiving a shock.

Burns

The most common non-fatal shock injury is a burn, which come in three categories.

An electrical burn occurs when a person comes in contact with electrical wiring or equipment that is energized. These are very serious and need to be given attention immediately. Additionally, clothing will become susceptible to fire, and a thermal burn can result.

Arc burns occur because of arc blasts, which happen when high-ampere currents arc through the air. Temperatures as high as 35,000 degrees F have been reached in arc blasts, meaning they give off thermal radiation, which, along with the intense light, can cause burns. By wearing the proper clothing and maintaining the proper distance between and arc, the risk of this injury can be greatly reduced.

Thermal burns can result if an explosive mixture is ignited in the air by a spark of electricity. The ignition can occur from a buildup of vapors, gasses or dusts.

Electrical Fires

Electricity is one of the most common causes of fires and thermal burns in the workplace. Defective or misused equipment is the major cause of electrical fires. Never intentionally abuse a wall circuit by overloading it with extra outlets. Also never use equipment with exposed wires. Never tamper with the grounding mechanism of an electrical circuit, and if the grounding mechanism appears to be damaged, or not functioning, do not use that

piece of equipment. Also, defective insulation can cause major problems as well. If there is an electrical fire, be sure to use the proper fire extinguisher to put it out, a class C or a multipurpose fire extinguisher.

xvii. 10. Lockout/Tagout Procedures

Many accidents in the workplace are caused by the unintentional release of energy. OSHA estimates that 2% of worker deaths can be prevented by adhering to the lockout/tagout procedures. Lockout is the practice of putting a lock on the part of a machine that controls the energy, whether it is a circuit breaker, switch, valve or other device. The first step is to ensure the switch or valve is off, then the lockout device is placed in order to keep the switch in the off position, finally a padlock is attached to the lockout device, so the lockout will not be able to be removed.

Applying Lockout/Tagout

The first step is shutting down the equipment. The authorized lockout/tagout person (safety officer) should know the following things before turning off any equipment:

i. The type and amount of energy being supplied to the equipment
ii. Hazards posed by each energy type
iii. Measures to control the energy

The equipment should be shutdown using the designated controls and following the procedure laid out by the manufacturer in order to decrease the risk of injury to the surrounding people. The next step is to isolate any sources of power, including electrical switch, pneumatic valves, and hydraulic valves. Theses sources should then be locked in order to prevent accidental or unintended startup, following these procedures:

i. Using the designated lockout/tagout device.
ii. If requiring more than one person, then the lockout should be locked with both personal locks, using a multi-lock hask.
iii. The label on the lockout device should be completely filled by the person administering the lockout.
iv. The tag should then be place on the operating control of the machine, the tag should say who was responsible for the lockout and the date and time it occurred.

Removing Lockout/Tagout

The equipment needs to be verified that it is safe to use by all of the employees before the lockout/tagout should be removed. The following is the proper guidelines to do so:

i. The equipment is completely assembled and all tools have been removed;
ii. Everyone in the are needs to be notified that the lockout/tagout is being removed, and they need to stay away from the main energy sources;
iii. Remove the lockout/tagout device and store it away properly
iv. The machine shall be restarted in a logical order, checking for any errors along the way.

The purpose of the lockout/tagout procedure is to ensure that when performing maintenance the safety of the workers is ensured by disabling the power sources. It is essential to never tamper with or remove a lockout/tagout device unless you have the proper designation and have notified all other people in the area. If there is a problem, contact the person who's name appears on the lockout/tagout device.

xviii.11. Ladder Safety

Falls are the leading cause of fatalities in the workplace, with up to 6,000 people suffering disabling injuries per year according to the National Safety Council. Most of these accidents happen when the rules of ladder safety are ignored or broken.

Some of the causes of accidents occurring with ladders include:

i. Failure to secure ladder or place at the proper angle;
ii. Reaching too far along side of ladder, rather than repositioning the ladder;
iii. Creating extra height for the ladder by standing it on top of objects;
iv. Climbing with one hand while carrying objects in the other;
v. Using metal ladders around electrical hazards;
vi. Using ladders that are damaged.

There are three basic types of portable ladders, the stepladder, the single ladder and the extension ladder.

Step Ladder

The step ladder is self supported and has flat planks on one side and rungs on the other side. Whenever using one of these ladders be sure to step on the planked side, and never the rung side, and never on the very top of the ladder. When working at on of the upper planks, have a person hold the bottom of the ladder, as it is much easier to lose your balance or for the ladder to tip, the higher the person is. Always fully open the step ladder and lock the spread joints in place.

Single Ladder

The single ladder is a straight non-height adjustable, non-self supporting ladder. Whenever working with a single ladder, it is necessary to have a person holding the ladder at the bottom to provide increased support. If nobody is available, be sure to brace the foot of the ladder, by tying it off or by other method. When standing the ladder up, the ladder should be offset from the base 1’ for every 4’ of elevation rise.

Extension Ladder

The extension ladder is a straight, non-self supporting ladder that is adjustable in height. The same rules for using a single ladder apply to the extension ladder. In addition, do not extend the ladder to unnecessary heights, and try to keep about 3’ above the edge of a ledge if that is what the ladder is resting on.

There are also some basic rules to consider when climbing the ladder:

i. Inspect the ladder for any defects, cracks or broken parts before using;

ii. Clean shoes and ensure steps have enough skid resistance on them;
iii. Always face the ladder and use both hands whether going up or down;
iv. Use a rope to raise any objects, do not climb with them;
v. Always keep your body within the ladder rails, and never reach to the side to put your body beyond the rails, move the ladder instead;
vi. Never climb onto a ladder from the side or switch from on ladder to another in the air;
vii. Never slide down a ladder.

Following these guidelines will help to increase ladder safety and protect against dangerous falls.

xix. 12. Fall Protection

Fall prevention and fall protection are two different words, often used interchangeably. Fall prevention involves keeping the workplace in a condition in order to minimize the risk of falls. Fall protection occurs when a situation already involves an inherent risk of a fall, so extra precautions must be taken. There are two main types of falls, slips and trips, and falls from elevation. Slips and trips often fall under the category of fall prevention, while falls from elevation fall under both categories

Slips

Slips occur whenever there isn't enough friction to provide necessary traction between a person's feet and the ground. Common causes of slips include:

i. Spills;
ii. Wet or greasy surfaces;
iii. Unanchored carpets or mats;
iv. Floors which have a different levels of traction in different areas.

Trips

Trips happens when the foot comes in contact with something, often on a different plane than the floor, and the person loses there balance and falls. Common causes of trips include:

i. Uncovered cables;
ii. Tools left lying on the floor;
iii. Improper lighting or obstructed view;
iv. Non-level walking surfaces;
v. Loose carpet or loose floor mats.

Prevention of slips and trips can be obtained by following the proper housekeeping practices. This includes cleaning up any spills immediately, cleaning up and tools or other objects that present a trip hazard when done working with them, and closing all cabinets and drawers. Fall prevention can be achieved by making sure all the lighting in the workplace is sufficient, and by replacing burnt out bulbs as soon as possible. If anything that may seem unsafe is seen, be sure to report it a department supervisor immediately. Finally, wearing the proper footwear in the workplace will help to prevent falls.

