KENNESAW STATE UNIVERSITY
COLLEGE OF SCIENCE AND MATHEMATICS
Department of Physics

Physics Laboratory Handbook

For Faculty, Staff and Research Students

Fall 2017

Preface

This handbook is presented as an information and reference source to be used, along with other materials, as a guide to proper and safe practices in the physics laboratories of the College of Science and Mathematics at Kennesaw State University.

The productive and safe operation of our laboratory space is a team effort. We have a collegial community of undergraduate students, graduate students, staff and faculty all working towards the same goal; the fostering of a safe and supportive working environment. No person is exempt from laboratory policy and regulations. Everyone using or visiting the laboratories must comply with the policies regarding lab safety, equipment use and lab etiquette.

9.12.4 Environmental and Occupational Safety

The Board of Regents is committed to achieving excellence in providing a safe working and learning environment, and supporting environmentally sound practices in the conduct of institutional activities. Each institution shall, at a minimum, comply with applicable environmental and occupational safety laws and regulations, and shall designate a key member of its administrative leadership team to oversee compliance. In the absence of specific laws or regulations, each institution will follow industry standards and good management practices.

Each institution shall maintain policies and procedures to govern activities to meet the goal of comprehensively integrating occupational safety and environmental considerations, and will periodically review and update such policies and procedures.

The USG chief facilities officer is responsible for developing standards, guidelines, and processes to promote, support, and access the implementation of environmental and occupational safety management programs and initiatives.

The USG chief facilities officer shall require institutions to provide reports related to environmental and occupational safety performance and shall report such data to the Board on an annual basis (BoR Minutes, June 2009).

Remember that **you** are responsible for:

- Your own health and safety.
- The health and safety of those around you.
- The security and the safe use of equipment and facilities that you have been authorized to use.
- Understanding and complying with all laboratory policies

Safe and proper participation in the laboratories is a requirement whether as an employee or student. Failure to do so may result in loss of laboratory privileges or termination of employment. **If any hazardous materials are to be used in your activities, see the General Laboratory Handbook for information**

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Definitions

The term "lab" has been used for several different meanings. For the purpose of our safety information, the following definitions will be used:

- Lab or Laboratory: A room where scientific scholarship activity takes place using hazardous chemicals or materials.
- Prep room or prep lab: A room where materials are prepared, stored and staged for instructional laboratory activities.
- Instructional Lab or Instructional laboratory: A room used for instructional activities.
- Instructional Laboratory Activity. Procedure performed for the purpose of instruction.
- Field Research or Study: Scientific scholarly activity conducted in an outdoor setting, on or off campus.
- Academic Field Trip: A course related activity which normally involves travel for the group of students enrolled in a class.

Smoke-free and Tobacco-free Policy

Kennesaw State University is dedicated to maintaining a healthy working and learning environment for employees, students, and visitors. The former KSU Smoking Policy has been updated to align with the Board of Regents of the University System of Georgia (USG) Tobacco and Smoke-Free Campus Policy, effective October 1, 2014. The purpose of this policy is to create a smoke-free and tobacco-free environment at Kennesaw State University (KSU) and to establish the KSU Smoke/Tobacco-Free Committee with the responsibility for developing, implementing, and overseeing this policy, procedures, best practices, and activities for the University.

smokefreeandtobaccofreepolicy_10012014.pdf

Firearms and Other Weapons

Information for the possession of firearms on campus can be found at http://police.kennesaw.edu/campuscarry.php

Emergency Procedures

This section is to provide instructions for some common occurrences. Refer to the Kennesaw State University Chemical Hygiene Plan and the Emergency Action Plan for more information.
http://www.kennesaw.edu/sss/planning/planning.html

Fire Alarms

Become Familiar with emergency evacuation plans for your building. When the fire alarm sounds, you must evacuate the building. Remind all in the room to take their Personal belongings (coat, keys, books, etc.) with them. You may be out of the building for a prolonged period of time.

Practice fire drills do not occur unless well planned and announced repeatedly in advance. Treat every alarm as a serious matter. You may only have seconds to evacuate.

Outdoor Sirens

The sirens outside are warnings to seek shelter indoors. In those types of situations, such as a tornado warning, other methods of notification such as automatic cell phone, text and computer pop-up will occur for those indoors.

Severe Weather

There are two types of tornado alerts issued by the National Weather Service:

TORNADO WATCH- *The formation of tornadoes is possible within and near the watch area*

TORNADO WARNING- *A tornado has been spotted on the ground or by Doppler radar. If you are in the warning area, should take action immediately to protect your life and the lives of others.*

If a **TORNADO WARNING** is issued, you may receive that information through the campus alert system. The sirens outside are to warn people outdoors and may not be heard indoors. In addition, there is no sure way to always predict and notify in the event of a tornado. It is in your best interest to stay informed of changing weather conditions and be prepared to take action.
During a Tornado Warning you may need to direct your students or others to safety during a storm warning. In general, you want to be away from windows and on the lowest floor possible. Here are some safer areas in our buildings. You should go to these areas immediately if a tornado warning is issued.

On the Marietta Campus
Shelter for **Building E and H** are the first floor interior hallways, away from the exterior doors and windows.

On the Kennesaw Campus
Clendenin Building: The first floor classrooms are windowless and would be the safest in that building. The Clendenin hallway is also a location as long as you stay away from the east doors or the lobby.
Science Building: SC109 is windowless as is the lab wing, 1st floor service hallway. Also the south area of the 2nd floor lab wing outside of SC224-226 and SC233-242
Science Lab Building: Use the southwest stairwell to access the first floor corridor to the mechanical rooms as the safety area.

Avoid the lobbies of all three buildings because of the glass windows. If you have classes in other buildings, you need to contact the Office of Emergency Management in advance to learn the designated shelter areas.
http://oem.kennesaw.edu/

While taking shelter for a few minutes during a tornado warning may be an inconvenience in your classes or work, the goal is to make sure we all are safe.

Injury or Illness

For any serious injury or illness, contact KSU Public Safety at 470-578-6666, then notify the lab safety officer or the department office and administer first aid if necessary. Do not call 911. While the local 911 center will dispatch EMS, the same response will occur through KSU Dispatch, but KSU officers will be on the scene much faster to render aid. In addition, KSU public safety will be coordinating with responders about directions and location minimizing response time.

Minor illness and injury can be handled by contacting the lab safety officer/lab coordinator.

Any injury or illness no matter how small, requires an incident report to be filled out for our records (see Appendix D)

Laboratory Accidents not Resulting in Injury

Contact the lab safety officer or lab coordinator immediately in the case of other accidents. Those will be handled as per the CHP and EAP.

Power Failure

Remain calm. Power failure is often short term. However, if a power failure lasts for more than 15 minutes, the building must be evacuated. Emergency lighting is only for the purpose of providing light to assist evacuation, not for continuity of activities. In addition, laboratory ventilation will not be functioning in a power failure.

Whenever there is a loss of laboratory ventilation for any reason, all laboratory activities involving hazardous chemicals, chemically preserved specimens or open flame must cease as well.

Concern

Kennesaw State University is committed to maintaining an environment in which concerns are addressed in a fair and collegial manner. This website provides a place to submit a formal, written concern where a resolution has not been informally reached. The more information that you can provide, the better we can serve you.

Current Features

When submitting a concern related to one of the areas below, please click on "Submit Your Concern" below:

- **Office of Victim Services**: Anonymous or confidential reporting options for incidents related to violence and assault.

- **Smoke/Tobacco-Free Policy Violations:** reporting incidents related to violations of the university policy and procedures.

- **University Services:** Housing, auxiliary services (parking, transportation, bookstore, card services, culinary and hospitality, copy/print services, student health services, retail shopping, postal services), ADA/disability, student activities, university events, facilities, or any other related services.

http://www.kennesaw.edu/concern.php

Student Stress and Health

Student Success Services (SSS) is a comprehensive service center where students obtain help with educational, career, and personal concerns from a trained staff of counselors, specialists, and advisors. Such assistance is intended to support Kennesaw State University's academic programs by offering relevant resources that facilitate the students' orientation to the university, contribute to personal development, enhance academic success, and facilitate career skills.

Student Success Services is located on the 2nd floor in Kennesaw Hall or call 470-578-6600.

http://sss.kennesaw.edu/ 470-578-6600

Student Success Services is made up of the following main areas:

Behavioral Response Programs
Behavioral Response Programs takes a planned and proactive approach to identifying and

assisting students who are distressed and/or exhibiting abnormal, threatening, or dangerous behavior. Kennesaw State University seeks to foster a proactive climate of care that can only be achieved through cooperative input from the entire community. To that end, KSU has created a Behavioral Response Team (BRT) that takes a planned approach to identifying and assisting individuals who are distressed and/or exhibiting abnormal, threatening, or dangerous behavior. Through early identification, the team can connect individuals of concern with the resources they need to succeed and hopefully prevent crises. The BRT is a multidisciplinary team that meets regularly to assess and manage concerns that have been brought to the attention of the team.

Below is the online reporting "Red Flag" link that anyone can use to share information about a person of concern with the BRT. The more information that is provided the better chance the BRT will have to successfully assist that individual. Specifically, please try and describe in detail observed behaviors and statements that generated the concern. Such behaviors are often referred to as "red flags" because they may indicate a larger or growing issue with which that person may be struggling.

NOTE: If this is an emergency and there is an immediate threat call the KSU Police at 470-578-6666. Submissions through the reporting form are not constantly monitored; therefore, the reporting form is never to be used for emergency response.

For a quick overview about the BRT, click below to watch a brief introductory video.

https://vimeo.com/album/1971402/video/43939337

Campus Awareness, Resource & Empowerment [C.A.R.E.] Center
As part of Counseling & Psychological Services, the C.A.R.E. Center is designed to offer support for students dealing with homelessness or are at-risk of being homeless.

Center for Young Adult Addiction and Recovery
The Center for Young Adult Addiction and Recovery (CYAAR) provides the Collegiate Recovery Community (CRC), a community of students in recovery from addiction; Addiction Education and Intervention Services; and Collaborative research in young adult addiction and recovery.

Counseling & Psychological Services
Counseling & Psychological Services Center (CPS) offers an array of services such as short-term personal counseling, group counseling, career counseling, crisis intervention, workshops and educational programming, referral services, and consultation for members of the KSU community.

First-Year & Undeclared Advising Services
First-Year & Undeclared Advising Services (FYUAS) is responsible for enforcing the First-Year Advising Requirement which mandates that first-year freshmen meet with an academic advisor two times in the first year at KSU.

Office of New Student, Parent, and Family Orientation Programs
The KSU Office of New Student, Parent, and Family Orientation Programs assist in the successful transition of new students and their family members to the University by conducting a series of one-day orientation sessions throughout the year for first-year students, transfer students, and their family members.

Student-Athlete Success Services
The Kennesaw State University Student-Athlete Success Services Program (SASS) is committed to providing the necessary support to assist all student-athletes in reaching their full potential academically, personally, and professionally.

Testing Services
Testing Services provides a wide range of testing services to Kennesaw State University students and surrounding community.

Veterans Resource Center
KSU's Veterans Resources Center (VRC) is committed to servicing the Veteran Community (i.e. Veterans, Service members, Dependents, and Survivors) by providing a welcoming environment, where members can gather and meet other fellow community members.

Women's Resource & Interpersonal Violence Prevention Center
Women's Resource & Interpersonal Violence Prevention Center is a gathering place for students, offering programming, crisis intervention and resource information.

All of the above programs are located in Student Success Services, 2nd floor in Kennesaw Hall, Room 2401 or call 470-578-6600.

Student Health Services
Kennesaw State University has established three health care facilities to provide KSU students with cost-effective, high quality, and accessible healthcare. These services include health promotion, disease prevention, the diagnosis and treatment of illnesses, mental health, and social services. We operate primary care clinics at University Village and at 3215 Campus Loop Road on the Kennesaw Campus.

Safety in Teaching

As per the requirements of the University System or Georgia, Board of Regents, Safety in the classroom, laboratory and field is to be maintained in order to provide a learning environment free of harm to students, faculty, staff, the general public and the environment. It is recommended that all who teach in laboratory and outdoor situations learn the appropriate practices to do so safely. All faculty and staff should attend the appropriate safety training offered by the Department of Environmental Health and Safety as well as those provided by the College of Science and Mathematics.

Another good source of info is the School Laboratory Safety Courses offered by Flinn Scientific. They are a free online collection of short, video-based trainings on different safety topics and situations. It is worth the time to go through the High School course and earn the certificate. There are also other resources available on that website like Science Classroom Safety and the Law. Many other opportunities are available elsewhere to increase your knowledge of safety. Get involved and be informed.

http://labsafety.flinnsci.com/Home.aspx

Physics Laboratory Safety

Although the physics laboratory doesn't often use chemicals like biology and chemistry labs, there are still safety concerns that not everyone is familiar with. Common laboratory hazards include electrical shock and fire, power tools, lasers, compressed gases, vacuum, radioactivity, exposed belts and pulleys, electromagnetic radiation, cryogenic liquids as well as the occasional wet chemicals and dry chemicals.

Instructors Responsibilities

The laboratory instructor will inform the students of possible hazards in working in the laboratory environment as these hazards present themselves. Some activities will have very little to be concerned about and then others there may be multiple safety hazards. The instructor will be responsible to maintain a watch on the different laboratory groups and point out safety issues and corrective action as the need arises. If you have a question about safety you are to direct it immediately to the lab instructor or the lab coordinator

Student Responsibilities

The students in the physics lab are expected to exercise common sense judgment when working with the laboratory equipment. When personal experience does not help in the identifying and avoiding possible safety hazards the student should exercise extra caution and ask the instructor for assistance. Safety is more important than pride and questions about safety will be answered promptly by the instructor. Note that it is better to NOT proceed if you suspect a safety issue than to learn a new safety lesson the hard way.
Students are expected to listen to and follow all instructions given by the laboratory instructor. This includes all safety precautions and guidelines. Please refrain from "horse play" in the laboratory.
If you feel you are exposed to a hazard that you do not fully understand, stop what you are doing and ask your instructor.

A physics laboratory should not be considered a dangerous place. Usually only a small amount of effort is needed to make your time in the lab as safe as the time you spend at home.

General Safety

- Students must wear appropriate clothing to laboratory. This includes shoes that are not open toed and or opened heel (No sandals, slippers, etc.). Please wear clothing to lab that you don’t care if it gets dirty. We don’t have a lot of chemicals but you will have to kneel on the floor to make measurements and some of the equipment can have greasy rotation points.
- No food or drink is to be consumed in the laboratory. Eating, drinking, storing or preparing food in rooms designated as laboratories or controlled areas is prohibited. Any food or drink brought to the lab must remain in the students carrying bag until they leave.