Falls From Elevation

In this workplace, falls from elevation include working on ladders, or on top of equipment. These are the types of situations which are inherently dangerous, and need to have fall protection, not just fall prevention applied to them. By following the rules set out for ladder safety, the risk of fall from a ladder will be greatly reduced. In addition,

whenever a person is performing a difficult task, it is important to have somebody hold the bottom of the ladder, or be at the base of equipment being stood upon. This not only provides a person who might be able to help break the persons fall, but it also can help the person get the tasks done, by handing them whatever tools they need, and keeping more room for them to safely work. Following these procedures will greatly reduce the risk of falls in the workplace.
Starting from six feet, fall protection rules are enforced.

xx. 13. Accident Reporting

OSHA requires that work related injuries or illnesses be reported and recorded using an OSHA form. This applies for any person who is working for the department, and even persons who are under the day to day supervision of the department.
An injury or illness that occurred in the work environment is considered to be work related. Even if an event in the work environment aggravated a previous injury, it is still considered to be work related. The following are exceptions where the injury is not to be considered work related:

i. The employee was injured in the work environment at a time in which he was not working; he was a member of the public.
ii. The symptoms that arise at work are a result of non-work-related injury that occurred outside the workplace.
iii. The injury results from a voluntary wellness program, fitness or recreational activity such as blood donation, flu shot, or basketball.
iv. The employee is injured from food consumption in which he brought into the workplace himself, such as choking. This does not apply if the food brought in becomes contaminated from the work environment and the employee becomes ill, such as food poisoning.
v. The injury was voluntary or personally inflicted from acts such as personal grooming, self medication, or personal tasks done by the employee outside of the regular work hours.
vi. Cases not applying are the common cold, flu or mental illness. Diseases such as tuberculosis and hepatitis can be work related if proven to have been caught from the work environment. Mental illness needs to be documented from a physician in order for it to be considered work related.

An injury or illness is considered to be a “New Case” if, the employee has not previously experienced an injury or illness to the same body part of the same type, or if the employee had previously experienced an injury to the same body part but had completely recovered from said injury.

Any work related needlestick injury or cut involving the risk of passing along bodily fluids which may contain HIV or hepatitis B must be recorded in the OSHA 300 Log. The employee is also to be protected by having his name left off the log. Any employee that has been determined to have hearing loss as a result of the work environment as determined by the Standard Threshold Shift is also to have the case recorded in the OSHA 300 Log. Any employee that has signs of a positive Tuberculosis test, this case must also be recorded in the OSHA 300 Log.

At the end of each year, the department must:

i. Review the OSHA 300 log to verify accuracy and completeness of records;
ii. Create an annual summary of the injuries in the OSHA 300 log;

iii. Certify this summary and post it in visible locations.

These OSHA 300 Logs along with any privacy summaries to go along with them are to be saved for 5 years after the summaries have been compiled.

Disclosing Injury Records to Governmental Agencies

The government representatives authorized to receive the records are:

i. A representative of the Secretary of labor conducting an investigation on behalf of the OSHA Act;
ii. A representative from the Secretary of Health and Human Services conducting an investigation under 20(b) of the OSHA Act;
iii. A representative from a State Agency responsible for administering a State Plan under Section 18 of the OSHA Act.

If the department receives an annual survey from OSHA, it is to be completed and returned to OSHA or the proper designee. The survey is to include the number of workers in the department, the number of hours worked by employees, and any other requested information about records kept.

Once OSHA inspectors arrive it is required site safety officer should verify there credentials, upon verification the officials should be made comfortable while attempting to contact the RPI safety manager.

Accident Investigation and Analysis

Our intent for the Safety Management Program is to eliminate accidents, injuries and other loss producing incidents. When an incident occurs, it is the responsibility of the individual(s) involved to report to the Site Safety Officer with details and information about the accident (including near misses).

The Site Safety Officer is responsible for performing the accident investigation and analysis of the root cause issues. The investigation will help to determine the following:

- Unsafe conditions that may have contributed to the accident
- Unsafe actions (behavior) that may have contributed to the accident
- Policies or procedures that may have failed to prevent the accident
- Corrective actions that are recommended to avoid future accidents

- What is being done and who is responsible for the corrective actions (include individual(s) names and the time frame to complete corrective actions)

The Accident Investigation Report form (RPI POLICY#01WNMD0725) will be used to document the incident and will be signed by the Site Safety Officer when completed. The form will be forwarded to the Safety Committee (with recommendations) for review and will be used to determine the cause of the incident and possible policy, procedure, and / or training changes that may need to occur to prevent future incidents.

All accident reports, investigation findings, and reviews will be documented through the Safety Committee. All documentation will be maintained and secured on site by the Site Safety Officer.

14. Hand Tool Safety Manual

The following precautions need to be taken when using any hand tools in the RPI Centrifuge Lab in order to promote a safe work environment and keep accidents as small and as infrequent as possible. In general, only use a tool for what it was originally designed to do. Also, be careful to inspect the tool before using it, as older and worn out tools become much more dangerous than a tool in good condition. It is also important to wear the proper safety protective equipment such as gloves or safety glasses whenever using any hand tools. Always remember to keep yourself and the other people working around you in mind when working with tools in the lab. It is important to be aware of your surroundings; not being aware of the position of coworkers is no excuse for an accident occurring in the lab.

Screwdriver:

- Never use a screwdriver as a chisel, as it might shatter and become a hazard.
- Always make sure the handle and shaft do not have any cracks and are in good condition before using a screwdriver.
- Never use a screwdriver as some sort of pry bar.
- Always take the time to find the right sized and right type screwdriver for the job, as this will make your work go by much quicker and also ensure the job gets done the safest way possible.

Hammer:

- Never use a hammer which has a loose or cracked handle, as the head may fly off and become a hazard.
- Ensure that the hammer is both the proper type and size for the job you are performing, as this will make your work go by much quicker and also ensure the job gets done the safest way possible.
- Never use a hammer with a chipped, cracked, or broken claw.
- When using a hammer, keep your motions short and compact, and try to avoid longer swings of the hammer. This will not only cause you to be more accurate with what you strike with the hammer, this will decrease the chance of you hitting something or somebody by accident at the top of the hammer stroke.

Saw:

- Ensure that the saw's teeth are sufficiently sharp, as a dull tool is much more dangerous than a sharp tool.
- Always be careful to cut in a direction that puts yourself and others out of harm whenever possible.
- Always us a vise or other means to secure your work, as this will make it both easier and safer to make a cut with a saw.
- Select the proper saw for your particular job, as this will make your work go by much quicker and also ensure the job gets done the safest way possible.
- Never use a saw with chipped teeth or cracked blades or cracked handles.

Chisel:

- Always select the proper size and type chisel for the job you are performing, as this will make your work go by much quicker and also ensure the job gets done the safest way possible.
- Always keep the chisel sharpened.
- Never use a chisel if it becomes dull and "mushrooms", as this greatly increases the risk of flying chips off the chisel.
- Never use a chisel as a pry bar, or for anything but its intended use.
- When hitting a chisel, keep your motions as short and compact as possible. Doing this will help to ensure that you strike your target, and don't miss the chisel, which might cause the object you are working on to break.

Wrench:

- Ensure the gripping teeth or jaws of a wrench are not worn, as this prevents a slip possibility which makes them a great hazard.
- Always select the proper size and type wrench for the job, as this will make your work go by much quicker and also ensure the job gets done the safest way possible.
- Ensure that the adjustability of an adjustable wrench operates smoothly before using.
- Never, under any circumstance, use a wrench as a hammer, or for any other use that the wrench is not intended for.

Pliers:

- Ensure that the pliers are in good working condition before using them. Inspect the handle, and the teeth of the pliers to make sure there is no excessive wear.
- Take the time to select the correct type and size of pliers for the job. Using the correct tool will not only make the job safer, but it will make the work go by faster with less mistakes.
- Do not use pliers for anything that they aren't intended for, such as a hammer, a pry bar, or any other unsuitable use.

Wire Strippers:

- Do not attempt to use wire strippers as a substitute for scissors, and only cut wires with them.
- When using the wire strippers, be careful of fingers, or any other objects getting caught in the tool.
- Do not use the wire strippers for something that they were not intended for, such as a substitute for a hammer.
- Never cut a wire that is connected to a power source. Always unplug any electric cords from the outlet, and disconnect the wires from any battery source before cutting a wire.