- Dangling jewelry should not be worn. Any jewelry that can cause short circuits should not be worn.
- The use of headphones other than approved hearing protection devices is prohibited.
- Keep the aisles and table tops clear. Stow your book bags, coats, etc. in the proper location.
- Keep your work area neat and uncluttered.
- Do not modify or damage the laboratory equipment in any way unless the modification is directed by the instructor. This does not include the changing of a lab setup as prescribed by the procedures in the carrying out of measurements.
- Use care when loosening and tighten screws and bolts. Some of them are plastic and break easily. Treat the equipment as if it were your own.
- Do not force any of the equipment. If an excessive amount of force is necessary then tell your instructor. There is most likely a problem with the setup and we don't want to make the problem worse.
- In case the fire alarm sounds, please exit the building by the nearest safe exit. Take your books, car keys, coats, etc. You may be outdoors for a prolonged period of time as the cause of the alarm is investigated.
- Doing experiments in the laboratory without supervision is prohibited. The performance of unauthorized experiments and the use of any equipment in an unauthorized or unsafe manner are strictly forbidden.
- Examine all apparatus for defects before performing any experiments.
- Do not use damaged, cracked, or otherwise defective glassware. Consult your instructor about where to place broken glass. All glassware must be handled carefully and stored in its appropriate place after use.
- If you break a thermometer or find a broken thermometer, report it to your instructor immediately.
- Extinguish all flames and turn off all equipment, as appropriate, before leaving
- The lab is only for the use of the students authorized to work there. Visitors, including children, are not permitted to enter the laboratories.
- Do not take laboratory equipment, glassware outside the lab without the permission of the instructor.
- Any liquid (safe liquid) spills must be cleaned up immediately to avoid injuries. In case of bigger leaks, the appropriate authorities (the primary faculty in charge) must be notified.
- Avoid working in a laboratory alone. This can sometimes be a very frustrating constraint but safer if two or more are present.
- Large permanent magnets and electromagnets may attract opposite poles or steel objects with unanticipated force. Students should be warned of the potential risk of pinching their hands between object and the magnet. In addition, exposed terminals on electromagnets should be insulated to prevent electric shock hazards.
- It may be necessary for students constructing apparatus for physics experiments to use various power tools contained in a wood or metal shop. In these situations the industrial arts instructor should be consulted for proper safety precautions necessary for each tool or machine.
- Work on each new project or major piece of new equipment, or revision to existing equipment, must be preceded by a safety review of the planned work.

- Never use any chemical if you are not aware of the hazards it presents.
- Check with EHS or the Lab Coordinator for disposal procedures when you need to dispose of hazardous materials (chemicals, flammable liquids, etc) or radioactive materials. Plan your disposal needs for you generate the waste. Never use any chemical that you do not know how to dispose of.
- Keep all electrical cables off of floors and away from traffic.
- Know where fire extinguishers and exits are located.
- Report any injuries to your instructor, the lab coordinator and Environmental Health and Safety. If the injury appears to be serious, call Campus Police immediately at 470-578-6666.
- Supervisors should promptly report safety-related incidents and near misses to the Lab Coordinator, Lab Safety Director and EHS.

Motion and Forces

Many of the devices in the physics lab require mechanical motion and use significant amounts of mass. Students should be careful to place themselves and sensitive electronics out of the path of possible lab masses in case a string or other holding device was to fail. This does happen from time-to-time in introductory laboratories.

- In demonstrating the flight of any projectile, students should be kept clear of the path and impact area. The instructor should always pretest the projectile to determine the path it will follow and its range as well as the amount of variability to be expected. Sharp-pointed objects should not be used as projectiles. Use of safety goggles should be used. A simple mechanical launcher (e.g., compressed spring, compressed air, stretched elastic) should be used. It should only be "loaded" at the specific time a flight is to be observed.
- Stretched or compressed springs contain mechanical potential energy. A stretched spring, unexpectedly released, can pinch fingers. A compressed spring, when suddenly released, can send an object at high velocity toward an observer. Care should be taken to avoid unexpected release of the spring's energy when working with dynamics carts, spring-type simple harmonic oscillators, and springs used in wave demonstrations.
- Springs should not exceed their elastic limits.
- Heavy masses may be used in experiments involving Atwood's machine, free fall, Newton's laws, and momentum. Warning should be given to students to prevent hands and feet from being caught between a moving heavy mass and floor or table surfaces. Students may not anticipate how difficult it is move or support a lead brick or kilogram mass.
- Rotators are sometimes used to demonstrate centripetal force, circular motion, and sound phenomena. Any device attached to a rotator should be fastened securely and checked for tightness frequently. Observers should avoid contact with moving accessories such as toothed wheels, siren discs, etc. Loose clothing and long hair should be kept away from moving parts, and observers should not be in the plane of rotation. The use of safety goggles should be considered in student laboratories investigating

centripetal force. Extremely high-speed rotation should be avoided when possible. High speeds may cause some objects to fly apart unexpectedly.

- A strobe light is sometimes used to illuminate a rotating object, making the object appear to be at rest. If the object is a fan blade, a toothed wheel, or anything else with sharp edges, there is danger of injury from touching or inserting an object into the apparently stationary object. Students should be alerted to this danger.
- Exposed belts and pulleys must be covered with a shield. This prevents the hazard of broken belts, and of fingers or clothing being caught between belts and pulleys.
- Make sure that devices that are to be stationary should be secured by a C-clamp.
- Spring-loaded carts and heavy masses should be used only as directed.
- Centripetal force labs should be conducted only with protective eyewear. If glass rods are used, they should be fire polished and wrapped in tape. Additional space may be needed to assure the spinning mass does not hit anything. Instructions should be given to caution students never to walk in the path of the spinning masses. Finally, the instructor should check to assure that the mass being used by each group is securely fastened.
- A planetary motion hazard is the viewing of solar eclipses. Never view solar eclipses directly; always use an indirect method.
- When using any apparatus that rotates, be sure the safety nut is secured.
- Sufficient space must be allowed during activities involving collisions

Sound

- In the production of sound, levels of 85 decibels or higher can cause hearing damage. Hearing protection must be used.

Electrical Hazards

- Know where the master electrical cut-off switch is.
- Use low voltage DC for studying simple circuits.
- The instructor should check all student circuits before the power is connected.
- Never touch electrical circuit components with the power on. Only insulated tools should be used to make checks.
- The last act in assembling a wired electrical circuit is to insert the plug. The first act in disassembling a wired electrical circuit is to remove the plug.
- When using an electrical current, you should use only one hand at a time to avoid bringing both hands in contact with live sections of the circuit.
- Electrical batteries should be checked for leakage and not be left in electrical appliances for extended periods of time.
- If electrical current is used near a metal object, the object should be permanently insulated to prevent contact. Care should be taken to assure that live wires do not contact grounded metal objects.
- Keep away from the fine spray that develops when charging a storage battery.
- Carefully handle a storage battery. In spite of its low voltage, a high current can be drawn from it on a short circuit.
- Switches should be labeled for "on" and "off" positions.

- Proper grounding of equipment should be checked by the teacher before using.
- Any equipment with frayed cords or any other visible defects should not be used.
- Installation and repair to electrical equipment should not be done by an amateur. Check with the lab coordinator or instructor for the appropriate procedures for equipment repair.
- Plugs should always be plugged in and pulled out using the plug, not the wire.
- Use properly grounded (3 prong - one constant ground) service outlets.
- Care should be taken not to spill liquids near electrical outlets or electrical equipment.
- All potentiometers should be checked by the instructor before use in circuits by students.
- If fire does occur with a "live" electrical apparatus, pull the plug then use an appropriate fire extinguisher (Class C), dry chemical - carbon dioxide. However, if you have not been trained in using a fire extinguisher, don't try to fight fires.

Body Resistance. Students must be warned of the high death potential present even when the voltage is low. The severity of an electrical shock depends primarily on the amount of current to which a person is exposed. Since the current is related to the resistance and voltage, these two factors, as well as the part of the body involved and the duration of the contact, determine the extent of injuries to the victim. If the skin is wet or the surface broken, the resistance drops off rapidly, permitting the current to flow readily through the bloodstream and body tissues.

See chart below for relative hazards of electric shock.

Mode of Electric Contact	**R (Ω)**	**I (mA)**
one dry finger on each electrode	100,000	1.1
one wet finger on each electrode	40,000	2.8
one salt/wet finger on each electrode	16,000	6.8
tight grip on each electrode	1,200	92.0

Current-Resistance Relationship. Ohm's law indicates that the amount of current in *amperes* flowing in a circuit varies directly with the electrical potential applied in *volts* (V) and varies inversely with the resistance (R) in *ohms*:

$$I = V/R$$

Thus, one can calculate the expected current in a given situation.

Example: Let R for a damp hand = 1,000 ohms. If an electrical potential of 110 volts is applied across the hand, the current would be:

$$I = \frac{110 \text{ Volts}}{1{,}000 \text{ ohms}} = 0.11 \text{ A or } 110 \text{ mA}$$

The table below illustrates how the various current values affect human beings. The readings are approximate and vary among individuals. In view of the information below, it would be sound practice never to receive an electrical shock under any circumstances if it can be avoided.

Current (mA) AC (60 Hz)	Current (mA) DC	Effect
1-3	5	mild perception
6-9	70	paralysis, inability to let go
25	80	danger to life from heart and respiratory failure
100	100	fibrillation, death

Burns. Many electrical devices become quite hot while in use. In addition, "shorted" dry cells and batteries can produce very high temperatures. Students should never grasp a recently operated device or wiring without first checking for excess heat.

Electrical Apparatus

Batteries. A battery is an unregulated source of current capable of producing large currents when resistance is low. When short-circuited, connecting wires can become very hot, raising the risk of burns. Short-circuited mercury batteries may even explode. Chemical leakage from batteries is a potential hazard, especially in the case of wet cells that contain caustic chemicals such as sulfuric acid.

Certain types of batteries are rechargeable while others are not. Carbon-zinc and nickel-cadmium type batteries can be recharged. Do not, however, attempt to recharge a completely dead carbon-zinc battery, a leaking or corroded battery, or any battery that carries a warning against recharging. Such batteries can cause damage to the charger and may explode, causing personal injury. Lead-acid batteries can be recharged but produce explosive hydrogen gas during the process. They should only be recharged in a well-ventilated area with an appropriate charger.

Capacitors. Capacitors are used to store electric charge. They may remain charged for long periods after power is turned off, and they therefore pose a serious shock/burn hazard. Before working on any circuit containing a capacitor, make sure to disconnect the main power supply and discharge the capacitor through a resistor or with proper equipment. Oil-filled capacitors may sometimes recharge themselves and should be kept shorted when not in use. Oil from older capacitors may be contaminated with dangerous PCBs. When installing electrolytic-type capacitors in a circuit, proper polarity rules must be followed (negative to negative and positive to positive). Improper connection can result in an explosion. Be on the lookout for capacitors in any apparatus with high voltage components such as oscilloscopes, TV sets, lasers, computers, and power supplies. Electrostatic generators and Leyden Jars are also capacitors and can be a source of unexpected shock.

Circuit Loads - Most school laboratory electrical circuits have a maximum power rating of 1,500 watts (if fuses are 15 amp) or 2,000 watts (if fuses are 20 amp). The total power load on a circuit should not exceed these values. The total load is the sum of the power ratings of all apparatus plugged into that circuit. The individual power rating is usually found printed on a plate somewhere on the apparatus.

Electrostatic Generators. Electrostatic generators used in demonstrations of static electricity produce high voltages (about 10^5 volts) with very low currents. The danger of these generators depends on their size and capacity to produce enough current to be

dangerous. In many cases the shock from such devices is very quick and not harmful. The startling effect, however, can be detrimental to persons with heart conditions.

In general, experiments that use human subjects to demonstrate the effect of electrical shock should not be attempted due to the large variation in physical and physiological factors. Leyden jars -- which can be charged with electrostatic generators -- are especially dangerous because of their capacity to store a charge for long periods of time. An accidental discharge through a person can be avoided by properly shorting the devices after use

Extension Cords. Use extension cords only when there is no convenient way to connect equipment directly to a receptacle. If an extension cord must be used, it should be checked for damage, proper grounding, and electrical capacity. An extension cord should be marked with its capacity in amperes and watts and the total load should not exceed these values. If the cord is unmarked, assume that it is 9 amperes or 1,125 watts. If an extension cord becomes very warm to the touch, it should be disconnected and checked for proper size. In general, science laboratories should be equipped with sufficient receptacles to minimize extension cord use.

Fuses/Circuit Breakers. Replace blown equipment fuses with fuses of the same amperage. Replace fuses with the equipment unplugged. Failure to use the correct fuse can cause damage to equipment and overheating. Frequent blowing of circuit fuses or tripping of circuit breakers usually indicates that the circuit is overloaded or a short exists. Circuit breakers and fuses that are tripped or blown should be turned on or replaced only after the cause of the short or overload is removed from the circuit.

Grounding. Use grounded 3-prong plugs when available. If the outlet is 2-prong, use an adapter and secure the ground wire to the cover-plate screw on the outlet. Grounding is particularly important for the light sources used with ripple tanks since these lights are suspended above the water in the tanks. Any apparatus with a metallic case or exposed metal parts should be checked to make sure that the case is grounded. Such ungrounded appliances should be retrofitted with a ground wire and three-pronged plug. The use of ground-fault interrupters should be considered.

Power Cords. Any power cord should be inspected periodically and replaced immediately if frayed or damaged. Apparatus should be located to keep power cords away from student traffic paths. When removing the cord from an outlet, the plug should be pulled, not the power cord. Wet hands and floors present a hazard when connecting or disconnecting electrical apparatus.

Vacuum and Pressure Hazards

Vacuums

Suitable Containers. Many popular physics demonstrations utilize a small vacuum pump to evacuate a chamber such as a bell jar, a coin-feather tube, or a collapsing metal can. Under no circumstances should a standard thin-walled, flat-bottom jar be evacuated because of the likelihood of implosion. If students are to be allowed to pump out a well-designed chamber, make sure it is firmly mounted so it cannot tip over and implode when under vacuum. Any large evacuated chamber should be equipped with a screen shield to help provide protection following an implosion. Such implosions can result from long-term stresses in glass or may result from thermal effects if heating occurs without opportunity to expand. On small chambers where a screen is inconvenient or undesirable, the walls should be wrapped with tape to reduce the flying glass following an implosion. When bell jars are used in

demonstrations, remind students that they are specifically designed to withstand atmospheric pressure, and that one should never pump on a conventional container. Full face shields should be worn whenever working with a system which could conceivably implode or explode.

Tubes and Implosions. Vacuum tubes, especially large ones, present a safety hazard if the tube breaks. Flying glass and electrodes can travel great distances when a tube implodes. This is a particular danger when tubes such as a cathode ray tube, a TV picture tube, or a Crookes tube are used in a demonstration or experiment that removes them from a protective housing. Under these conditions, safety goggles or shields should be worn by all observers.

When an inoperable tube is to be discarded, it should be covered with a heavy canvas cloth and broken by striking the rear of the tube with a hammer. The broken tube should then be carefully disposed of.

Vacuum Pumps. Vacuum pumps equipped with belts and pulleys must have the belt and pulley system shielded to prevent clothing and hands from getting caught. This shield should also prevent injury from broken belts striking nearby observers. Students should be warned to be careful of the hot motor and other parts after operation. (OSHA Regulations: 29 CFR 1910.219).

Pressures

Compressed Air. Students in laboratories equipped with compressed air at lab stations or lecture tables should be warned of the danger of blowing dust or other debris into the eyes accidentally with compressed air. High pressure air directed at glassware for drying purposes can provide enough force to knock containers from the hands. The flow of air should be adjusted first to prevent this hazard.

Gas Bottles. One of the most common items to be found in any science laboratory is a container of compressed gas. The pressures in gas containers may vary from atmospheric pressure to 10,000 psi, with most tanks essentially designed as shipping containers (with a minimum weight and wall thickness). A container of gas should not be kept around if the gas and its characteristics are unknown. Any gas cylinder should be anchored to the wall or mounted in a well-designed holder. When a gas cylinder tips over and is damaged, it can become a high powered, massive rocket capable of going through many walls and people. Large tanks should be carefully moved in a wheeled cart with a tie-down chain safety cap in place, and should never be pulled by the threaded cap or rolled on the floor. (OSHA Regulations: 29 CFR 1910.101).

Almost all cylinders have internal pressures greatly exceeding what is needed for an experimental apparatus. Small laboratory lecture bottles may be controlled with a needle valve as long as they are not discharging into a system allowing pressure to build up to bottle pressure. Large cylinders should be controlled by a single or double stage regulator of a suitable pressure range. When a regulator is being used, the main cylinder valve should still be closed each time an experiment is shut down since regulators are not made to be reliable shut-off valves.

If compressed gas is used as a propellant, students should remain clear of the gas exhaust and propelled objects.

Generating Gases. A pressure relief safety valve of some type should be an integral part of any system constructed to generate gas or steam.

Heat and Cryogenic Hazards In a few labs the use of boiling water and steam to test theories of thermodynamics is employed. This represents a scalding hazard and care must be taken when working with hot metals and steam generators. Use gloves and hot pads when handling hot objects and steam lines/generators and always test the temperature of an object before picking it up when you are working with a thermodynamics lab.

Heat

Heating Procedures. Often it is necessary to heat liquids and solids in physics experiments and demonstrations. It is safer to use water baths and hot plates than to heat directly with open flames such as with Bunsen burners. Below are guidelines for heating and handling hot objects.

- Locate the master gas valve cut-off and leave master control "off" when not in use.
- Never leave gas jets open.
- Any glass apparatus that is to be heated should be made of Pyrex® brand or Kimax® brand. It must be free of chips and cracks.
- Gas burners should be kept away from the body at all times. The pressure of the gas should be adjusted to allow proper ignition. Too high a pressure tends to blow the flame out. Do not allow gas to accumulate if ignition is delayed for any reason.
- Never heat a closed container if there is no means of pressure relief.
- Many substances, especially glass, remain hot for a long time after they are removed from the heat source. Always check objects by bringing the back of the hand near them before attempting to pick them up without tongs, hot pads, or gloves.
- Never set hot glassware on cold surfaces or in any other way change its temperature suddenly, because uneven contraction may cause breakage.
- Bunsen burners should be periodically checked.
- Fire retardant pads and gloves should be used when handling hot materials.

Steam. Live steam is generated in experiments to determine coefficients of thermal expansion and the heat of vaporization of water. Potential hazards can be avoided by following a few simple guidelines.

- Produce steam only in a container with a direct open line to the atmosphere.
- Instruct students that steam has a very high heat capacity and is invisible (the visible "vapor" is already condensed droplets). Caution them not to aim steam outlets at their own skin or at other students.
- Production of steam under pressures higher than atmospheric pressure should be limited to instructor demonstrations. The instructor should take necessary precautions associated with the higher temperatures of this steam and the explosion hazards.

Thermometers. Thermometers present several possible hazards in the laboratory related to breakage and spillage of mercury. Following the guidelines below will minimize the hazards.

- Use alcohol thermometers in place of mercury thermometers to eliminate the hazards associated with mercury spills.
- If a mercury thermometer is used, be alert to the potentially serious hazard of a mercury spill. Instruct students that they must report any such breakage immediately and remove any source of heat which is present. Each laboratory where mercury is used should be equipped with a mercury-spill kit. Follow the directions that come with the kits.
- Consider the range of temperatures to be measured when choosing a thermometer. If heated beyond its capacity, a thermometer may break.
- Mount a thermometer in a safety rubber stopper whenever possible. When using other types of stoppers, use a lubricant on the glass or a split stopper. If necessary to free the thermometer from the stopper, split the stopper with a single-edge razor blade. Instructors should ensure that students use the thermometer in such a way that the equipment does not become unstable.

Burns. A common cause of student injury is a burn from recently heated glassware. To avoid such burns, check the glassware by bringing the back of the hand close before attempting to pick it up. In case of an accidental burn, administer first aid and report it to the Lab Coordinator, the Department or Public Safety.

Asbestos. Many older hot plates, hair dryers and other heating elements contain wires or parts insulated with asbestos. Since the dangers of asbestos are well documented, all efforts should be made to replace this equipment with non-asbestos-insulated apparatus.

Cryogenics

Dry ice (solid carbon dioxide) is used in some low-friction pucks, as a source of carbon dioxide gas, and as a cooling agent. A mixture of dry ice and alcohol or liquid nitrogen might also be used as low-temperature baths. The temperatures of these materials are low enough to cause tissue damage from a cryogenic "burn." This is not likely to occur if contact is brief, because the vapor layer formed between the cryogen and the tissue is not a good conductor of heat. Follow the guidelines below to avoid a dry ice "burn." The handling of cryogenic liquids (Liquid N2, O2 and He) requires care. Proper protective clothing must be worn to eliminate the possibility of receiving a cryogenic burn. Goggles and insulated gloves should be worn when using cryogenic fluids. All glass-exterior dewars must be taped. Severe burns can result from direct contact with these liquids.

- Flush the skin that came into contact with the dry ice with water. Water should always be readily available during cryogenic experiments.
- In preparing a dry ice/alcohol mixture, pour the alcohol over the dry ice rather than dropping the dry ice into the alcohol to avoid spattering. When storing alcohol that has been used in a dry ice/alcohol mixture, the alcohol should be returned to room temperature to allow the escape of excess dissolved gas before placing in a closed container.
- When dry ice is used in a confined space, provide sufficient ventilation to eliminate the risk of asphyxiation. This risk is caused when the more dense carbon dioxide gas released produces an oxygen-deficient layer.

- Used to produce a special effect (such as fog in a drama production), dry ice may produce large amounts of carbon dioxide. Students and others should be warned of this risk and informed about avoiding it.
- Cryogens should be kept in double-walled containers such as Thermos bottles or Dewars. Any fluid which gets between the walls at low temperatures may become trapped and vaporize at higher temperatures, building up pressure and exploding the container. The outer wall should be heavily wrapped to avoid this hazard.

Radiation Hazards

Infrared Radiation. All should be aware that, beyond a limited exposure, infrared waves (heat waves) entering the eye can cause burns to the cells of the retina. Infrared lamps and the sun are concentrated sources of these waves.

- Follow manufacturer's instructions when using any infrared lamp.
- The sun should never be viewed directly, especially at times when its visible light is partially obscured. (The visible light triggers the body's natural defenses of avoidance and pupil constriction.) Lenses and sunglasses do not offer protection from this radiation. Safe viewing of the sun can be done by projecting an image of it through a very small hole onto a white piece of paper about one-half meter behind the hole.

Microwaves. A microwave apparatus is often used to demonstrate various wave behaviors of electromagnetic radiation. Microwave devices designed for high school use have sufficiently low power to be free of radiation hazards when the manufacturer's instructions are followed. Microwave ovens that are in good working order and used properly do not pose any safety hazard in a classroom. Follow these guidelines:

- Check the apparatus for radiation leakage before use if there are any doubts about its safety.
- Inspect ovens periodically to ensure they are clean and the door, hinges, vision screen, seals, and locks are secure and working properly.
- Do not place metal objects in the heating cavity.
- Do not permit students to stand close to an oven during operation.

Radioisotopes. Radioisotopes produce biological injury (cell damage) resulting from their ionizing properties. Gamma rays and beta particles are hazardous both inside and outside the body. Alpha particles cannot penetrate skin and are not hazardous if kept outside the body. The use of license-exempt quantities especially sealed sources will create minimum hazard because of the small amount of radiation present. Safe handling requires these protective measures:

- *Time*. Minimize contact time with samples.
- *Distance*. Use tongs, forceps, etc., to avoid direct contact.
- *Shielding*. Use shielding appropriate for the radiations encountered.
- *Storage*. Store radioactive materials so that people are not in frequent close proximity to them and they are not damaged accidentally.

Ultraviolet Radiation

Ultraviolet light can be absorbed in the outer layers of the eye, producing an inflammation known as conjunctivitis. The effect usually appears several hours after exposure and, unless the exposure is severe, will disappear within several days. Sources of harmful ultraviolet

light likely to be encountered in physics include mercury vapor lamps, electrical arcs (e.g., the carbon arc lamp), incandescent ultraviolet lamps, and the sun.

- Mercury vapor lamps and electric arcs should not be observed without elimination of their ultraviolet emissions.
- Plastic or glass sheets which transmit poorly in the ultraviolet region offer good protection for the viewer of these sources.
- Use black paper with caution because, while it absorbs well in the visible range, it may be highly reflective in the ultraviolet range.
- The sun should never be observed directly.
- Incandescent ultraviolet lamps present a minimal danger from their ultraviolet emissions, as the energy of this radiation is very low. These bulbs, however, get extremely hot when in use and must be given plenty of time to cool before handling.

Visible Light (including Lasers)

Intense sources of visible light are usually not hazardous due to the inability of the human eye to remain focused on an intense source. Infrared and ultraviolet radiation sometimes present along with visible light provides a greater hazard.

- Caution should be exercised in the use of ultraviolet light sources, such as mercury-quartz lamps or carbon arc lamps that can cause severe sunburn or damage to the retina. Proper instructions, labels, and protective gear should be provided.
- Wave motion, when studied with light, generally includes the use of large coil springs or rubber hoses. Care should be given not to exceed the elastic limit of the coils or to release the hose unexpectedly.
- Ripple tanks should be set up to assure the stability of the high intensity light, the motor, and the electrical source.
- When simulating Young's experiment, caution should be given to handling the delicate slides and the single edge razor blades. Spectroscope high voltage supplies should be checked prior to classroom use.
- Students should be cautioned never to touch the ends of the spectrum tube while the voltage supply is connected.
- Mirrors that are sharp should be taped. Jagged-edged mirrors should be discarded.
- The use of lenses and prisms in direct sunlight should be supervised.
- Some students may have physiological or psychological reactions to the effects of a strobe light. (e.g., epilepsy)

X-ray Radiation

X-rays may be produced in any situation in which high-speed electrons strike a target. These conditions may exist in evacuated tubes where the accelerating voltages are in the range of 10,000 volts or more. Crookes tubes and other cold cathode discharge tubes are potential sources of X-rays in the classroom. (Spectrum tubes used to observe spectra of elements and compounds are not a source of X-rays if the tubes are in good condition because the enclosed gases prevent electrons from achieving high enough energies.) To minimize possible X-ray exposure, three rules should be observed by teachers and students:

- Minimize the voltages used to operate vacuum tubes.
- Maximize the distance between the tube and the observers.

- Minimize the time during which the tube is operated. If any tube or apparatus is suspected of emitting X-rays, it should be checked for dangerous amounts of radiation. Commercial companies listed in the yellow pages should be able to provide this service.

Laser Safety

The laser produces an intense, highly directional beam of light that, if directed, reflected, or focused upon an object, is partially absorbed, raising the temperature of the surface and/or the interior of the object. Potentially, this can cause an alteration or deformation of the material. These properties can cause adverse biological effects in tissue. Photochemical effects are also a danger when the wavelength of the laser radiation is sufficiently short (i.e., in the ultraviolet or blue light region of the spectrum). Low-power lasers may emit levels of light that are not a hazard, or are no more hazardous than an electric light bulb.

Some lasers concentrate visible light to an extent that retinal damage can occur in a very short time. Fortunately, these lasers are not often found in secondary school science laboratories. Most lasers used in secondary school laboratories are the continuous wave, low power (0.5 - 3.0 mW.), helium-neon lasers. The only optical danger is possible damage to the retina if a subject looks directly into the beam or non-diffused reflection. The diameter of the beam, the time of exposure, blink response time, and retina spot size all can affect the probability of injury. Since some of these lasers in this range are considered Class III lasers (see chart below), certain safety precautions are important to teach and use when working with lasers.

Biological Effects

The human body is vulnerable to the outputs of some lasers and can, under certain circumstances, incur damage to the eye and skin. The human eye is almost always more vulnerable to injury than human skin. In the near-ultraviolet region and in the near-infrared region at certain wavelengths, the lens of the eye may be vulnerable to injury.

Of greatest concern, however, is laser exposure in the retinal hazard region of the optical spectrum approximately 400 nm (violet light) to 1400 nm (near-infrared). Within this special region, collimated laser rays focus in a very tiny spot on the retina. This hazard only exists if the eye is focused at a distance; reflecting the laser light off diffuse surfaces also prevents the hazard. Higher levels of laser radiation would be necessary to cause injury.

Since this ocular focusing effect does not apply to the skin, the skin is far less vulnerable to injury from these wavelengths. The light entering the eye from a collimated beam in the retinal hazard region is concentrated by a factor of 100,000 times when it strikes the retina.

Safety Standards

A system of laser hazard categories has been developed based on millions of hours of laboratory and industry laser use. Each laser is placed into one of at least four separate classes, or risk categories. The safety measures to reduce or eliminate accidents depend

upon which class of laser is being used. See the chart below for laser risk classes and their hazards.

Laser Risk Classes*

Class	Power Output (mW)	Hazard	Comments
I	‹0.39	**inherently safe**	*Exempt lasers.* Considered incapable of producing damaging radiation and therefore exempt from control measures. Do not exceed maximum exposure levels.
II	‹1.0	**low risk**	*Low-power lasers.* Hazardous if looked at continuously. May be viewed directly; avoid continuous intrabeam viewing. Emission limited to 1 mW for less than 0.25 seconds between 400 and 700 nm; hazards are prevented by aversion reflexes.
IIIa	‹5.0	**low risk**	Limit up to five times that for Class II. Viewing by the unaided eye is safe, but the use of optical instruments may be hazardous. Requires control measures that prevent viewing of the direct beam.
IIIb	‹500	**medium risk**	*Higher emission limit.* Direct viewing may be hazardous; but viewing by diffuse reflection is safe. Requires control measures that prevent viewing of the direct beam.
IV	›500	**high risk**	*High powered systems*. Emission limit higher still; even viewing by diffuse reflection may be hazardous. Skin injuries and fire hazard are also possible. Requires the use of controls that prevent exposure of the eye and skin to the direct and diffusely reflected beam.