Files:

- When using a file, be careful to be aware of the motion of the file and the surrounding people in the room, including you. Avoid motions in which the file could slip and strike yourself or another person.
- Always try to keep your motions as short and compact as possible, as this will be much safer than using a longer motion.
- Ensure that the file is in good condition before using, as a worn down file will make the job harder and much more dangerous.
- Do not use a file as a pry bar, or for any other use that it was not originally intended.
- Always select the proper type and size of file for the job you are performing, as this will make your work go by much quicker and also ensure the job gets done the safest way possible.

Vise:

- Put the object in a vise in an orientation that would line up the flat sides of the object with the closing jaws of the vise. If there is no obvious flat side of an object, orientate the object as best you can to make sure it is secure in the vise.
- Make sure that the object will not be damaged in any way when the vise is tightened, and consider using some sort of buffer between the jaws of the vise and the object if this is the case.
- Ensure that the object is securely fastened in the vise before performing any type of work on the object.
- Never use a vise other than for the purpose to secure an object, which is its intended purpose.
- Ensure that the vise is in good working condition before using it. Check the jaws and make sure the vise slides as it should.

Cutting Knives:

- Make sure that knives are in good condition before using them. A sharp knife is much safer than a dull knife. Also, check to make sure the handles are not loose at all.
- Always be aware of your surroundings when using a cutting knife. Use the knife in a motion that will not possibly injure yourself or another person if a slip occurs.
- Keep your motions with the knife as short and compact as possible, as this will be much safer than a longer motion.
- Select the proper type and size knife for the job, as this will make your work go by much quicker and also ensure the job gets done the safest way possible.
- Never use a cutting knife for anything other than its intended purpose.

If the preceding instructions are followed, accidents caused from the use of hand tools will be minimized, and the overall safety of the work environment will be greatly improved. In addition to the preceding instructions, always keep tools clean, sharp, oiled, or in otherwise good condition; never force a tool beyond its capability; and always select the proper size and type tool for the job. If at any time, you find that the tool you have

chosen is broken, defective, or unfit for use in one of the ways previously described, this tool should be removed from everyone else reach. The decision then has to be made whether the tool can be fixed, or whether it should be thrown out all together. Safety is always the top priority in the lab, and it is everybody's responsibility to help promote a safe work environment. The mechanical engineer will evaluate tools to determine whether they will be replaced or repaired.

15. Power Tool Safety Manual

The following precautions need to be taken whenever using a power tool in the RPI Centrifuge Lab. It is important to always use a tool for its intended purpose, and to make sure that the tool is not broken and is in proper working condition before beginning to operate it. Always wear the proper safety equipment, especially safety glasses, when working with power tools. All electric tools must be checked to ensure the electric cord is not frayed or broken, to ensure the risk of electrocution is minimized.

Powered Abrasive Wheel:

- Before using an abrasive wheel inspect the wheel itself to ensure there are no cracks or chips which may cause the wheel to disintegrate upon use.
- Always perform a sound test, by gently tapping the wheel, to make sure it is free from defect. A proper wheel will make a clear tone or "ring".
- Never stand directly in front of the wheel on start up.
- Always be aware of any sparks coming off of the abrasive wheel, and ensure they are not hitting any other person, or hitting any object which would create a fire hazard.
- Always use a vise or other means to secure the object you are working on when using a portable abrasive wheel.

Drill Press:

- Always ensure that the drill bit is properly secured in the drill before attempting to use the tool.
- Never use a dull drill bit, as they create a larger safety hazard than a sharp one does.
- Use the drill for its intended purpose, and never force the tool beyond the limits of its capability.
- Be careful to make sure the drill bit will not end up hitting the plate in which the object rests on. Do this by extending the drill to its lowest point before turning on the press, and seeing if it either goes through the hole in the plate, or it stops short of the plate.
- Make sure the object being drilled is securely fastened down, as it can possibly spin around and create a safety hazard while being drilled if it is not fastened.
- Guards shall be affixed to the machine where possible and secured elsewhere if for any reason attachment to the machine is not possible. The guard shall be such that it does not offer an accident hazard in itself.
- Staff should be fully aware of all guarding systems and never remove these systems unless the lock-out-tag-out procedures have been fully implemented.

Cordless Drill:

- Always ensure that the drill bit is properly secured in the drill before attempting to use the tool.

- Never use a dull drill bit, as they create a larger safety hazard than a sharp one does.
- Use the drill for its intended purpose, and never force the tool beyond the limits of its capability.
- When inserting the battery into the cordless drill, make sure it is orientated properly, and insert the battery until it is "clicked" into position.
- When the drill begins to lose power, the battery is low and needs to be charged. Release the battery by clicking the two tabs, and then place the battery in the charger as directed by the instructions.

Power Drill:

- Always ensure that the drill bit is properly secured in the drill before attempting to use the tool.
- Never use a dull drill bit, as they create a larger safety hazard than a sharp one does.
- Use the drill for its intended purpose, and never force the tool beyond the limits of its capability.
- Do not attempt to use the drill if the cord is at or near its limit in being stretched from the electrical outlet. If necessary, use an extension cord to provide some extra slack. This will not only prevent the cord from coming unplugged in the middle of an operation, it prevents a trip hazard to the other people in the work area.

Electric Saw:

- Ensure that the saw is working properly and is free of defects before attempting to use it.
- Always make sure the blade is sharp. A sharp blade is much safer than a dull blade.
- Make sure that the object you are attempting to cut is securely in place, and will not come loose during the cutting.
- Be aware of your surroundings when using the saw. Position yourself and others away from the cutting blade. Be aware of the possibility of the saw "jumping" when the cut has been completed, and stay out of the area where the saw might "jump" to.

Fork Lift:

- The only person using a fork lift is somebody who has previously been trained and certified to do so.
- Always keep hands and feet away from moving parts, and from under any raised loads at all times.
- Working around ledges and inclines calls for extreme carefulness in order to prevent any falls or rolls of the equipment.
- Never stand on the forks, or ride on the forks, under any circumstances.
- Always move at a speed in which you will be able to react under an emergency, and always avoid sharp changes in direction and speed.

- Never attempt to use the fork lift to raise more than what it is rated to do.
- Always be careful to properly load the fork lift, in order to reduce the possibility of the load tipping.
- Always check the truck to ensure the battery level; water level and rest of the truck are in good condition before beginning to use it.
- Crown M Series Fork Lift _ manual http://www.crown.com/usa/safety/pdfs/m_operator_manual.pdf

Engine Hoist:

- Never let your feet or any other body part go below the object currently being lifted by the engine hoist.
- Never exceed the load capacity of the hoist, or attempt to lift an object that will cause the hoist to tip over due to a non-centered load.
- Always inspect the hoist for any defects before attempting to use it.

Paddle Jack:

- Never let your feet or any other body part go below the object currently being lifted by the paddle jack.
- Ensure that the loads being lifted will not tip when being raised or transported.
- Never attempt to use the jack as a platform, or allow another person to ride on the paddle jack.
- Always inspect the paddle jack for defects before use, and keep it properly lubricated at all times.

Hydraulic Table:

- The hydraulic table is operated by battery power, which raises the table up and down. If there is trouble using the table to lift, the power supply might be low.
- When raising and lowering the table, always look out for objects above and below that are potentially a crushing hazard.
- Ensure that the load being lifted is as centered on the platform as possible, and will not tip while being moved.
- Never use this table as a platform or a ladder, or allow another person to ride on the table.
- Do not exceed the load capacity of the table.

Drum Lifter:

- Inspect the lifter for any defects or parts that are not working before attempting to use it.
- Before lifting the drum, ensure that the drum is securely attached to the arm, and the chain is fastened.
- Never let yourself or anyone else's feet or body parts go below the drum while it's being lifted.
- Do not exceed the load capacity of the drum lifter.