* Adapted from *Fundamentals of Laboratory Safety*

Laser Guidelines

Lasers can be used safely through the use of suitable facilities, equipment, and well-trained personnel. Class II lasers require no special safety measures. However, as in the case of a movie projector, a person should not stare directly into the projection beam. Safety training is desirable for those working with Class III systems. Eyewear may be necessary if intrabeam viewing cannot be precluded. Operation within a marked, controlled area is also recommended. Finally, for Class IV lasers or laser systems, eye protection is always required; facility interlocks and further safeguards provide additional protection.

The following general guidelines for safe laser use in the classroom are excerpted from *Laser Fundamentals and Experiments*.

- Before operation, warn all individuals present of the potential hazard.
- In conspicuous locations inside and outside the work area and on doors giving access to the area, place hazardous warning signs indicating that a laser is in operation and may be hazardous.
- Do not at any time look into the primary beam of a laser.
- Do not aim the laser with the eye. Direct reflection can cause eye damage.
- Do not look at reflections of the beam. These, too, can cause retinal burns.
- Do not use sunglasses to protect the eyes. If laser safety goggles are used, be certain they are designed for use with the laser being used.
- Report any afterimage to a doctor, preferably an ophthalmologist who has had experience with retinal burns. Retinal damage is possible.
- Do not leave a laser unattended.
- View holograms only with a diverged laser beam. Be sure the diverging lens is firmly attached to the laser.
- Remove all watches and rings before changing or altering the experimental setup. Shiny jewelry can cause hazardous reflections.
- Practice good housekeeping in the lab to ensure that no device, tool, or other reflective material is left in the path of the beam.
- Before a laser operation, prepare a detailed operating procedure outlining operation.
- Whenever a laser is operated outside the visible range (such as a CO_2 laser), a warning device must be installed to indicate its operation.
- A key switch to lock the high voltage supply should be installed.
- Use the laser away from areas where the uninformed and curious might be attracted by its operation.
- Illuminate the area as brightly as possible to constrict the pupils of the observers.
- operate the laser at the lowest possible power
- Set up the laser so that the beam path is not at normal eye level (i.e., so it is below 3 feet or above $6\frac{1}{2}$ feet.
- Use shields to prevent strong reflections and the direct beam from going beyond the area needed for the demonstration or experiments.
- The target of the beam should be a diffuse material capable of absorbing the beam and reflection
- Cover all exposed wiring and glass on the laser with a shield to prevent shock and contain any explosions of the laser materials. Be sure all non-energized parts of the equipment are grounded.

Rocketry

Local Regulations

When using model rockets or other unmanned aircraft, you must comply with the *Kennesaw State University Unmanned Aerial System (UAS) and Other Aircraft Policy* (pending) and the safety code of the *National Association of Rocketry (NAR)* should be followed.

- Only factory prepared solid engine propellant should be used and only as recommended by manufacturers.

- Be sure also to check regulations about launch sites and fire codes in your area.

•*See* NFPA 1122.

The following website offers more information on this topic:
http://www.nfpa.org - National Fire Protection Association

Model Rocketry Safety Code

Follow the guidelines for safe launching and recovery of model rockets outlined below.

- **Construction.** In making model rockets, use only lightweight materials such as paper, wood, plastic, and rubber; use no metal as structural parts.
- **Engines.** Use only pre-loaded, factory-made model rocket engines in the manner recommended by the manufacturer. Do not alter or attempt to reload the engines.
- **Flying Conditions.** Do not launch a rocket in high winds or near buildings, power lines, tall trees, low flying aircraft, or under any conditions that might endanger people or property, such as the threat of lightning.
- **Jet Deflector.** The launcher must have a jet deflector device to prevent the engine exhaust from hitting the ground directly.
- **Launch Area.** Always launch rockets from a cleared area that is free of any easy-to-burn materials; use non-flammable recovery wadding.
- **Launch Rod.** To prevent accidental eye injury, always place the launcher so the end of the rod is above eye level, or cap the end of the rod with the hand when approaching it. Never place head or body over the launching rod. When the launcher is not in use, always store it so that the launch rod is not in an upright position.
- **Launch Safety.** Do not let anyone approach a model rocket on a launcher until making sure that either the safety interlock key has been removed or the battery has been disconnected from the launcher.
- **Launch Targets and Angle.** Do not launch a rocket so its flight path will carry it against a target on the ground; never use an explosive warhead nor a payload that is intended to be flammable. The launching device must always be pointed within 30 degrees of vertical.
- **Launching System.** The system used to launch model rockets must be remotely controlled and electrically operated, and must contain a switch that will return to "off" when released. All persons should remain at least 10 feet from any rocket that is being launched.
- **Power Lines.** Never attempt to recover a rocket from a power line or other dangerous places.
- **Pre-Launch Test.** When conducting research activities with unproven designs or methods, try to determine their reliability through pre-launch tests. Conduct launching of unproven designs in complete isolation from persons not participating in the actual launching.
- **Recovery.** Always use a rocket system with model rockets that will return them safely to the ground so that they may be flown again.

- **Stability.** Check the stability of model rockets before their first flight, except when launching models of proven stability.
- **Weight Limits** Model rockets must weigh no more than 453 grams (16 ozs.) at liftoff, and the engine must contain no more than 113 grams (4 ozs.) of propellant.

Chemical Hazards in Physics

If any hazardous materials are to be used in your activities, see the General Laboratory Handbook for information

Carbon Dioxide

The use of dry ice in cryogenic experiments must be accompanied by precautions against production of an oxygen-deficient atmosphere. Carbon dioxide, which is denser than air, easily collects in a non-ventilated area.

Carbon Monoxide

Do not allow carbon monoxide from incomplete combustion to collect in a closed area. Always conduct demonstrations using small internal combustion engines under a vented hood or outdoors.

Explosives

Do not attempt to make explosive compounds such as those that might be used in model rocketry. Only factory-made, pre-loaded rocket engines should be used for this purpose.

Flammables

Do not use flammable substances near an open flame unless the purpose is to demonstrate flammability. Many flammables produce toxic fumes and should be burned only under a vented hood. Large containers of flammable liquids should be opened, and liquids transferred, in a room free from open flames or electrical arcs and, preferably, under a fume hood.

Mercury

Do not use mercury in the classroom. Use alternate equipment not requiring mercury in place of mercury. There are many reasons for this recommendation: The vapors from free mercury are cumulatively toxic. Mercury is absorbed through the skin. The vapors it forms are absorbed by inhalation. Complete clean-up of any mercury spill, which is absolutely necessary, is difficult to accomplish. *NOTE:* As stated earlier, each laboratory where mercury is used should be equipped with a mercury-spill kit. Follow the directions that come with these commercially available kits.

Other Heavy Metals/Solder

Highly toxic cadmium oxide may be produced when silver solder containing cadmium is overheated. Some solders contain flux, which may produce noxious fumes. Use fume hoods when working with these materials.

Who to Contact

If you have any questions, the following are your safety resources:

- College of Science and Mathematics, Director of Safety and Operations,

  Dale A. Zaborowski, SL5007, 470-578-6165, dzaborow@kennesaw.edu

- Department of Physics Lab Manager,

  Toazmin Siddqui, H260L, 470-578-4211, tsiddiqu@kennesaw.edu

- Environmental Health and Safety, 470-578-3321, ehs@kennesaw.edu

Guidelines for the Use of Chemicals and Compressed Gasses

If any chemicals or compressed gasses are used in the lab, refer to the *General Laboratory Handbook for Faculty, Staff and Research Students* for more information and guidance,

Safety Training and Laboratory Access

Safety Training

Everyone having access to the laboratories is required to have the appropriate training. All new employees and research students will attend a new employee lab safety training session before having access to any of the labs. All personnel will also have to take an annual refresher either online or on campus. Required online training will be available through "My Plan" in the Owltrain website (below). Access will be granted by the Lab Safety Officer/Lab Coordinator following the KSU campus policy after the appropriate training. Key or card access could be withheld if the new employee or annual training is not completed.

Training shall cover the appropriate topics and a record of the training will be maintained by EHS and the Lab Safety Officer.

The website for the KSU EHS Department online training is:

https://ksu.skillport.com/skillportfe/custom/login/ksu/login.action

Lab Visitors

Short-term, casual visitors, such as those touring a laboratory or several labs and outside repair vendors will be accompanied and supervised by qualified KSU personnel. They are also required to follow all safety rules as well. It is the responsibility of the chaperone to enforce the safety rules.

Children are not allowed in the laboratories at any time unless part of an organized KSU sponsored or approved program. The supervising faculty or staff member of the program is wholly responsible for enforcement of the safety rules.

KSU has a policy for volunteers who may want to work in a lab (see Appendix B). Volunteers, as well as other visitors such as consulting researchers, service workers and Plant Operations personnel will require proper training before receiving access to the lab areas.

Laboratory Access

Key or card access will be granted by the Lab Safety Officer or designee after training following the KSU campus policy for key and card access. After-hours access will be granted after a background check. The Lab Safety Officer can assist with that procedure. Refer to Appendix I, page 103 for more details.

Kennesaw State University
College of Science and Mathematics

Laboratory Safety Training
Participant Record

Trainer_____ Date _____

Duration of Training_____

Name (print)	KSU #	Position and Dept.	Signature	Supervising Faculty

Positions: D = Directed Study/Methods Student, SA = Student Assist., F = Faculty, S = Staff, G= Grad student, O = Other

Academic Field Trip Guidelines

Academic field trips have long been part of the curriculum at Kennesaw State University. In recent years, growing concern about travel and increasing attention to the need to manage risks associated with virtually all University activities prompts us to look at the manner in which academic field trips are conducted and to recommend certain best practices that are consistent, clearly communicated and offer the greatest likelihood of student safety, recognizing that the University cannot provide absolute assurances in this regard. For purposes of this document, an ***academic field trip*** is defined as a course related activity which normally involves travel for the group of students enrolled in a class. Independent study, internships, class meetings, off campus work on an individual project are not considered an Academic Field Trip. An academic field trip serves educational purposes and occurs outside of the classroom at a location other than the campus on which the course is regularly taught. Such trips may be scheduled during normal class hours or for extended periods outside of class.

General Guidelines for Faculty

- Academic field trips are University sponsored events.
- Whenever possible, academic field trips should be clearly identified in the course syllabus (as to location, time, means of transportation, and with some reference to inherent risk associated with the particular activity). The syllabus should also identify the academic field trip as "required" if this is the case. In addition to the description of risks in the syllabus, faculty members should discuss in appropriate detail with students the risks associated with the activity, relevant emergency preparedness information, as well as expectations for behavior during the activity (including transit to and from the location(s)).
- If there are students who will be participating for whom special accommodations are potentially necessary (as a result of disabilities), faculty should discuss these matters with the student(s) in individual settings. If needed, the Office of Disabled Student Support Services can assist with planning for accommodations.
- A College/department may require a student to sign a standard "informed consent" waiver that acknowledges risks associated with this activity.
- A faculty member or other designated University representative must accompany all academic field trips. Only Faculty, staff and students registered for the course are authorized to attend the trip. No spouses, friends, children are allowed to participate.
- Whenever practical, the site of the academic field trip should be reviewed by the faculty member or an appropriate University representative in advance to evaluate potential risks and to mitigate, to the extent possible through effective planning, risks associated with the location.
- The University, through the Department, School or College, should have complete information about the location, duration and transportation route for each academic field trip on file and accessible prior to the occurrence of the event.
- The University, through the Department, School or College, should have a complete list of all participating students including emergency contact information on file and accessible prior to the start of the event.
- The faculty or staff member in charge of each academic field trip should ensure that s/he has access to communication (e.g., cell phone) throughout the event.

- Each department should have a designated contact person on campus with information about the academic field trip and participants in the event that emergency communication is necessary.
- Faculty members should not use their private cars to transport students on field trips. It is recommended that they use University System vehicles or rent vehicles for this purpose. KSU employees who drive their private cars in the course of their official job responsibilities are excluded from liability coverage under the University System's automobile insurance policy. The University is covered, but employees' only coverage for their liability is whatever they have under their personal automobile insurance. Further, the University System's general liability policy excludes coverage for claims arising out of the use of an automobile.
- Students should not be required to drive their own vehicles to a field trip site; neither should they be required to provide rides to other students.

General Guidelines for Students

- Students participating in college-sponsored field trips are expected to conform to the same standards of behavior as published in the Students' Rights, Rules and Responsibilities. Any violation of the student code of conduct or local, state, or federal laws may result in disciplinary action or sanctions by the College/University. No alcohol, illegal drugs or firearms are allowed during any portion of the trip.
- The University does not have liability or automobile coverage for students driving themselves or other students to University-sponsored events. Automobile insurance policies held by the students are the primary and only policies covering them for injuries to themselves and others, as well as damage to their vehicles or other vehicles.
- Departments should notify students who choose to ride in a private automobile that they do so of their own free will.

Vehicles

- University vehicles or chartered buses should be used for field trips.
- Anyone who operates a University owned vehicle for field trip activities must be qualified as per the policy of the State of Georgia.
- If a chartered bus is used, the bus service must be approved by Purchasing. KSU has a bus charter contract with *American Coach Lines of Atlanta*. Contact Shane Shipman by e-mail, rshipman@coachamerica.com or phone 770-449-1806 ext. 120 Also, KSU Departments and Organizations may now charter bus service through the Department of Parking & Transportation with the ***Big Owl Bus*** (***B.O.B.***) For additional information on charter bus service with B.O.B. please visit this web page: https://web.kennesaw.edu/auxiliaryservices/content/charter-bus-services.
- If a personal vehicle is used for a University field trip, the driver's own insurance policy serves as the primary policy.
- Any traffic and parking violations are the responsibility of the driver, not the institution.

Foreign Study

- For foreign study, please refer to the Study Abroad Program.

Acquiring Materials and Supplies

Laboratory materials can be provided from many funding sources. There are many sources for funding and can be specific as to what can be purchased. These budgets require approval from the department chairs and/or Dean for any purchases. In addition, any purchases made with the student lab fee fund must be used for items that students will be directly involved in. Equipment and supplies purchased with student fees cannot be used for individual faculty research.

Equipment and supplies purchased for instructional laboratory activities are for those uses only. Do not take items from the instructional laboratory rooms and the prep rooms. Neither of these areas maintain general supplies for all to take. Instructional labs and prep rooms are not for research equipment or supply storage without special permission as per the College of Science and Math Space Policy. A rule of thumb, unless you are prepping an instructional lab, you do not belong in the prep room nor can you take anything from there.

Purchase Requests

Always consult with the Lab Safety Officer or others who are making purchases for you before you begin to search for products to purchase. There are specific rules for several different commodity categories involving vendors and preapprovals.

When requesting a purchase, provide the list with description of the items, catalog number, vendor and quantity. Please do this by email (preferred) or some other written form. DO NOT send large spreadsheets or complicated Word documents. A simple list is all that is needed.

Quotes

Prior to requesting a quote from a vendor, consult the Lab Safety Officer or other purchaser to ensure compliance with all appropriate policies.

Inventory

Most equipment items are inventoried. Approval is required before taking anything off of campus. Loaning equipment is not allowed without special approval.

Repairs

Contact the Lab Safety Officer or other purchasers if equipment purchases are needed. Special procedures and approvals may be needed before a service technician can begin service.

Equipment Moves

Equipment moved on or off campus and between campuses is required to be decontaminated if used with hazardous materials. A Decommissioning Form must be filled out, the equipment must be inspected by EHS and a decontamination sticker attached to the equipment before it can be moved.

If used equipment is to be brought to campus, documentation of decontamination is required to accompany the equipment. Used equipment without documentation cannot be brought on campus.

Any equipment to be installed on campus requiring connection to services such as electrical, water, ventilation, etc. must be approved by Facilities Services BEFORE it is brought on campus. Installers are to coordinate through Facilities Services prior to arrival of the equipment. Any equipment that requires connection to computers, whether networked or not, needs approval from UITS Technical Support.

Also, taking any recorded asset (items of value over $3000 or computer equipment) off campus for any reason must be approved and documented with Asset Management.

Standard Operating Procedures

Standard operating procedures (SOP) are required for all lab or field activities. The SOP could be for:

- A specific research project
- A PI's Laboratory
- A common procedure or operation
- Use of a specific material

An SOP manual shall be located in each room where required. It will contain all SOP for common activities.

In addition, Directed Study and Directed Method student projects will have an SOP for each project.

Appendix A contains the forms and examples of a correct SOP.

Guidelines for Student Laboratory Assistants

Student Laboratory Assistants for the College of Science and Mathematics are part-time employees of Kennesaw State University. The assistants are a vital part of a team effort directed toward the education of students in the sciences. As such, they are depended upon to be responsible and reliable support personnel in a variety of laboratory settings.

Responsibilities of Student Laboratory Assistants include any or all of the following: Preparation of media and solutions, care of laboratory animals and plants, setting up of experiments, care of laboratory instruments, equipment, glassware and facilities. Duties and assignments range from semi-skilled routine tasks to highly specialized technical procedures.

General Personnel Information

Student Laboratory Assistants are employed on a semester-to-semester basis as the need for assistants arises. Student laboratory assistants are assigned to courses or "at large' at the beginning of the term. Student Laboratory Assistants are employees of KSU and are expected to act in a professional manner, follow and encourage others to follow safety rules, practice good personal habits and be able to work productively with others. Failure to do so could result in re-assignment or termination.

Supervision

Student Laboratory Assistants are hired by the designee of the department or the college supervised by the laboratory coordinators, with cooperation of the faculty and staff of the department.

Pay Period

- The work week for Student Laboratory Assistants starts on Saturday at 12:01 am and ends the following Friday at midnight. **Student laboratory assistants are permitted to work a maximum of 20 hours per week.** However, there is seldom that much work available. The maximum applies even if a student works in more than one department. The combined total should not exceed 19 hours. Some special situations may require students to work more than 19 hours per week, but **never** more than 40 hours per week. In addition, no promises are ever made to provide a student a consistent number of hours each week.
- For purposes of payroll, the two-week period is the official pay period. Each individual week is considered separately regarding compensation time calculations.
- Students are paid on Friday of the week following the due date for electronic timecard system, ADP.

Overtime

- Working hours that exceed 40 hours within the KSU workweek is considered overtime. Compensation is calculated at 1 ½ times the hourly rate for all time in excess of 40 hours. **Student laboratory assistants are not allowed to work overtime, either in a single KSU department or a combination of KSU departments.** Before any employee can work more than their assigned hours, they must complete the ***Prior Authorization for Non-Exempt Overtime/Compensatory Time*** form. This form must be approved, in advance, by the Department chair and the Dean of the College of Science and Mathematics.

Attendance, Tardiness and Absenteeism

- All Student Laboratory Assistants are advised of their work hours when they are hired. For the University and the Department to maintain a smooth and consistent operation, its employees must report to work at the designated time and remain on duty in accordance with his/her schedule.
- All Student Laboratory Assistants are expected to report to work promptly at the beginning of their workday and after meal breaks. There are seldom replacements for someone tardy or absent so make arrangements to cover your labs. If any employee finds it necessary to be absent or late for work, such absences or tardiness must be immediately reported to the lab safety officer, lab coordinator and/or the main biology office. **It is important that you speak to a live person rather than leave a message or send an email** so your duties can be covered by someone else. **It is important that you plan your studies and your work schedule carefully. It is better for the department to plan on having someone else do the job from the beginning than to replace you at the last minute. You have two important responsibilities; you are a student and a student assistant.**

A record of tardiness or absenteeism may result in disciplinary action, and can eventually result in termination of employment. In addition, disruptive or uncooperative behavior will not be tolerated among the student assistant workforce. Those doing so will be terminated.

Reporting Hours

In all cases, student laboratory assistants are expected to maintain and report the appropriate information on their ADP time cards. Send an email to your supervisor for any clocking errors or discrepancies.

The ADP time records must be a true reflection of the time worked each day. Any attempt to defraud KSU by supplying false information will result in termination.

Duties of the Student Laboratory Assistants

For those assigned to a specific course, section, of courses, or room, the student assistants are responsible for setting up labs, making solutions, supplying all glassware, instruments, and equipment, and monitoring the successful completion of experiments, keeping the lab clean and in order at all times, as well as other duties not listed here. All student laboratory assistants will receive job-specific safety and operational training.

Special attention should be given to the chemicals and supplies. You should check two weeks in advance of what will be needed to allow for supplies to be ordered. If supplies are needed it should be brought to the attention of the lab coordinator as soon as possible. It is best to do so in writing so it is not forgotten (note, email, etc.). The same attention should be given to the equipment. If something is not functioning properly, it should be brought to the attention of your supervisor. When setting something aside for repairs, label it with the condition, your name and the date. Inform the lab coordinator as soon as possible.

If you are assigned a course or an area, you must meet with the lab coordinator prior to and during the semester to receive syllabi and further instructions for the semester. Keep the lab coordinator informed as to what is happening in your assigned area. If you are an "at large" assistant, your duties will often change from day to day. You will receive specific instructions as to the tasks you are to perform.

Some guidelines to follow for all student laboratory assistants

- Always follow the safety rules.
- Lab prep is a team effort. We have a community of student assistants, staff and faculty all working toward the same goal. No single person has ownership of a lab or priority over others.
- If you cannot come in to prep a lab, find a replacement and/or contact the lab coordinator or lab safety officer. You must talk to a live person to make sure your prep is being covered. Do not just leave a message or send an email.
- Make sure all materials and supplies are returned to their proper location.
- Plan enough time to complete your prep. It is far better to be done early than not be ready by class time.
- There will be several communications sent out during the semester by email or Facebook. Respond promptly when asked for information.
- Report any accidents to the instructor or lab coordinator no matter how small they may seem.
- Always wear the proper attire. A lab coat is recommended and may be required in some areas.
- If you take equipment or supplies from another room, leave a note in the space you took it from. Leave your name and what room it was moved to.
- Return any borrowed items to the original location.

Guidelines for Directed Methods, Directed Study and Undergraduate Research Students

Because the College of Science and Mathematics laboratories and equipment are shared by the faculty for research and our lab classes, special considerations have to be taken in order to have an equal opportunity to successfully and safely complete your research. All persons using the lab facilities must read and comply with the following policies regarding lab safety, equipment use and lab etiquette.

Remember that you are responsible for:

- Your own health and safety.
- The health and safety of those around you.
- The security and the safe use of equipment and facilities that you have been authorized to use.
- Understanding and complying with all laboratory policies.

Be prepared to work hard and work independently, especially if your project is an ambitious one. Laboratory procedures require patience and techniques that only practice can teach. Long hours of observation may be involved. Things do not always go as expected and they rarely go according to a predetermined schedule. Be sure you have adequate time to do the work and have an alternate plan ready in case you reach one of the infamous dead ends.

With that said, keep in mind that the rewards of a successful project are great. The techniques you will learn are applicable in the many career paths in today's job market. Your project will look great on a resume or graduate school application!

Before beginning any project, it is important to learn as much as possible about the methods you will be using. You don't want to waste your valuable lab time learning something you could have read in a textbook or published paper.

Keep in mind that each project will need a unique set of methods and techniques. A method that works for one project may be the wrong method for your project. You will need to find out more specifics about your application.

Finally, be sure you have what you need to complete this project. We cannot always supply many of the consumable items you will need such as chemicals or microorganisms at the last minute. Most of our supplies are for laboratory classes only and are very limited.

Laboratory Policies

In order to manage risks, it is necessary to limit access to equipment, laboratories, supplies and certain storage areas. The following general policies apply to ALL laboratories within the College.

Access

Directed Study students will be assigned an area to work in. Other areas are off limits unless given specific permission. You may not enter any other lab, stockroom, storeroom or

office unless you have been specifically authorized. If you are granted access to the laboratory for a particular project, you are permitted to work on only that project and not on an unauthorized project.

Having swipe card or key access does **NOT** mean you are authorized to access a lab. To be authorized, you **MUST** have been trained in the appropriate hazards and control measures by the supervising faculty or laboratory coordinator. Once authorized, you may gain access only to that laboratory for the time you have been approved for.

Where access to a room is restricted, such as by a swipe card or lock, you are **NOT** authorized to allow entry by people who do not have authorization for access to that facility. This means that you are **NOT** allowed to unlock the facility or provide entry for someone else or have friends visiting you in the lab.

In ideal circumstances, work in the labs would be completed during normal working hours. In practice, however, it is sometimes necessary or desirable for staff or students to work on campus at other times. In these circumstances there is an increased risk to health because of the lack of supervision and a lower availability of assistance if someone is incapacitated due to accidental injury or sudden illness. Such risk is greater in certain laboratories or where there are particular hazards. Our goal is to ensure that appropriate measures are taken to minimize risk to the health and safety of staff or students who work on campus in laboratories after hours.

Prior to students working after hours in a designated laboratory, they:

(a) must have completed appropriate training, including emergency evacuation and other necessary emergency procedures;
(b) must notify their supervising faculty of their intentions;
(c) must obtain their supervisor's authorization to perform any designated high-risk procedures; (note: approval will not be given for such procedures to be performed by anyone intending to work *alone)*

Students working after hours in a designated laboratory:

1. must not perform any designated high-risk procedures if working *alon*e;
2. must comply with all normal safety procedures and take any special safety precautions as previously agreed with their supervising faculty and the lab coordinator;
3. must follow the background check procedures through KSU Human Resources and Card Services for after-hour access.

It is best to use the "buddy system" in order to have a second authorized person present in the laboratory to summon help in case of an accident. However, if you are working alone in the lab, it is recommended that you keep your cell phone on your *person* so it is within reach at all times, not in your book bag or on the lab bench.

Supplies and Reagents
Directed Study students must make a realistic list of the supplies needed for their project. The list must be discussed with the supervising faculty and the lab coordinator prior to the start of the project so supplies can be ordered.

Write out your calculations before obtaining and mixing chemicals. Don't be shy about asking your faculty supervisor to check your calculations. Keep this information recorded in your experimental lab notebook, reviewing it often.

Materials in the lab are for class use. All material for projects must be purchased using the project's budget, identified as to the project, and separately stored on a space available basis. **The cost of unauthorized use of materials will be directly charged to you**.

Unless given permission, Directed Study students are not allowed to take stock supplies, solutions or media prepared for instructional labs. Do not "borrow" class materials for a special project or project materials for a class. Plan ahead. Even with permission, let someone know when you take supplies. Never take the last of anything without asking first.

Student lab assistants are a great source for information when locating items and making solutions. However, they are there to prep for the lab classes and are not expected to work on your project.

It is a good practice and part of the learning experience to prepare your own media.

You are not permitted to bring materials and/or chemicals into the lab without approval from the lab coordinator.

All materials must be stored in viable, closed containers. These containers must be labeled with the original manufacturer's label, or a reasonable facsimile.

Each and every container used for materials must have the common compound name (no formulas or abbreviations) or the solution content and strength, the users' name, the date, and appropriate hazard information. This policy applies to all containers or glassware whether the material is hazardous or not (i.e. water, buffers, etc.) including solvent waste containers. Each room has a poster explaining proper labeling

The Safety Data Sheet (SDS) must be read for all materials in use. The forms may be obtained in the room where the chemical is found, from web sites or through the lab coordinator. All researchers must have a printed copy of the SDS on file in the lab for all chemicals being used**.** Photocopy them if necessary, and keep them in your lab notebook. All the necessary information that you require to carry out your lab work should be kept in the lab and within reach.

Housekeeping
When you set up your area for experiments, check the fume hoods, lab bench, etc. for space and cleanliness. You want to insure that nothing else is going to interfere with your

experiments. If the area requires cleaning, use nitrile gloves (or other glove types) even if you are using a lab bench cleaner. Better to be safe!

Keep the work area clean and tidy. Keep common work areas clean. When you have finished for the day, make sure all tools, equipment, and supplies are returned to their proper storage, and the equipment is shut down. All glassware must be cleaned before it is put away. Be courteous to your colleagues--CLEAN UP!

All the glassware, containers, bags, that you use are to be properly labeled. Follow the Department guidelines. Make sure that you have all the relevant information on your containers (name, dates, etc.). Never store anything without labeling. It will likely be tossed out by the lab coordinator.

Each student is responsible for cleaning all of his/her glassware at the end of each day. It is never acceptable to leave dirty glassware in the sink for someone else to clean. Glassware must be cleaned properly immediately after use to avoid having solutions and compounds dry on the surface. Persons not cleaning their glassware immediately after use will no longer be permitted to use glassware. This rule is strictly enforced.

Arrangements for storage and disposal of hazardous material must be made in advance prior to using the lab. Proper waste disposal is an important part of our lab chemical hygiene program and subject to fines from the State if not handled properly. All waste should be placed in the proper container for the appropriate disposal method and should be properly labeled, then placed in the designated Waste Consolidation Area in each room. Please also be sure that the waste bottle is capped AT ALL TIMES unless you are adding waste. Notify the lab coordinator when you have full containers.

Sharps (blades, disposable syringes and syringe needles) must be disposed of in the red sharps containers. Sharps must never be disposed of in the wastepaper baskets for any reason!

Hazardous material spills must be dealt with immediately and appropriately. This includes the proper cleanup of workspaces, glassware and equipment as well as the proper cleanup and disposal of consumables.

All instruments, counter tops, exhaust hoods, tool kits, and work spaces must be left in a clean and operable condition following the completion of work.

All data stored on computers must be backed up and deleted within 48 hours or it will be removed. In all circumstances, data on the computers is stored at the researchers own risk.

Normally, all lights are to be turned off when leaving the lab and all doors checked as locked.

Safety

Research with a variety of materials presents potential hazards of exposure that need to be carefully considered. Guidelines for safe use of equipment as well as hazardous chemicals require that safe practices and procedures be in place to reduce or eliminate these exposure risks. First and foremost, read our Physics Safety Guidelines (pg 13). It explains the important safety considerations. Also, you need to know the specific risks of the equipment and/or materials you will be working with.