Hot Glue Gun:

- The hot glue gun needs to be plugged in to warm up before using.
- While it is warming, ensure that the nozzle end is in the air (the gun is resting on its supports like it should).
- Do not leave anything flammable in the immediate area of using the glue gun.
- When using the glue gun, be sure to keep the hot glue away from any body parts, especially fingers.
- Always unplug the hot glue gun when done using it.

Hot Plate:

- The hot plate is used to heat things up, and used to heat wax up in the lab quite frequently.
- When using the hot plate, be sure to use a ceramic or glass bowl that won't melt on the plate like a plastic bowl would.
- Be sure to never allow body parts or fingers come in contact with the plate.
- Always use gloves or other handling device to pick up the bowl or other object being heated by the plate.
- Turn the plate off after finishing working with it.

Soldering:

- Never touch the element or tip of the soldering iron.
- Always keep the soldering iron in its stands when not using it. Do not put the iron down on the bench even for a short amount of time.
- Work in a well ventilated area when using the iron.
- Always wash your hands when finished soldering, as the solder contains lead which is a hazardous metal.
- Always be sure to unplug the iron when done using the soldering iron.

Safety Officer:

All tools will be inventoried and inspected weekly (in addition to visually inspecting the equipment upon each use). Any equipment found to be in dis-repair will be removed and repaired or discarded.

xxi. 16. Dress Code

The following is the dress code that is to be followed at all times while present in the lab in order to promote a safe work environment. Long pants and fully enclosed shoes are to be worn by any person present in the lab. This includes faculty, students, staff and visitors. This dress code applies all the time (24 hours a day), and applies to every activity, even simple ones.

Whenever operating equipments such as the angle grinder, or anything else that has the potential to injure a person's bare arms, long sleeve shirts become mandatory. This will prevent any inadvertent objects from landing on the person's arm which can cause injury. In cases like this, one is reminded to wear there proper safety glasses and gloves as previously mentioned in the personal protective equipment section of the Safety Manual. Also, whenever operating equipment that rotates like a drill press, there should be absolutely no loose clothing worn. This will prevent the clothing from getting caught in the equipment and posing a large safety hazard.

In addition to these mandatory regulations, it is highly recommended that when working in the lab near heavy equipment, the use of steel-toed shoes. Steel-toed shoes can prevent heavy objects from crushing all the toes on a person's foot.

xxii. 17. Lab Equipment Safety Procedure

The following will detail the proper way to assemble and disassemble the various lab equipment pieces throughout the lab. By following the guidelines laid out here, and keeping general safety precautions in mind, the chance of an accident occurring when maneuvering this heavy equipment will be minimized.
The following information systematically review the steps involve in completion particular job, we have identified the hazardous that a worker will face and established a work plan which includes appropriate safe guards for each hazard.

17.1

Soil Container:
The loading of the soil container on to the centrifuge basket requires the use of the forklift, due to the heavy load by both the soil and the container. Also, in many instances, the container must be loaded onto the basket as smoothly as possible in order to avoid any unnecessary disruption to the soil model that is about to be tested. Below will be a step by step procedure that will allow for the process of loading and unloading a soil container to become easier, and become much safer.

Loading Procedure

1. Wheel the soil container with the associated soil test already set up into the staging room just outside the centrifuge by using the paddle jack.
2. Ensure that the container is in-between the basket and the forklift, otherwise move the forklift into position now.
3. Ensure that the orientation of the soil container is the same orientation that it should be when it is loaded onto the basket. The container will be brought straight to the basket, and not turned around 180 degrees or even 90 degrees, so make the necessary adjustments.
4. Once the container is positioned properly, attach the eyebolts to the container.
5. Screw 1 eyebolt into each of the 4 corners of the soil container.
6. Ensure that the final position of the eyebolt is lined up with the longer length of the soil container. This means the open hole in the eyebolt should be lined up with the shorter width of the container, and the long round top of the bolt should be lined up with the longer length of the container.
7. Attach the lifting arm to the forklift.
8. Ensure the lifting arm is properly set underneath the back brace of the lift and the crossbar is properly resting across the lifting arms of the fork lift.
9. Use a red strap to securely fasten the lifting arm to the forklift arms.
10. Raise the forklifts arms to a position about 1-1.5’ above the top of the container.
11. Using the orange strap, connect one end to the left front eyebolt, allow the strap to pass over the lifting arm, and then connect the other end to the right front eyebolt.
12. Ensure that the strap has not been twisted, and if it has been, undue a connection and untwist the strap.

13. Fasten the strap down.
14. Repeat steps 11-13 for the left rear and right rear bolts.
15. Ensure that both straps have nearly the same amount of slack in them, so when the container is lifted, the container will be allowed to travel level.
16. Before raising the container, make sure the basket of the centrifuge is properly lined up, so the container can rest on it lined up with the edges of the basket in a parallel fashion.
17. At all times while the container is to be transferred in the air, it is extremely important to keep feet and other body parts clear from under the container. In addition, any additional people in the room need to allow for plenty of room between the fork lift/soil container and themselves.
18. Slowly begin to raise the container with the forklift.
19. Raise the container until the bottom of the container is 1-2" above the top of the basket.
20. Check that the height of the lifting arm will not interfere with the top crossbar of the hanging basket. If this is a problem, lower the basket and tighten the orange straps further, to reduce the total height of the moving soil container/lifting arm.
21. Slowly begin to bring the container forward.
22. It is essential, for this phase, that at least one or more persons be present to be able to tell the forklift operator directions and assist him.
23. These extra people need to be positioned to the side of the basket, not behind the basket, as this is a much safer place, and in a spot that the lift operator can easily see and communicate with them.
24. As the container is continued to be brought forward, ensure that the top lifting arm will not come in contact with the crossbar of the centrifuge basket.
25. In order to safely position the container on the basket, on check on the dimensions of the overhang when the fork lift operator is aware, and has stopped moving the container.
26. If the container is aligned properly, and is at the proper overhang distance in reference to the back of the basket, lower the basket down.
27. If adjustments need to be made, do so keeping in mind the extra people being used as spotters, never to move the soil container when they are too close to the container and the basket.
28. Once the soil container is resting safely on the basket, remove the orange straps, and remove the forklift.
29. Look the setup over once more to ensure that the container is sitting on the basket the way as it should before attempting anything else.
30. Unhook the red fastening strap from the lifting arm.
31. Remove the lifting arm from the fork lift.

17.2

Unloading Procedure

The unloading procedure is slightly easier than the loading procedure, because there is less precision involved with placing the soil container on the paddle jack for return than there is placing on the centrifuge basket for a test. However, it is still very important that this procedure is done very carefully, so as to minimize the risk of an accident occurring, and keep the equipment in overall good condition.

1. Attach the lifting arm to fork lift.
2. Ensure the lifting arm is properly set underneath the back brace of the lift and the crossbar is properly resting across the lifting arms of the fork lift.
3. Use a red strap to securely fasten the lifting arm to the forklift arms.
4. Raise the forklifts arms to a position about 1-1.5' above the top of the container.
5. Using the orange strap, connect one end to the left front eyebolt, allow the strap to pass over the lifting arm, and then connect the other end to the right front eyebolt.
6. Ensure that the strap has not been twisted, and if it has been, undue a connection and untwist the strap.
7. Fasten the strap down.
8. Repeat steps 5-7 with the left rear and the right rear eyebolts.
9. Ensure that the lifting arm attached to the fork lift is clear of the top cross bar of the basket.
10. Lift the soil container only a slight amount, 1-2".
11. Slowly bring the fork lift and the soil container back until it is clear of the centrifuge basket by a few feet.
12. It is extremely important to not allow feet or other body parts to go directly below the soil container at any point while it is suspended in the air.
13. Position the paddle jack underneath the suspended container, ensuring that the jack is raised enough to be able to roll on when the container is loaded.
14. Slowly lower the container onto the paddle jack.
15. It is important to not that with such heavy loads, it can sometimes be hard to lower the soil container smoothly, so keep any body parts clear, and be ready for sudden moves of the container during the lowering.
16. After the soil container has come to a rest on the paddle jack, remove the orange straps from the container.
17. Maneuver the fork lift from the area, and wheel the soil container away for the test to be disassembled.

17.3

Roto Drive Shaft Table

This is the special provisions for the loading and unloading of the roto drive shaft table. Due to the size of this container, the procedure for loading it onto and off of the centrifuge basket is slightly different, and the details will be explained here. Again, by following these directions, this procedure will become much simpler, quicker, and also much safer.

1. The roto table will start off by being positioned on top of the hydraulic table.
2. Position the centrifuge basket so it is closest to the door, in a position that is ready to be loaded.
3. Position the hydraulic table with the roto drive shaft container next to the centrifuge basket.
4. Ensure that the orientation of the container will be the desired orientation once it is pushed onto the centrifuge basket.
5. Once the positioning is done, make sure that the hydraulic table will be unable to move while the transfer is being done.
6. Raise or lower the hydraulic table so that bottom of the container is at the same level as the top of the basket.
7. Remember to keep feet and other body parts out from underneath the roto drive shaft container at all times during the process of transferring it to the centrifuge basket.
8. Use a jack to lift the roto drive shaft table, so rollers can be placed underneath the container, and on top of the hydraulic table.
9. Place additional rollers on top of the centrifuge basket.
10. When transferring, have a second person position themselves on the other side of the roto container as you. This will help to push the container, and to keep an eye out.
11. Once the container is on top of the centrifuge basket, remove any remaining rollers, using the jacks to lift the container again if necessary.
12. Lower the hydraulic table down again, and wheel it out of the room.

The same basic procedure is followed for the unloading of the roto drive shaft container, using rollers to transfer the container from the centrifuge basket, to the hydraulic table.

1. Position the hydraulic table next to the centrifuge basket.
2. Raise or lower the table so that the top of the table is about the same height as the top of the basket platform.
3. Make sure that the hydraulic table will be unable to move during the transfer process.
4. Use a jack to lift the roto drive shaft table, so rollers can be placed underneath the container, and on top of the centrifuge basket.
5. Place additional rollers on top of the hydraulic table.

6. When transferring, have a second person position themselves on the other side of the roto container as you. This will help to push the container, and to keep an eye out.
7. Once the container is on top of the hydraulic table, remove any remaining rollers, using the jacks to lift the container if necessary.
8. The table can now be lowered back down, and the hydraulic table and the roto drive shaft container can be wheeled out of the room.

Following the preceding loading/unloading procedures will allow for this process to become much safer and also will help keep the equipment in good condition. It is important to keep general safety measures in mind the whenever working with the loading and unloading of the heavy equipment.

17.4

Centrifuge Spin Procedure:

Once the soil container or split box has been properly loaded onto the centrifuge basket, and the soil itself is set up for the test properly, it is time to spin the centrifuge and conduct the test. However it is extremely important to adhere to the following procedure in order to minimize the chance of an accident occurring. The amount of weight and speed involved with the spinning of the centrifuge test means that if even a small detail is overlooked, it can be cause for a huge problem. Along with a procedure laid out instructing what to do to perform the final check before running a test, photos will be included to help explain the procedure. For many of these steps, following them in the exact order will not be necessary, but the list should be treated more like a check list, because each step is extremely crucial to the overall safety of the test. However, the order should be followed as closely as possible, so as to not miss any steps, or perform any of the steps at the wrong time.

1. In any of the soil containers or split boxes, there needs to be 2 inches of clearance between the end of the container, and the back edge of the basket. When looking at the basket from the door, with the basket between yourself and the center of the centrifuge, the back edge of the basket refers to the edge furthest away from you. Ensure that the container has an overhang of at least 2 inches and that the overhang is uniform for the length of the container (not 2 inches on one side and 3 inches on the other). This is very important for the overall balance of the entire setup. If not properly adjusted now, time will be taken up later to go back and rebalance the container, so it is important to try to get this step out of the way.
2. Ensure that the container or box is perfectly centered on the centrifuge basket. Do this by carefully measuring the distance from the sides of the container or box, to the edge of the basket. If the container or box is not perfectly centered, make the necessary adjustments. Due to the nature of spinning the arm, the basket needs to be centered for the test to run properly, and more on this concept will be explained in greater detail later on in the procedure. Once again, it will be much more time efficient to get this centered now, instead of having to stop the test and fix it later on.
3. Once the box is positioned correctly, connect the hydraulic hoses to the appropriate endings. The hydraulic hoses need to be secured to the arm by using steel ties, and not zip ties. The reason for using the steel ties is because the weight of the fluid running through the hoses can cause the zip tie to break, and thus steel will do a better job in this situation.
4. Connect the input signal cables to the controller, and tie down any loose cables with the zip ties. Fasten the cables to each other, and to the centrifuge arm itself, so nothing will become loose and cause a problem during the test. Any loose cable can pose a risk here as they can become even looser during the experiment, and have a chance to cause an accident.
5. Finish any work preparing the soil for the test. While doing this keep the container or box centered in the basket as it was previously lined up. Also, if the

container is to be loaded eccentrically, load it in the same way in which it was planned to be loaded when calculations were done to balance the container.

6. Connect the sensors and gages from the test to the corresponding receivers on the basket.
7. Connect the cameras and set them up in the proper positions. This step requires that they be angled so that what is being filmed has the proper lighting, and a useful view of what is actually going on. Once the cameras are positioned, turn them on, and take a look at what the video feed quality is. Make any necessary adjustments to improve the video quality.
8. Check the setup for any loose wires or any loose or incomplete connections. Loose wires need to be tied down with zip ties, and connections need to be secured, in order to withstand the forces while the test is spinning at very high speeds.
9. Connect the cards to the SCXI.
10. Tighten the wing nuts on the wire panel. These need to be tightened a moderate amount.
11. Tighten the controllers.
12. Close the hydraulic and electricity cabinet doors. Ensure that the wires and hoses coming out of these cabinets do not interfere with the complete closing of the cabinet doors, and take the time to properly reposition the wires and hoses to ensure the door can be completely closed, if this is the case.
13. Balance the counterweights by moving them into the position that was calculated for the particular test. When moving the weights forward or backwards, do not stop directly at the desired position. Instead, move the weights 2 cm extra, and then proceed to move the weights in reverse, back to the correct position. Moving the weights 2 cm extra, then moving them 2 cm back is extremely important and needs to be done every test. This extra motion prevents the counterweight from sliding during the test, and creating an unbalance problem that will cause the test to be stopped.
14. Rotate the basket 360 degrees by moving it with your hands. While doing this look for any potential conflicts between moving parts. Also, check to make sure that wires, cables, and hoses will not become or possibly become tangled or caught on any objects.
15. Clean the floor and the centrifuge. Clear out any debris as the debris can become airborne and cause a lot of interference during the test. Clean the floor from any oil spills or soil on the ground, and also clean up any zip ties that are on the ground as well.
16. Turn on the main power supply at this point, as it will need some time to warm up before it can be used. Also, turn on the auxiliary power.
17. Close the main centrifuge door, and check the handle to ensure that it has latched, and it is fully closed. Ensure that no equipment or people are left inside the room before closing the door.
18. Close the secondary doors. Ensure that the red light of the safety switch has turned on, as this will mean the door is closed. Again, ensure that nobody is left inside the room before closing the doors.