Users must be aware of appropriate emergency procedures *before they are needed.* All users must know the location of telephones, fire extinguishers, eyewash stations, showers, and spill clean-up stations. All users must also know the location of emergency contact information.

The safety of self and others is the personal responsibility of each and every lab user in the CSM labs. Users must constantly be aware of the hazards associated with the chemical and biological materials present throughout the lab and the instrument they are using.

In all circumstances, the use of hazardous materials must be restricted to areas with the proper design, ventilation, the exhaust hoods or biological safety cabinets. Users should be aware of the operating principles of the safety hoods.

The appropriate level of protective clothing and eyewear must be worn when using hazardous materials.

You should locate posted information regarding emergency contact information and identify the location of fire extinguishers and eye washes (if appropriate) within the laboratory.

You should review and understand all additional posted access, safety warnings, and safety policies for the laboratory.

All injuries that occur in the laboratory must be reported immediately to the lab coordinator.

If you create a hazard you must control it. It is important to notify and involve a faculty member or the lab coordinator where the hazard is located.

Consumption of food and drink is prohibited in all laboratories.

APPROVED EYE PROTECTION MUST BE WORN AT ALL TIMES WHILE IN THE LABORATORY WHENEVER THERE IS A RISK OF EYE INJURY, regardless of whether you are a visitor or you are working on the project. Eye protection includes protective goggles or safety glasses with side shields.

NO SHORTS, TANK TOPS, SANDALS, OR OPEN HEEL or OPEN-TOE SHOES ALLOWED. Long hair must be tied back, long sleeves must be cuffed or rolled up, and loose jewelry secured when working on machinery.

IT IS YOUR RESPONSIBILITY TO KNOW THE SAFETY REGULATIONS GOVERNING THE OPERATION OF ANY EQUIPMENT PRIOR TO USING SUCH EQUIPMENT.

Additional safety equipment can be made available to you if necessary. Masks, specialty gloves, etc. can be obtained from the lab coordinator.

Equipment Use

The laboratories and their equipment must be maintained in manner that allows for clean, safe use by all persons in the KSU science community. Persons operating in a manner that jeopardizes the research and safety of others or in a manner that damages or renders instruments or lab facilities unusable to others may have their lab privileges suspended or revoked.

Respect the rights of others to use the instrument, and honor their reserved times on the instrument.

Conflicts in schedules are best resolved when all parties work in cooperation. Persons refusing to cooperate when asked to do so may have their lab privileges suspended or revoked. **Instructional lab courses have priority in equipment use.**

In all cases, the lab coordinator has final say in instrument scheduling and usage.

In the laboratories, only students qualified and approved to run equipment may do so. Approval is by faculty knowledgeable of equipment operation and safety or the lab coordinator, you are not to "teach" unapproved students how to use equipment. **YOU ARE REQUIRED TO COMPLETE TRAINING ON ANY EQUIPMENT PRIOR TO USE**

If you have any questions regarding the operation of a machine, ask for help from a qualified faculty member or the laboratory coordinator.

Do not attempt to modify or repair any equipment or apparatus unless you have been authorized to do so.

Do not use equipment that is broken, dangerous or malfunctioning. Report all such items to the lab coordinator.

Follow guidelines posted on the walls of the lab and, in some cases, on the individual pieces of equipment.

In order to prevent injury to you and damage the equipment, DO NOT ATTEMPT TO OVERLOAD THE CAPABILITIES OF THE MACHINERY**.**

Electric shock, high temperature, moving parts or magnetic field hazards are associated with some analytical instruments. Users must be aware of the hazards associated with the specific instrument and exercise proper care in the vicinity. The bottom line: Know your instrument, know your materials, and know what to do in an emergency.

Notify the lab coordinator when maintenance or repairs are required for an instrument.

Violations and Enforcement
Faculty, staff and lab assistants will strictly enforce laboratory policies and safe use practices.

Anyone found under the influence of drugs or alcohol or is impaired in such a way as to compromise safety will immediately be asked to leave. Offenders will have their lab privileges revoked for the semester. Any violation of laboratory policies or witness of an unsafe act can result in the loss of authorized laboratory access.

Failure to Comply

All students, faculty, staff and visitors who work in the laboratories at Kennesaw State University are expected to comply with the procedures published in the Chemical Hygiene Plan and the Laboratory Handbook.

In instructional laboratories, the instructor or the graduate teaching assistant assigned to teach the course is responsible for enforcing that students enrolled in the course are in compliance with safety procedures. Students who do not comply may be subject to a reduction in their grade and/or dismissal from the laboratory, according to the policies established in the course syllabus.

In research laboratories, the principal investigator assigned to the laboratory space is responsible for enforcing that all personnel in their group (including but not limited to undergraduate research students, graduate students, postdoctoral fellows, research scientists, and short-term visitors) are in compliance with safety procedures.

Failure of faculty and staff to comply with safety procedures may result in negative performance reviews, loss of laboratory privileges, and possibly termination of employment, subject to University guidelines for personnel review.

Laboratory Safety Violation Report Form

The Laboratory Safety Violation Report Form is the method used to inform a PI, faculty or staff of a safety violation. It is created and given to the non-compliant party by the Laboratory Safety Officer, the Department Chair and EHS together after an investigation. This form is not meant to be a punishment. It is a method of informing the need for changes to be in compliance. Other action may come as the result of a collection of violations or violations of considerable danger (see Laboratory Safety Standards). That action is done by the dept. chair, etc. However, this form is not that process, only a way to inform of a violation and the way to resolve it. This process focuses on safety and compliance only. Corrections of safety violations could be viewed as a positive action and favorable for a PI, faculty or staff member.

Maintaining records of such actions demonstrates KSU's proactive response and commitment to safety. It also provides a record of cooperation with compliance corrections or demonstrates a pattern of non-compliance.

Safety violations can be for any regulation we are subject to (see BOR Statement, pg 2)

Kennesaw State University

LABORATORY SAFETY VIOLATION REPORT

This form is given to the Kennesaw State University employee by the Department Chair along with the Laboratory Safety Officer and the Department of Environmental, Health and Safety. The purpose is to inform the employee of the need for changes to be in compliance with any regulations the University and employees are subject to or to eliminate a hazardous situation. Other action may come as the result of this violation, a collection of violations, or violations of considerable danger. However, the first and foremost purpose of this form and proposed action described is to eliminate hazards and be in compliance.

Date: _____

Employee(s):

_____

_____

_____

_____

Department:

_____

____

Violation Classification:

☐	☐	☐	☐
Imminent Danger	Serious Violation	Non-Serious Violation	Documentation Violation

Summary of Violation (attach additional information):

_____

_____

_____

_____

_____

Response Meeting

In Attendance:

_____

_____

_____

_____ Date: _____ Time: _____

Comments:

_____

_____

_____

Corrective Action:

_____

_____

_____

Additional Training Required:

_____

_____

_____

_____

I have read and understood the above safety violation report. I further understand that I have received a written warning and that failure to correct the violation may result in disciplinary action.

Employee Signature: _____ Date: _____

Supervisor Signature: _____ Date: _____

Laboratory Safety Standards

The health and safety of workers and building occupants is the most important factor to consider in laboratory work. In addition to these health and safety concerns, compliance with OSHA, State of GA and EPA regulations is also important because of the severe financial consequences, especially related to EPA hazardous waste regulations. Fines for seemingly minor violations, e.g., improper labeling, lids not screwed-on tight, etc., may run into the tens of thousands of dollars, therefore compliance with these regulations must receive special attention.

Sources of environment, health and safety standards and key compliance issues include:

Standard	Key Compliance Issues
OSHA Laboratory Standard	Laboratory Safety Plan, training of staff, MSDSs, emergency plan, secure compressed gas cylinders, outdated peroxide-formers
EPA/State Hazardous Waste regulations	Lids, labels, mixing incompatibles, secondary containment, location
Fire/Life Safety Codes	10-gallon open storage flammables limit, clear laboratory egress, hallway storage
Biological Safety, Security	Biological agents and toxins use practices, containment, facilities, management and security
University and BOR policies	Training, prevention of injuries, personnel policies, grant proposal review,
Consensus standards of good laboratory practice	Hazardous material inventory minimization and storage compatibility, housekeeping, appropriate attire, food & drink within designated area

VIOLATION SEVERITY CLASSIFICATIONS

The University uses the following categories of violations:

Imminent danger

a process, action, or condition where there is reasonable certainty a hazard exists in a KSU laboratory that can be expected to cause serious physical harm.

Serious violation

a process, action, or condition in a KSU laboratory that will probably lead to physical harm or significant exposure to biological or physical agents or violates regulatory standards (e.g. hazardous waste container management).

Non-serious violation

a process, action or condition that has a direct relationship to health and safety in a KSU laboratory but probably would not cause serious physical harm or significant exposure to biological or physical agents. Related non-serious violations may result in a serious violation where in combination they present a substantial probability of exposure, injury or physical harm.

Documentation

Required KSU laboratory EHS documentation has not been completed, updated, submitted, and/or retained.

ENFORCEMENT POLICIES

Imminent danger

Environmental, Health & Safety, along with the Department Chair and Lab Safety Officer, notifies lab personnel to immediately cease operations and close the laboratory, then notifies the EHS Director who in turn notifies the department head of the affected PI to request assistance in abatement of the problem. The EHS Director also notifies the Facilities to secure the area if necessary. EHS will perform follow-up inspections to ensure compliance.

Serious violation

Environmental, Health & Safety, along with the Department Chair and Lab Safety Officer, notifies lab personnel and PI, if available, of the violation and sets a deadline for abatement, and may recommend that the PI shut down the operation until abated. Follow-up notification, in writing, goes to the PI and safety supervisor. EHS will perform follow-up inspections to ensure compliance if appropriate. ALL laboratory personnel, including Principal Investigators, may be required to complete additional training. All lab members must complete the training course within two weeks of the laboratory safety inspection report date. If not all lab personnel complete the training within two weeks, EHS will act in accordance with the policies of the University and the College. EHS will conduct a follow-up inspection in three months to verify that compliance with the regulations is being maintained.

Non-serious violation

Environmental, Health & Safety, along with the Department Chair and Lab Safety Officer, notifies laboratory personnel of the violation and requests abatement as soon as practicable. EHS sends follow-up notification in writing to the PI. EHS sends a summary report of all inspected PIs to respective department heads annually.

Documentation violations

Environmental, Health & Safety, along with the Department Chair and Lab Safety Officer, notifies laboratory personnel of the violation and requests abatement as soon as practicable. EHS sends follow-up notification in writing to the PI. EHS sends a summary report of all inspected PIs to respective department heads annually.

NOTIFICATION OF GRANTING AGENCIES

For some research, EHS has signed a "Certificate of Environmental and Safety Compliance", a requirement for some granting agencies. This certification requires EHS to notify the granting agency if that laboratory is in violation of any applicable environmental or safety law or regulation.

REPORTS TO DEPARTMENT HEADS AND LABORATORY SAFETY COMMITTEE

EHS will send annual reports to the department head summarizing inspection activities within his or her department. The reports will list the nonserious, serious, imminent danger, and documentation violations for each PI and render a general assessment of Outstanding, Good, Fair, or Unacceptable. EHS will also report these findings at meetings of the Safety Committee, as appropriate.

SOP Information, Examples and Forms

Procedures and protocols for each individual laboratory or group of laboratories should be developed to handle potential emergency situations. Standard operating procedures (SOP) for
using specific chemicals or apparatus that could cause injury should also be developed. This appendix will provide guidance as to what procedures or protocols should be developed and what
information should be contained within the procedures or protocols. The SOPs should be brief and to the point. If it is too lengthy, it will not be read. SOPs can also be extremely valuable in academic laboratories and can be employed anytime there is procedure that potentially more than one person will use in a research group. They can be written to:

- outline sampling procedures, describe the proper procedures for the transportation of research materials;
- standardize the methods of training for often used experimental methods and/or analytical instrumentation; and to
- document the methods used in data handling and/or analysis.

To be effective, SOPs need to describe not only what needs to be, but who is qualified to carry it out, and under what conditions the procedure can be performed reliably.

SOPs can be invaluable to students involved in undergraduate research in providing written guidelines detailing how to carry out new/unfamiliar methods reliably. The action of authoring an SOP can be beneficial in helping you to think through the procedures you use in a thoughtful step-by-step manner and document clearly and succinctly in writing your understanding.

Research Laboratory
Standard Operating Procedure
Guidance Document

What information is needed in a laboratory standard operating procedure?

Well-developed Standard Operating Procedures (SOPs), or Standard Laboratory Practices, are essential tools for any laboratory that manipulates biological research materials. SOP's serve as a resource to train new lab staff, supplement recurrent training curriculum, and as a valuable reference in the event of an emergency. The following components should be considered when establishing *minimum* best practices in a research laboratory. However, the value of an SOP only holds merit if it is implemented by all laboratory workers and enforced by the Principal Investigator.

Principal Investigator Responsibilities

The Principal Investigator (PI) has the primary responsibility for ensuring that their laboratory is safe through establishment of the initial risk assessment, administrative controls, and by ensuring that all work is conducted with appropriate engineering controls. PI's must adhere to all applicable guidelines and regulations. The PI is responsible for the safe use of biological agents in their laboratory.

Laboratory Staff/Student Responsibilities

The laboratory staff and students are responsible for knowing the potential hazards contained within their respective work areas, in particular the biological material and appropriate procedures and practices to be used in the laboratory. Laboratory employees must follow approved laboratory procedures and safety guidelines at all times. For information regarding minors working in laboratory areas, please contact EHS.

General Emergency Contact Information

The first page of the SOP should include emergency contact information so that it is quickly and easily accessible. and the laboratory location

Section 1 - Purpose

What is the overall purpose of the SOP?
As an example: *This SOP has been developed to outline the hazards involved with research using bacterial pathogens and how to safely manipulate these materials to avoid any lab acquired infection (LAI).*

Section 2 — Process

List the process or type of process involving hazardous chemicals - for example, "atomic absorption spectroscopy for heavy metals." Include any unique equipment used. If the term "process" does not apply, proceed to Section 3.

Section 3 —Hazardous Chemicals Involved

List the hazardous chemicals (or class of chemicals) involved, including any hazardous products or by-products. Material Safety Data Sheets (MSDSs) for highly reactive or unstable chemicals should be on hand; MSDSs for all chemicals should be readily accessible. MSDSs for most chemicals are available through the EH&S web site or through the chemical manufacturer.

Section 4—Potential Hazards

Describe the potential dangers for each hazardous chemical or each element of the hazardous process or procedure. Include physical, health, and environmental hazards. To find hazard information, look up the MSDSs (available from the EH&S web site or from chemical manufacturers) or look online for other sources such as Cameo Chemicals , a National Oceanic and Atmospheric Administration (NOAA) database that provides hazard information in a user-friendly format. In addition, the Sigma- Aldrich web site, has technical bulletins that provide detailed information about various processes, equipment and classes of chemicals.

Section 5—Approvals Required

List the circumstances under which a particular laboratory operation, procedure, or activity requires prior approval from the Principal Investigator (PI), laboratory supervisor, or other personnel.