19. Close the third set of doors. Again, ensure that nobody is left inside the room before closing the doors.
20. In the control room, turn on the screens, and check the camera feeds and the microphones to ensure that they are working properly, and picking up the correct visual feed. Make any necessary adjustments to fix the audio and visual inputs. The nature of many test make it very important to have quality visual data that can be reviewed after the experiment.
21. Start the unbalanced pump.
22. Start the centrifuge, and keep the test at only 20 G's to begin. This is so the balance of the setup can be read and any necessary adjustments can be made before spinning the test at high speeds. It is extremely important to properly balance the setup in the early stage. If the experiment is run unbalanced at a high speed, the risk of an accident occurring becomes much greater, and thus, this action should be avoided.
23. Check the unbalance. The unbalance needs to be in the range of 0-15 KNs. The preference here is that the unbalance is as close to 0 as possible. If the unbalance is too high, 16+ KNs, then the container and basket are too heavy, and the counterweights need to be moved back further. This means that the counterweights need to be moved away from the basket, and towards the wall. If the unbalance is negative, and exceeds -16 KNs, then the container and basket are too light, and the counterweights need to be moved in further. This means that the counterweights need to be moved towards the basket, and away from the wall. Keep in mind, when adjusting the counterweights, to follow step 13, and move the weights an extra 2 cm and then reverse, as this procedure is necessary for the overall safety of the experiment.
24. If the unbalance is close to 0, it is okay to proceed with the test, if it is close to the 15 KNs, it may call for the weights to be adjusted, and this decision is left up to the primary authorized personnel. The primary authorized personnel and the procedure designated for making this and other decisions regarding running tests on the centrifuge will be detailed later on in this manual.
25. Next, check the Off Axis. The Off Axis is not to exceed 14 KNs, with the optimal value being 0 once again. If the Off Axis is negative, the right side of the basket is too heavy. When looking at the basket from the door, with the basket in between yourself and the center of the centrifuge, the "right side of the basket" refers to the edge of the basket on your immediate right. If the values here are unacceptable, it becomes necessary to stop the test, and reposition the container or basket so that the Off Axis will now fall within the correct limits.
26. If the Off Axis is close to 0, it is okay to proceed with the test. If it is not, then it may be desirable to reposition the container, and again, this decision is left to the primary authorized personnel. It is likely that if both the Off Axis and the unbalance are in the acceptable range, but just barely, that the test should be stopped and the equipment be adjusted accordingly.
27. Once the equipment has been balanced, proceed with spinning the test to the designated speed, keeping an eye on the unbalance and Off Axis, making sure they don't exceed the limits at higher speeds. Both the authorized personnel need

to be present in the control room and watching the experiment the entire time the centrifuge is in its spin procedure.

Following these procedures will help to ensure the safety and the overall quality of the experiments run in the centrifuge. Due to the nature of the heavy objects being spun at high speeds, it is extremely important to follow these and any other general safety procedures. Doing so will also ensure that the data collected from these test is of the highest accuracy, which is extremely important as well, since the process of running a test is very intensive, and they cannot be run every day.

17.4 Confined Spaces

Located above the centrifuge machine a space to access the rotary joint, no one is permitted to access that space unless authorized. The authorized personnel who are allowed to access that space is the mechanical engineer and people who took special training by the mechanical engineer.

17.5 Explosives

For handling explosive, there are two certified personnel who can handle explosives, Prof Tarek Abdoun and Prof Tom Zimmie.
Explosives are stored in a special steel safe, the combination key for opening that safe is known only by the pre-mentioned professors.

17.6

Special Note on Centrifuge Personnel

The following will give an outline of requirements of the centrifuge personnel necessary to be present in order to conduct an experiment. The requirements set out here are to keep the general safety of everybody in the lab in mind. These guidelines must be followed every time a test is conducted using the centrifuge.

1. Primary authorized personnel can operate the centrifuge machine when at least one other secondary authorized personnel is present. These personnel have the most experience in the conducting of centrifuge experiments, and are the most qualified to handle making the decisions required to run a test. Currently, the primary authorized personnel in the lab are:

i. Tarek Abdoun
ii. Inthourn Sasanakul
iii. Mohamed Elbibary

A secondary authorized personnel is a faculty member or student who has been designated their title by the operations manager. Currently, the operations manager is Inthourn Sasanakul. The approval to become a secondary authorized personnel is done on a case by case basis. These personnel are subject to change with time, but it is still necessary to properly designate the personnel before the test is run. In the event that two primary authorized personnel are present, then it is unnecessary to have a secondary authorized personnel present. This system ensures that there will be several people present during any running of the centrifuge, which is very important. Sometimes having that extra person there means the difference between catching the mistake in time or allowing for an error to occur.

2. Before the centrifuge can be operated, it is necessary for both the authorized personnel on site to perform an inspection of centrifuge. This inspection should include the centrifuge basket, all attached equipment, the centrifuge itself, and the surrounding area. These final checks should make sure that the equipment is properly set up to be run at a high speed, and also used to give one last check to find any loose wires or debris that can create a problem during the experiment. The high speed of the centrifuge while it is operating means that this room has to be clear of all debris, and since so much work is done in the centrifuge room setting up and preparing the experiment, it is easy to leave a screwdriver or other object on the ground. Both of the inspecting personnel need to agree that the centrifuge is safe and ready to operate before the test can actually be conducted. In the event that the two authorized personnel can't agree whether or not the equipment is safe, the operations manager needs to be called in order to make the final decision.

3. The lab users are responsible for the equipment that is corresponding to the test they are running. If any new parts are added, the user is responsible for the design and analysis of this part. The new part should be looked at on how it will react under strained

conditions being put on by the centrifuge. Also, the part should be checked to make sure that it will integrate properly with the rest of the setup that is planned to be used for the test. The analysis and the method of attachment will need to be reviewed by the lab engineer before the test is to be conducted.

2. In the absence of a manager, question about centrifuge operations are to be handled by the associate director and/or the director of the CEES center.

17.7

Soil Mixer:

The soil mixer is used in order to obtain a uniform mixing of large samples of soil. Often clay is put into the mixer in order to remix it by adding water, and the use of a mixer makes the process much easier. The size and power of the soil mixer make it extremely important to be careful when using, and as always, using large industrial machines requires attention to detail so that there are no slip ups. This mixer's original intended use is for industrial kitchen applications; however it will serve its purpose in the lab perfectly, as the process of mixing soil is similar to that of mixing dough or whatever else this model is used for in the kitchen. By following the following procedures, and keeping general safety ideals in mind, it will be possible to safely use the soil mixer, and minimize the chance of accidents from occurring.

1. Use the specific dolly to roll the mixer bowl around and into position. This dolly is designed to carry the mixing bowl, and makes the transporting of it much safer and cheaper.
2. Ensure that the mixing screen has been rotated so it is out of the way for the loading procedure. This is the protective cage that needs to be swiveled around that way while loading there is no blockage of motion.
3. The mixing arms will need to be attached before the bowl is put in place, to make for an easier set up.
4. Remove the arms and clean them of any debris if necessary.
5. Reattach the arms. These arms need to be fastened in from the bottom up. These arms should "lock" into place, and once in place, they can't be taken out unless the release switch is hit.
6. Ensure that the arms are securely fastened, and properly locked in.
7. Lower the bowl connecting brackets to the level of the bowl as it sits on the dolly. The control for the connecting brackets, and the entire assembly, can be found on the right side of the mixer.
8. Ensure that the bowl is orientated so that the proper connecting brackets align with the bowl's own brackets.
9. For frame of reference, the left bracket refers to the bracket on your immediate left as you are facing the front of the machine.
10. The left bracket is a double bracket, so it lines up with the corresponding double connection of the mixing bowl.
11. Lock in the bowl's left connection to the left bracket.
12. The bowl will now be free to swing around, allowing for the right connection and right bracket to be securely fastened.
13. If at this point, the bowl is sitting on the arm crooked, then inspect the connections between the bowl and the mixer. Ensure the double pin and double bracket are properly lined up, and that there is nothing in the way of the pins and the brackets.