Section 6—Designated Area

Consider establishing a designated area for this operation within the laboratory. A fume hood, portion of the laboratory, or the entire laboratory may be the designated area.

Section 7—Special Handling Procedures and Storage Requirements

Describe special handling procedures and storage requirements including, (but not limited to): specific laboratory techniques; ventilation requirements; temperature controls; chemical incompatibilities; special containment devices; and access restrictions. If applicable, describe safe methods to transport the chemicals.

Section 8—Personal Protective Equipment (PPE)

List the PPE required for each activity or chemical. PPE includes gloves, laboratory coats, safety glasses, goggles, face shields, and respirators. If applicable, indicate the type of PPE (e.g., gloves, splash protection) needed for each phase of a process. For help with PPE selection or to determine if respirator use may be necessary, contact EHS.

Section 9—Engineering/Ventilation Controls

List any engineering controls used. An engineering hazard control is generally defined as equipment or physical infrastructure that reduces or removes hazards from the laboratory. It can include specifically selected and arranged experimental equipment. Common engineering controls include the fume hood, glove box, biosafety cabinet and laser interlock.

Section 10—Spill and Accident Procedures

Describe procedures for handling potential emergencies related to this chemical or process such as accidental releases to the sanitary sewer, spills, fires, chemical burns to skin or eyes, shattered glassware, etc. Note the location of emergency equipment such as spill kits, emergency eyewash/showers, fire extinguishers, etc. Take care to describe any special procedures for dealing with personal exposures (e.g., calcium gluconate should be used for HF exposures). Identify the location of emergency response phone numbers and emergency contact phone numbers. **Emergency situations** can affect your ability to think clearly. It is important that everyone feel confident in their understanding of proper emergency procedures, including nearby lab members whose work may not be related to this SOP but who may need to respond in an emergency.

Section 11 —Waste Disposal

Describe any unique waste disposal procedures for the chemicals.

Section 12—Decontamination

Discuss any appropriate decontamination procedures for equipment, glassware, and clothing. Where applicable, include controlled areas (e.g., fume hoods, glove boxes) in the text.

Section 13 — Process Steps (Optional)

This section is useful for particularly complex or multi-step processes. List each step of the process or procedure chronologically on the left side of the SOP Template page. On the right side of the page and directly across from the corresponding process steps, list precautionary safety measures to be taken, including the use of specific laboratory techniques and PPE. If possible, describe indicators (visual or otherwise) which show whether the reaction, equipment, etc. is working safely as intended or that a hazardous situation may be developing.

Training

SOPs should be reviewed by the PI or at least one peer who is doing similar research. Once an SOP is written, everyone performing work described by that SOP should read it carefully and sign the SOP Training Documentation page at the end of the SOP Template. The location of SOPs should be noted in the "Standard Operating Procedures (SOPs)" section of each laboratory's Chemical Hygiene Plan.

Laboratory staff should have both instructional and hands-on training for all biological and chemical hazards present in the laboratory. Laboratory-specific training should be provided by the PI, lab manager or senior scientist who has several years' experience working with the biological materials or chemicals and can direct staff in safe handling of the materials so as to avoid any accidental exposures. Technicians and students should demonstrate proficiency in techniques before being permitted to perform laboratory procedures independently.

All training sessions should be documented, to include the training session topic, information covered, instructor, date, and attendees. Depending on the significance of the hazards involved, curriculum training and proficiency testing may be warranted.

Kennesaw State University Kennesaw, Georgia	EFFECTIVE DATE: mm/dd/yyyy	DOCUMENT NUMBER: EHS- 0000
	NEXT REVIEW DATE: mm/dd/yyyy	PAGE: Page 58 of 80
TYPE: STANDARD OPERATING PROCEDURE	ISSUED BY: DEPARTMENT NAME	
DOCUMENT TITLE: Handling and Disposal of Phosphonates and other Potential Nerve Agents		

Approved By:	
director of Environmental Health and Safety	Date

1. Purpose

Diethyl (hydroxymethyl)phosphonate, other phosphonates, and similar phosphorus-containing compounds may be nerve agents and should be handled and disposed of with care. Supplies and glassware that come in contact with these chemicals must also be handled properly.

Potential rooms SC 465

Emergency contact Gregory Gabriel; office: 678-797-2653; cell: 512-784-0348
Ben Huck; office: 770-423-6404

2. Scope

All student researchers using these chemicals should be trained in their safe handling and disposal.

3. Responsibilities

It is the responsibility of all users to know the proper handling procedures of potential nerve agents or chemical warfare agents (CWA) outlined in the next section. Known phosphonates such as DMMP and Sarin attack the nervous system and lead to loss of muscle control. Lab users should treat all phosphonates, such as diethyl (hydroxymethyl)phosphonate, used in lab room SC 465, as potential nerve agents and CWA. The emergency contacts should be alerted if the user feels any side effects due to contact with the skin or significant inhalation. The emergency contact may recommend going to the KSU clinic or emergency room.

4. Procedure

Handling : Lab students should seek their advisor's supervision before they handle phosphonates. The chemical can be weighed into a vial on a balance outside a hood but once dispensed, all supplies that have contacted the chemical should be placed in a hood. Before returning the bottle of the chemical back to a vented cabinet it should be closed tightly and wiped down with a wet paper towel and dried.

Disposal: All supplies including gloves, vials, syringes, needles, and glass pipets that have contacted the chemical should be placed in a 1 L beaker containing 500 mL of a 1:1 solution of a commercial bleach, such as Clorox bleach and water. After 48 hrs the 500 mL solution can be safely put in a solvent waste container. The supplies can be rinsed with water one time into the solvent waste container and then disposed of in the normal fashion. For purification of a product from a reaction using these chemicals, the student must seek the advice of their advisor.

Spills: Evacuate the lab room and immediately tell the emergency contacts. The spill will be cleaned up by them using bleach.
Additional Information: The MSDS of diethyl (hydroxymethyl)phosphonate is available online from <www.sigmaaldrich.com>.

Kennesaw State University Kennesaw, Georgia	**EFFECTIVE DATE:** mm/dd/yyyy	**DOCUMENT NUMBER:** EHS- 0000
	NEXT REVIEW DATE: mm/dd/yyyy	**PAGE:** Page 60 of 80
TYPE: STANDARD OPERATING PROCEDURE	**ISSUED BY:** DEPARTMENT NAME	
DOCUMENT TITLE: **Title of the Procedure**		

Approved By:	
rector of Environmental Health and Safety	Date

1. The following pages are example of Standard Operating Procedures. Use these to create specific SOPs for operations in your lab. Purpose

I brief description of the purpose of the procedure/policy. You can site what regulatory requirement the procedure/policy seeks to comply with.

2. Scope

Who is going to be affect by the procedure/policy? What, if any, is exempt from requirement of the procedure/policy?

3. Personnel Qualifications and Responsibilities

- Identify any special qualifications users should have such as certification/training or experience before performing the activities being described in this procedure.
- Outline responsibilities of individual or positions having a role in the activity being described.

4. Definitions

Identifying and define any acronyms, abbreviations, or specialized terms used

5. Environmental Health & Safety Hazards

Identify specific potential hazard from the operations that could result in personnel/student injuries, illness and loss of life or in environmental contamination. Explaining what will happen if the procedure is not followed or is followed incorrectly. You may need to consult EHS department for help with hazard assessment.

1.0 Hazards Prevention and Control

Describe specific measures that should be taken to protect personnel/students from identified hazards. Prevention and control measure may include:

1.1 Engineering Controls:

Describe any specific engineering controls which are required to prevent employee injury to hazards such biosafety cabinet, fume hood, use of engineered sharps, etc.

1.2 Designated Area:

Identify any designated area require for performing this process and required signage

1.3 Personal Protective Equipment (PPE):

Identify the personal protective equipment required to be used.

Emergency Contact

6666

2.0 Emergency Procedures

Describe immediate steps required in the event of an emergency situation. This may include;

- emergency contacts and notifications
- evacuation procedure,
- first aid treatment (e.g. antidotes),
- decontamination & spill clean-up response

3.0 Waste Management

Identify waste stream including hazardous waste, bio/pathological waste, solid waste, etc. and describe appropriate methods of handling and disposal of the waste, including unused stock of chemicals, in accordance with the university procedures.

6. Procedure

Outline all pertinent steps, in order, and the materials needed to accomplish the procedure. For instance a lab procedure may include items such as:

- Instrument or Method Calibration and Standardization
- Sample Collection
- Sample Handling and Preservation
- Sample Preparation and Analysis (such as extraction, digestion, analysis, identification, and counting procedures)
- Troubleshooting
- Data Acquisition, Calculations & Data Reduction Requirements (such as listing any mathematical steps to be followed)
- Computer Hardware & Software (used to store field sampling records, manipulate analytical results, and/or report data), and

If reference is made of another KSU procedure or if a particular subject is covered in more details in another procedure, cross reference the procedure, including the title and procedure number.

Standard Operating Procedure

Read the EH&S Standard Operating Procedures Fact Sheet before filling out this form. Print out the completed form and keep a readily accessible hard copy in the lab (also keeping an electronic copy is highly recommended).

Date: _____

SOP Title: _____

Principal Investigator: _____

Room and Building: _____

Lab Phone Number: _____

Emergency Contact Information:
Campus Security:
Environmental Health and Safety:
Safety officer:
Principal Investigator:

Section 1 – Purpose

Section 2 – Process

Section 3 – Hazardous Chemicals

Section 4 – Potential Hazards

Section 5 – Approvals Required

Section 6 – Designated Area

Section 7 – Special Handling Procedures and Storage Requirements

Section 8 – Personal Protective Equipment

Section 9 – Engineering/Ventilation Controls

Section 10 – Spill and Accident Procedures

Section 11 – Waste Disposal

Section 12 - Decontamination

Section 13 – Process Steps

Process Steps	Safety Measures

Training Documentation

Name (Printed)	Signature	Date

Kennesaw State University Volunteer Program

Kennesaw State University is self-insured through the Department of Administrative Services against state tort claims. This coverage is extended to KSU volunteers who are part of a structured program organized, controlled and directed by a Kennesaw State University Department for the purpose of carrying out the functions of the University. The liability coverage is for injuries and/or property damage volunteers may cause others while acting in the course of their official volunteer duties. Liability coverage does not apply when volunteers deviate from the course of their volunteer duties.

Kennesaw State University does not provide volunteers with any accident or medical insurance. Volunteers are not eligible or entitled to any employee benefits. Volunteers are not covered by worker's compensation laws in connection with their officially approved volunteer activities. If the volunteer activities involve the use of the volunteer's personal vehicle, no comprehensive or collision coverage would be provided to their personal vehicles.

Departments that wish to utilize volunteers for the purpose of carrying out the functions of their department must briefly describe what benefit the University derives from their volunteer program and complete the Volunteer Agreement Form. The Volunteer Agreement Form is to include signatures as required and acceptance of the responsibilities associated with this agreement. The volunteer agreement form will establish the guidelines and description of duties for the structured volunteer program.

The following forms are needed to be in compliance with the structured volunteer program:

1. The Kennesaw State University Volunteer Agreement form
2. The Kennesaw State University Volunteer Services Description form

Submit the volunteer agreement and description of duties forms via email to: jhull@kennesaw.edu or to Janet Nash at Mail Drop 1402. The approval will be sent to the Dean or Director.

If there are any questions regarding the structured volunteer agreement or additional information is needed, please call or email Janet Nash at 470-578-6985 or jhull@kennesaw.edu

Volunteer Services Description

Department/Unit:

_____

Full Name of Volunteer:

_____

Volunteer's Responsible
Supervisor:_____

Volunteer Services: From: _____ To: _____

Purpose for Volunteer Services:

_____

_____

_____

_____

_____

Scope of Volunteer's Work and Duties (per responsible supervisor):

_____

_____

_____

_____

_____

Department/Director Approval:

_____

Date Approved: _____ Email & Phone:

_____

Responsible Supervisor Signature:

_____

Volunteer Signature:

_____

Parent's Signature (if under 18):

_____

Please maintain copies of the *Agreement for Volunteer Service* and *Volunteer Services Description* forms on file with your Department/Unit for at least 2 yrs. Forward original copies to the Risk Manager, Janet Nash at jhull@kennesaw.edu or Mail Drop 1402.

AGREEMENT FOR VOLUNTEER SERVICES

I, _____, agree to work as a volunteer in _____ at Kennesaw State University from _____until _____.

_____ I agree that services are offered strictly on a volunteer basis. I understand that I will not be paid or compensated in any way for my services by KSU, nor will I be considered an employee of KSU for any purpose. I understand that I am not entitled to any worker's compensation.

_____ I agree that my participation in the activities outlined in the attached Description of Volunteer Duties (which is part of this agreement) is not in exchange for any consideration (i.e. payment, employment or the promise of either in the future).

_____ I understand that KSU is self-insured through the Department of Administrative Services against state tort claims. This coverage is provided for volunteers in programs organized, controlled and directed by KSU for the purposes of carrying out the functions of KSU. **I UNDERSTAND THAT COVERAGE DOES NOT APPLY WHEN I DEVIATE FROM THE COURSE OF MY VOLUNTEER DUTIES.**

_____ I release and hold harmless the Board of Regents of the University Systems of Georgia, Kennesaw State University, their members, employees, agents and authorized representatives from all losses, damages, costs, and expenses, claims, demands, rights and causes of action resulting from any personal injury, death, or damage to property arising out of my volunteer activities.

Volunteer's Signature Date

_____

_____

Parent's Signature (If volunteer is a minor) Date

Risk Assessment

A laboratory risk assessment is nothing more than a careful examination of what, in your laboratory operation, could cause harm to people in the immediate area, in the entire facility, or the external environment so that you can weigh whether you have taken enough precautions to prevent harm. Two important things that need to be decided are whether a hazard is significant, and whether satisfactory precautions have been taken so that the risk of injury, damage or loss is small.

Hazard – something that is dangerous and can cause harm; hazards are categorized into three groups: physical, chemical and biological
Risk - the chance of injury, damage, or loss
Chance - the probability of something happening
Certain prerequisites required before attempting to perform a risk assessment include:

- Knowledge of biological, chemical, and/or physical hazards to be encountered
- Understanding of the principles of biological, chemical, and physical safety
- Knowledge of the modes of transmission for the various infectious agents encountered in the laboratory
- Understanding of aerosol production and mitigation
- Knowledge of safety features of your facility
- Knowledge of the type of medical surveillance needed for each employee's job • Knowledge of institutional requirements under which the laboratory operates (this includes local, state and federal regulations) Five steps to risk assessment:
- Look for the hazards
- Decide who might be harmed and how
- Evaluate the risks and decide whether the existing precautions are adequate or whether more should be done
- Record your findings
- Periodically review your assessment and revise it is necessary Some factors that influence risk:
- Mode of transmission
- Procedures that produce aerosols
- Nature of the room ventilation
- Availability of containment equipment and/or personal protective equipment
- Severity of the consequences of exposure
- Concentration of the pathogen or chemical
- Volume of the pathogen or chemical
- Availability of medical intervention strategies

Defining and understanding risks allows laboratory workers to make better decisions to reduce them. Without enough facts one cannot prepare to face situations involving risk. Use knowledge, education, and experience to best estimate the actual risk and plan ways to control or minimize those risks. Risk assessment forms can be obtained from the Department of Environmental Health and Safety.

Below is a link to the NIH guide on risk assessment for further information.

http://www.ncbi.nlm.nih.gov/books/NBK55880/

1.0 Purpose

1.1 To establish a policy for the use of KSU owned or leased vehicles and the transporting of employees and students, by authorized operators of KSU vehicles.

2.0 Policy

3.0

2.1 Only KSU faculty, staff, and approved contract personnel who hold a valid state drivers' license, and who maintain good driving records, are authorized to operate KSU vehicles. The term KSU vehicle shall include all vehicles owned or leased by KSU.

2.2 KSU vehicles will be used for officia1 university business only. Operators will operate KSU vehicles in accordance with all applicable traffic laws and in a safe manner. An employee must complete the Motor Vehicle Use Program Driver Acknowledgment and be approved before operating any university vehicle. The Form must be filed and approved each year.

Procedure

3.1 Public Safety and Human Resources

3.].1 At the request of the employee's department head, Human Resources will conduct a check and validate that the person being considered to operate KSU vehicles is the holder of a current driver's license. If the employee is not the holder of a valid driver's license, they may not operate any KSU vehicles, including utility carts and scooters. Human Resources will provide written notification to the department head, Strategic Security & Safety/Enterprise Risk Management (SSSIERM) and to the KSU Fleet Supervisor.

3.1.2 If the employee is cited for any moving violation, either on or off duty, including a DUI citation, that employee must report the information to his/her supervisor, who will in tum, report the information to Public Safety. After a review of the citation by the Chief of Police or designee, in coordination with Human Resources, a determination will be made regarding the employee's continued authorization to operate KSU vehicles.

3.2 **Department Head(s)**

3.2.1 It is the responsibility of each department head to manage the vehicles assigned to them, including leased vehicles under their control. The department heads will request a driver's license check for all new hires, and any current employees not already checked, prior to allowing them to operate a vehicle.

3.2.2 All operators of KSU vehicles are obligated to report all traffic violations either on or off duty, to the department head or their immediate supervisor within 24 hours of the occurrence. Operators who fail to do so may have their operating privileges revoked and be subject to disciplinary action up to and including termination.

3.2.3 The department head/supervisor will report this information to Public Safety and SSS/ERM. If a vehicle operator reports a

citation for Driving under the Influence of drugs, or alcohol (or any violation included in Appendix 1), the department head/supervisor will immediately suspend the operator's KSU driving privileges and report the matter to Human Resources.

3.2.4 When Human Resources notifies a department head/supervisor, Fleet Supervisor, and SSS/ERM that a vehicle operator has accumulated ten or more violation points within the last 36 months on their driver's license, the vehicle operator will be suspended from driving any university vehicle. The department head/supervisor will contact the Chief of Public Safety, or their designee for assistance in determining the status of the operators driving privileges. "

3.3 All Employees

3.3.1 All employees who operate KSU vehicles are required to use seatbelts and operate vehicles in a safe and lawful manner.

3.3.2 All employees who operate KSU vehicles must successfully complete the Motor Vehicle Use Program Driver Acknowledgement form and receive approval prior to operating a KSU vehicle.

3.3.3 All employees who operate KSU vehicles are required to complete vehicle utilization log which includes dates, time, odometer, fuel. Cost, gallons purchased, and other maintenance costs. Whenever possible aKSU fuel card should be used for fuel purchases. Using a Purchasing Card (P Card) for fueling is strictly prohibited.

3.3.4 All traffic violations whether on or off duty in a KSU vehicle must be reported. Failure of vehicle operators to complete utilization logs or to report traffic violations will be considered a violation of KSU work rules and may result in disciplinary action.

5.3.5 Faculty, staff, volunteers, and students, who transport KSU employees or students, in their private vehicles on official KSU business, must have a valid driver's license.

3.3.6 No smoking is allowed in any KSU vehicle. This is State Law and violations may result in disciplinary action.

3.3.7 No text messaging is allowed when driving a KSU vehicle. The use of cell phones should be strictly limited while operating a vehicle.

4.0 Vehicle Accidents

4.1 All vehicle operators are required to report any accident involving a KSU owned or leased vehicle to the appropriate enforcement agency (KSU Public Safety 470-578-6666 if on or near campus or local enforcement agency 911 if the accident occurs off campus) to ensure that an incident report is made.

4.2 The driver involved in any vehicle accident must notify DOAS Risk Management by calling the Network at 1-877-656-7475 as soon as possible and obtain the case number assigned to the accident.

4.3 The driver involved in any vehicle accident must notify their Department

Head/Supervisor, Fleet Supervisor 479-578--6224, and KSU Office of Enterprise Risk Management (OERM), 470-578-2599 as soon as possible to ensure that the claim is processed in a timely manner.

5.0 "Report My Driving" Reports: As part of the Comprehensive Loss Control Plan (CLCP), KSU agrees to comply with the "Report My Driving" program.

5.1 Drivers who receive negative driving reports have the right to comment regarding the reported action. They must fill out the a comment form within 48 hours of notification of the negative report

5.2 Drivers must complete training based on the severity of the offense

5.3 Reports received will be added to the employee file.

5.4 Excessive reports will be reviewed and may result in disciplinary action.

Appendix 1:

Leaving the scene of an accident

Reckless driving

Refusal to submit to testing

At fault in a fatal accident

Driving under the influence

Vehicular homicide, assault, manslaughter or other driving felonies

Eluding or attempting to elude a police officer

Allowing unauthorized use of the vehicle

Appendix 2: Driving Violation Scale (based on a 3 year history)

# of Minor Violations	Number of At- Fault Accidents			
	0	1	2	3
0	Great	Acceptable	Poor	Unacceptable
1	Acceptable	Acceptable	Poor	Unacceptable
2	Acceptable	Poor	Unacceptable	Unacceptable
3	Poor	Unacceptable	Unacceptable	Unacceptable
4	Unacceptable	Unacceptable	Unacceptable	Unacceptable

Low Speed Vehicle Addendum

Golf Carts and Gators are motorized vehicles that should be treated with the same care, caution, and attention as any other motorized vehicle. The following are guidelines that should be followed when operating Golf Carts, Gators, or any other off-road motorized vehicle.

Before You Drive

- Make sure the horn, brakes and lights work.
- Check the back-up alarm, tire pressure and battery gauge.
- Before backing up, ensure the area behind you is clear of all obstacles, including vehicles and pedestrians.

When You Drive

- Drive only in within the KSU community staying off major city streets when possible.
- Drive beside pedestrian walkways when possible.
- Observe all standard rules of the road, such as coming to a complete stop at stop signs, signaling before a turn and keeping to the right, except to pass.
- Yield to other vehicles and pedestrians.
- Don't drive faster than a quick-paced walk.
- Slowdown in wet conditions, on steep slopes, when approaching corners, intersections or blind spots, and in areas of heavy pedestrian traffic.
- Slow down for speed bumps and uneven pavement. Keep off curbs.
- To avoid tipping, drive the cart straight up and straight down slopes - not on a diagonal.
- Don't drive while distracted. If something other than driving the cart has your attention, stop the vehicle. This includes eating, talking on a cell phone or jotting down notes.

Passenger Safety

- Observe passenger limits. Only two people should ride in a two-person cart and four in a four-person cart.
- Wear the seatbelt and make sure passengers wear theirs.
- Don't stand up in a moving golf cart and don't let your passengers either.

Stopping and Parking

- Don't park in front of emergency exists, fire hydrants, fire lanes, sidewalks, ramps or doors.
- When parking, set the brake, place the cart in neutral and remove the key.
- Secure the parked golf cart with a cable or other locking mechanism.

Transporting Goods

If the golf cart is used to transport equipment, there are some special safety rules to consider:

- Transport materials during periods of low traffic and pedestrian activity
- Don't overload the cart. Take only the bare minimum.
- Make sure the materials are securely fastened.
- Loads should not extend more than a foot from either side or front of the golf cart.
- Use brightly colored material to flag any loads that extend more than three feet (one meter) from the rear of the cart.

Hazardous materials should not be transported in the golf carts

ACCESS PROCEDURES

Providing access to students and others to your lab

1. **Registered Directed Methods/Directed Study students**
    - The student must attend laboratory safety training provided by CSM as well complete the online safety training modules provided by EHS. A safety training schedule is provided at the beginning of the semester and additional training are offered periodically or by arrangement.
    - Once safety training is completed, key card access can be requested for specific rooms through Access Control/Locksmith with approval of the CSM Laboratory Safety Director (see below)
    - The student may need to have their ID card activated at Card Services
    - Upon completion of the project, notify the CSM Laboratory Safety Director to have the access for the student removed
    - All students' access are purged from the locks at the end of May each year unless arrangements are made in advance.
2. **Registered student, but not registered for a formal laboratory experience class with you**
    - They will need to sign a volunteer form
    - The student must attend laboratory safety training provided by CSM as well complete the online safety training modules provided by EHS. A safety training schedule is provided at the beginning of the semester and additional training are offered periodically or by arrangement.
    - Once safety training is completed, key card access can be requested for specific rooms through Access Control/Locksmith with approval of the CSM Laboratory Safety Director
    - The student may need to have their ID card activated at Card Services (see below)
    - Upon completion of the project, notify the CSM Laboratory Safety Director and Access Control to have the access for the student removed
    - All students' access are purged from the locks at the end of May each year unless arrangements are made in advance.
3. **Non-student wanting to work in your lab**
    - They will need to sign a volunteer form
    - The individual must attend laboratory safety training provided by CSM as well complete the online safety training modules provided by EHS. A safety training schedule is provided at the beginning of the semester and additional training are offered periodically or by arrangement.
    - If the individual is a visiting faculty member working at another institution, safety training may be waived based on the training program of their home institution. The Volunteer form can be waived depending on the other institutions policies.

- Room Access may be obtained by Filling out the Non-Paid Affiliate/ Long Term Visitor Form. Follow the instructions on this webpage: http://cardservices.kennesawstateauxiliary.com/visitors/
- Once safety training is completed and the proper approvals are in order, key card access can be requested for specific rooms through Access Control/Locksmith with approval of the CSM Laboratory Safety Director (see below)
- Upon completion of the project, notify the CSM Laboratory Safety Director to have the access for the individual removed
- All students/non-employee access are purged from the locks at the end of May each year unless arrangements are made in advance.

4. **A non- KSU student who is under the age of 18**
    - Your program must be in compliance with BOR and KSU policies relating to minors
    - A parent or guardian must complete the *Waiver and Release Agreement regarding the Use of Kennesaw State University Science Labs*.
    - The individual must attend laboratory safety training provided by CSM as well complete the online safety training modules provided by EHS. A safety training schedule is provided at the beginning of the semester and additional training sessions are offered periodically or by arrangement.
    - No key card access is granted to minors who are not KSU students

    KSU Minors on Campus Policies
    http://protectingminors.kennesaw.edu/policyKSU.php

Requesting Room Access

Due to the changes in the oversight of building and room access on the KSU campuses, there is a new procedure for access requests. Use the website linked below for access requests.
http://dooraccess.kennesaw.edu/
Lab access must be approved by CSM Safety Officers and the college still needs to maintain records of access to rooms and buildings for safety and security reasons.

Below is the new procedure for using the new website.

1. The simplest method is to make the request to your department admin or the access designee. They will then complete the appropriate procedures listed below.
2. For a getting access for a single individual, use the Single Request form. If you are requesting access to multiple individuals at the same time, use the Bulk Request form.
3. Fill out the necessary form. Near the bottom of the form, it asks for the requester information. Dale Zaborowski and Ben Huck are the official requesters for laboratory access. So, fill in as follows (depending on your department or rooms requested)

Name: Dale Zaborowski/your name or Ben Huck/ your name
Email: dzaborow@kennesaw.edu or bhuck@kennesaw.edu
Phone: 470-578-6165 or 470-578-6404

The doors will be programmed shortly after. Undergrad students must go to Card Services after approval and have their card activated.

Undergraduate and graduate students cannot request access themselves. It must be done by the supervising faculty.

Building Access and After Hours Access for Undergrad Students and Non-Students

Building access requires completion of:
Student Access Request Form (for a student) OR **Non-Paid Affiliate/ Long Term Visitor Form** (non-student)
AND a **Background Investigation Consent form**. Both completed forms are sent to Crystal Starr at Human Resources by campus mail or fax (ex. 9176), not by email.
Student Access Form
http://cardservices.kennesawstateauxiliary.com/media/Student-Access-Request-Form.pdf

Note: The current Student Access Form says to send it Card Services. Do Not Do So! They are no longer involved in the process.

Long Term Visitor Form
http://cardservices.kennesawstateauxiliary.com/media/Non-Paid_AffiliateLong-Term_Visitor_Form-1-m.pdf.

Background Investigation Consent
http://hr.kennesaw.edu/forms/16%20Background%20Consent%20Form.pdf

Make sure the forms are filled out completely, otherwise they will be rejected, causing a delay.
After approval a request can be made to Access Control/Locksmith to add the individual to the building access with approval of the CSM Laboratory Safety Director.
The cost of the background investigation is billed to your department.

Additional Information

General Laboratory Handbook for Faculty, Staff and Students
A general guideline for working with hazardous materials as well as other hazards and risks. It can be found at

http://csm-intranet.kennesaw.edu/system/files/2017-01/2016-csm-laboratory-handbook.pdf

Chemical Hygiene Plan
The development and implementation of a written Chemical Hygiene Plan (CHP) is the foundation of compliance required by the Occupational Safety and Health Administration (OSHA) as stated in the publication Occupational Exposure to Hazardous Chemicals in Laboratories (Federal Register, January 31, 1990, pages 3327-3335, part of CFR 1910).

The Chemical Hygiene Plan for Kennesaw State University can be found at:

http://www.kennesaw.edu/ehs/downloads/EOSMS-201-Chemical-Hygiene-Plan.docx

Bloodborne Pathogen Exposure Control Plan
The purpose of this document is to comply with OSHA's Occupational Exposures to Bloodborne Pathogens in Title 29 Code of Federal Regulations 1910.1030 and as revised in 2001 by the Needlestick Safety and Prevention Act P.L. 106-430. The intent of this exposure control plan is to prevent bloodborne infections by eliminating or minimizing employee exposures to blood, blood products, and other potentially infectious materials (OPIM).

Bloodborne Pathogen Exposure Control Plan
http://ehs.kennesaw.edu/docs/programs/EOSMS_215_Bloodborne_Pathogen_Exposure_Control_Plan_v3.0.pdf

Biosafety Manual
http://ehs.kennesaw.edu/docs/programs/EOSMS_203_KSU_Biosafety_Manual.pdf

Emergency Operations Plan
http://oem.kennesaw.edu/preparedness.php

Protective Glove Recommendation Guide
http://www.ansellpro.com/specware/