14. Raise the height of the mixing bowl, trying to do so before any soil has been added to the bowl, in order to avoid the interference of trying to raise a bowl filled with soil, hitting the bottom of the mixing arm.
15. If there already is soil in the bowl, it is possible to still raise the bowl into the proper position, but it becomes more difficult. It may be necessary to start and stop the mixer, just to break up the jam caused by the mixing arm compacting the soil.
16. Close the mixing screen. In its closed position, the cage should be between you and the soil inside the bowl. Always close this screen before starting the machine. Even though it may not seem like the screen is necessary, this will prevent hands or anything else from accidentally entering the bowl while the machine is on. This is important as it will keep someone who is walking near the bowl from tripping and falling into the bowl.
17. Before starting the mixer, ensure that no hands are near the bowl, and also keep any loose clothing away from the moving parts of the mixer. Also ensure that there are no foreign objects that have fallen into the bowl that are not supposed to be mixed in.
18. Make sure that the timer is set correctly for the designated time, and begin mixing. Always set the time for a shorter rather than longer time, as it can be easy to go back and mix the soil more if needed. The same principle holds true for adding water or any other ingredient to the soil in the mixing bowl.
19. When the soil is mixed to a sufficiently, stop the machine. Never attempt to try to check the results of the soil until the mixing arm has been shut off and has come to a complete stop.
20. Rotate the mixing screen to an unguarded position. This means that the screen has been rotated away from you, giving maximum room to work with inside the bowl while it's attached to the mixer.
21. Position the dolly under the bowl. Line up the cone of the bottom of the bowl and the hole in the center of the dolly.
22. Lower the bowl onto the dolly. While performing this process, make sure that there is nothing on top of the dolly that will interfere with how the mixing bowl is sitting on the dolly. Lower the bowl slowly
23. Remove the connections with the brackets, starting with the left connection, followed by the right connection.
24. Wheel the dolly away from the soil mixer.
25. Return the connecting arms to their upright position before turning the soil mixer off.

By following these procedures, the use of the soil mixer will not only become much easier to use, the chances of an accident occurring while using it will be minimized. As with any equipment or machines used in the lab, it is important to keep general safety precautions in mind:

- Keep all body parts, especially feet; out from under the bowl at any time it is not securely fastened to the mixer or resting on the dolly.
- Keep hands and loose clothing away from any moving parts while the mixer is running.

- Use safety glasses and wear any other personal protective equipment while the machine is on, to avoid the chance of having soil fly out of the bowl and become an eye hazard.
- Be aware of your surroundings whenever using the machine. Never turn on the machine until it is absolutely clear that there are no obstructions in the way of the mixing arm.

18. Fire Safety Policy

In the case that the building fire alarm sounds, the following procedure needs to be followed no matter what you are doing. Even if you are doing something important, whenever you get to a safe spot, stop what you are doing and follow the procedure.

- Evacuate immediately, checking your immediate are to make sure that others have also left, and close the doors behind yourself.
- Use the stairway at the end of the hall, and proceed out the door in the hallway of the second floor. Do not use the elevators during a fire alarm.
- Be careful when opening doors. Touch them carefully to make sure it isn't hot indicating fire on the other side. Look threw the glass window for any signs of smoke. If you have to walk threw smoke, stay low and breath threw a wet towel if possible.
- Do not re-enter the building until the safety officials have given the all clear.
- Always know where the fire safety equipment is in and around the work area. Also, remember the escape route, and what to do in case of the main route being blocked.

Following these steps will greatly increase the safety of everybody in the lab during times of a fire. The most important things to remember is to stay calm, but to move quickly.

Flammables and combustibles are stored in Room 1321.Flammables are limited to spray lubricants or cleaning solvents

19. Emergency Plan

EMERGENCY RESPONSE PLAN

The following emergency response plan specifies the actions management and employees must take during disasters such as tornadoes, hurricanes, earthquakes, floods, fire, chemical spills and other potentially hazardous conditions.

This facility location must develop their own action plan around the following outline:

EMERGENCY ORGANIZATIONAL STRUCTURE

1. Emergency First Responder Team
   a. Qualifications
   b. Duties

2. Emergency First Responder Teams
   a. Recruitment
   b. Training
   c. Duties

3. Emergency Equipment and Supplies
   a. Alarms
   b. Communications
   c. First Aid (refer to the lab layout for locations)

EMERGENCY EVACUATION PROCEDURES

1. Map Indicating:
   a. Escape Routes
   b. Emergency Assembly Areas
2. Shutdown Procedures
3. Method to Account for all employees
4. Security Measures

EMERGENCY TRAINING FOR ALL EMPLOYEES

1. Elements
2. Timing
3. Drills

LOCAL OFFSITE EMERGENCY RESPONDERS

1. Fire Department
2. Police Department
3. Ambulance Service
4. Civil Defense/Red Cross

PLAN DEVELOPMENT

Local management has the responsibility for providing emergency response plans at their facilities. They must decide which program best meets their needs.

The emergency response plan should be clear and made available to all personnel. The plan should be reviewed and updated as required reflecting changes in personnel and the facility.

Risk Assessment

The emergency response action plan should address all potential risks and emergency situations that could develop. Effective risk assessment recognizes potentially dangerous conditions and builds a response plan for controlling the situation.

Identify and list the specific types of disasters that pose the greatest threat to individual locations. Some of the exposures that should be considered are:

1. Fire
2. Major gas and water main breaks
3. Flood
4. Earthquake
5. Snow and ice buildup
6. High winds
7. Tornado

PLANT DETAILS

Alarms

Alarms alert employees to evacuate or take other action. The alarm system in use must be evaluated to determine if it can be seen or heard by all people in the facility. Police and fire departments may be asked to evaluate the alarm system being used.

Communications Equipment

When alarms are activated, employees should receive additional instructions through the public address system or intercom. During a disaster portable radio units and battery operated P.A. systems are needed to communicate to employees.

Emergency Evacuation Procedures

Floor plans or work area maps clearly showing escape routes should be posted in key areas and easily seen. These should indicate the nearest shelter areas, best routes for escape and assembly points outside the building.

A designated person must account for all employees after evacuation. Inform the Response Team of any missing personnel.

Shutdown Procedures

Before evacuation, employees should turn off their own equipment such as machinery and forklifts. Employees responsible for the shutdown of critical systems such as electric, gas and other systems should complete these procedures before evacuating if safe to do so.

Emergency and First Aid Supplies

If safe to do so, designated individuals should bring emergency supplies to their assembly area. These supplies should be stored in the immediate area, packaged in a kit-like form, kept fully stocked and used for emergency purposes only. Supplies should be checked monthly to ensure their reliability and availability. At a minimum, the following items must be included: portable radio with spare batteries and flashlights with spare batteries.
Designated individuals with first aid should be in charge of bringing first aid supplies to their designated assembly area. First aid supplies should be stored in the immediate area, packaged in a kit and checked on a monthly basis. The following items may be included: bandages, antiseptics, special medicines, blankets and a first-aid handbook.

Security Measures

An Emergency First Responder Team member should be appointed to handle security after an emergency. This individual should compile a list of security issues that can take place after a disaster, including looting of inventory, theft of company records and documents and prevention of further accidents to onlookers and employees in unsafe areas. Security efforts should be coordinated with community law enforcement personnel.

IMPLEMENTING THE EMERGENCY RESPONSE PLAN

An effective method for implementing the Emergency Response Plan is to assign that responsibility to an Emergency First Responder Team (ERT). The ERT should have an appointed leader and team members trained in emergency procedures.

Emergency First Responder Team Coordinator

An individual should be designated Emergency First Responder Team Coordinator.

The duties of an Emergency First Responder Team Coordinator include:

1. Assessing the situation and determining whether the emergency requires the activation of the Emergency Response Plan.

2. Directing the implementation of the Emergency Response Plan, including the evacuation of personnel and the minimization of property loss.

3. Activating required security procedures.

An alternate Emergency First Responder Team Coordinator, having authority similar to the Emergency First Responder Team Coordinator, should be appointed and trained.

Emergency Response Teams

Personnel should be recruited who are physically capable of performing duties assigned to them by the Emergency First Responder Team Coordinator. Ideal team members would already have training and experience in responding to emergencies, such as volunteers on local fire, rescue and first-aid squads.

Emergency First Responder Teams should be trained in the following emergency procedures:

1. Firefighting
2. First aid and cardiopulmonary resuscitation (CPR).
3. Shutdown procedures.
4. Disaster evacuation procedures (tornado, flood, explosion, etc.)
5. Chemical spill control procedures (not all locations).
6. Use of personal protective equipment, including respirators (not all locations).
7. Search and rescue procedures.

All team members should be informed about any special hazards such as flammable materials.

Local Offsite Emergency Responders

A survey of the location and services of local offsite emergency responders should be made. Information that should be provided to each of these agencies follows. Site operation manager, safety officer will meet any responders to detail information of the emergency in the lab.

1. Fire Department
    a. The location, construction and arrangement of all buildings.
    b. Accurate floor plans of each building.
    c. Knowledge and acquaintance with all special hazards such as flammable gases, liquids and materials.
    d. On-site fire equipment: type, location
    e. Access routes in and around the property.

2. Police Department
    a. The location and arrangement of all buildings.
    b. Accurate floor plans of each building.
    c. Traffic patterns in and around the property.
    d. Potential security problems.

3. Ambulance Service(s)

    a. The location and arrangement of all buildings.
    b. Accurate floor plans of each building.
    c. Access routes in and around the facilities.
    d. Hospital locations.

4. Employee Training

    Employees should be trained in procedures to follow for each type of emergency. Proper training reduces the chance of panic and confusion. Training should include:
    a. Types of potential emergencies.
    b. Evacuation plans.
    c. Alarm systems.
    d. Reporting procedures.
    e. Operating equipment shutdown procedures.
    f. Response action.

    A most important aspect of training is practice drills, which ensure that employees know where to report and what their duties are in an emergency. Drills should be held at random intervals at least two times per year.

Employees and departments should be evaluated as to their drill performance. Evidence of ineffective emergency response procedures should be noted and investigated by management, with follow-up drills scheduled to observe if past problems have been corrected

20. Vehicle Exposure

NEES centrifuge facility does not own or maintain any vehicles. It is the responsibility of the driver to follow the laws and rules of the operation and use of motor vehicle for the state of New york. Tickets for moving violations and parking violations are solely are the responsibility of the individual driver.

21. Appendix

21.1

Links to Manufactures Safety Manuals:

DeWalt 4 ½ "Heavy Duty Angle Grinder DW28110
http://www.dewaltservicenet.com/documents/English/Instruction%20Manual/641881-00,D28110.pdf

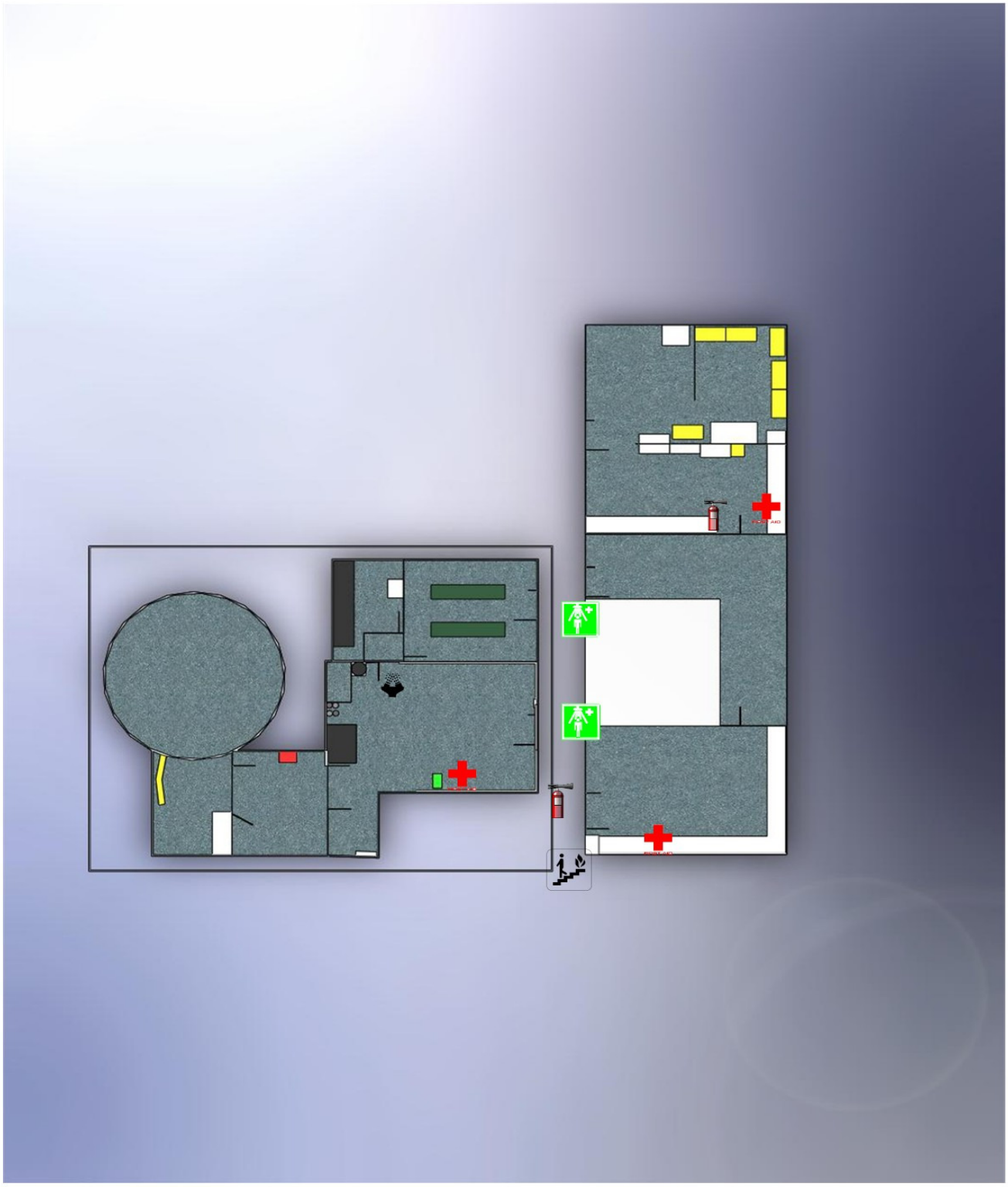
DeWalt Cordless Drill DC728KA
http://www.dewaltservicenet.com/documents/English/Instruction%20Manual/631370-00,DC727.pdf

DeWalt 3/8" VSR Drill D21008K
http://www.dewaltservicenet.com/documents/English/Instruction%20Manual/626493-00,D21002.pdf

Grizzly Industrial Bench Floor Drill Press G0485
http://www.grizzly.com/images/manuals/g0485_m.pdf

Crown M Series Fork Lift
http://www.crown.com/usa/safety/pdfs/m_operator_manual.pdf

Hobart Soil Mixer HL600 ML 134284
http://www.hobartlink.com/extranet%5Cextranetmanualsandcatalogs.nsf/43F403414D9003D28525724C0046D59E/$File/F34916_RevB_03_07.pdf



RPI Centrifuge Lab Layout