LABORATORY SAFETY PLAN FOR

LABORATORIES

This is the Laboratory Safety Plan specific to the following areas:

Keck Hall Room 301 (Including 301A, 301B, and 301C)

Principle Investigator: Professor Matthew R. Bennett, Ph.D.

Department: Biosciences

PI Cellular Number: 281-221-4158

Emergency Contacts (Names/CellPhone Numbers):

Andrew Hirning 801-557-2991

Important Telephone numbers

713-348-6000 (x6000 on campus) for Emergency and urgent consultation
713-348-4444 Environmental Health and Safety (http://safety.rice.edu)
713-348-2485 Facilities, Engineering and Planning
713-348-4095 Facilities, Engineering and Planning (after hours)

Revised on: **November 5, 2014**

Laboratory Safety Manual
Table of Contents

Emergency Contact and Response

CONTACT INFORMATION

Principal Investigator: Matthew R. Bennett, Ph.D.
Office location: Keck 306
Office number: 713-348-4161
Cell number: 281-221-4158

Laboratory Safety Representatives
Name: Andrew J. Hirning
Office location: Keck 301C
Office number: 713-348-4393
Cell number: 801-557-2991

Rice Police Department	713-348-6000
Environmental Health and Safety	713-348-4444
Facilities Engineering and Planning	713-348-2485
	713-348-4095 (afterhours)

NEAREST EMERGENCY EQUIPMENT

Phone: Inside either lab office

Fire Extinguisher: By both main lab entrance doors

First Aid Kit: In cabinet at rear of lab

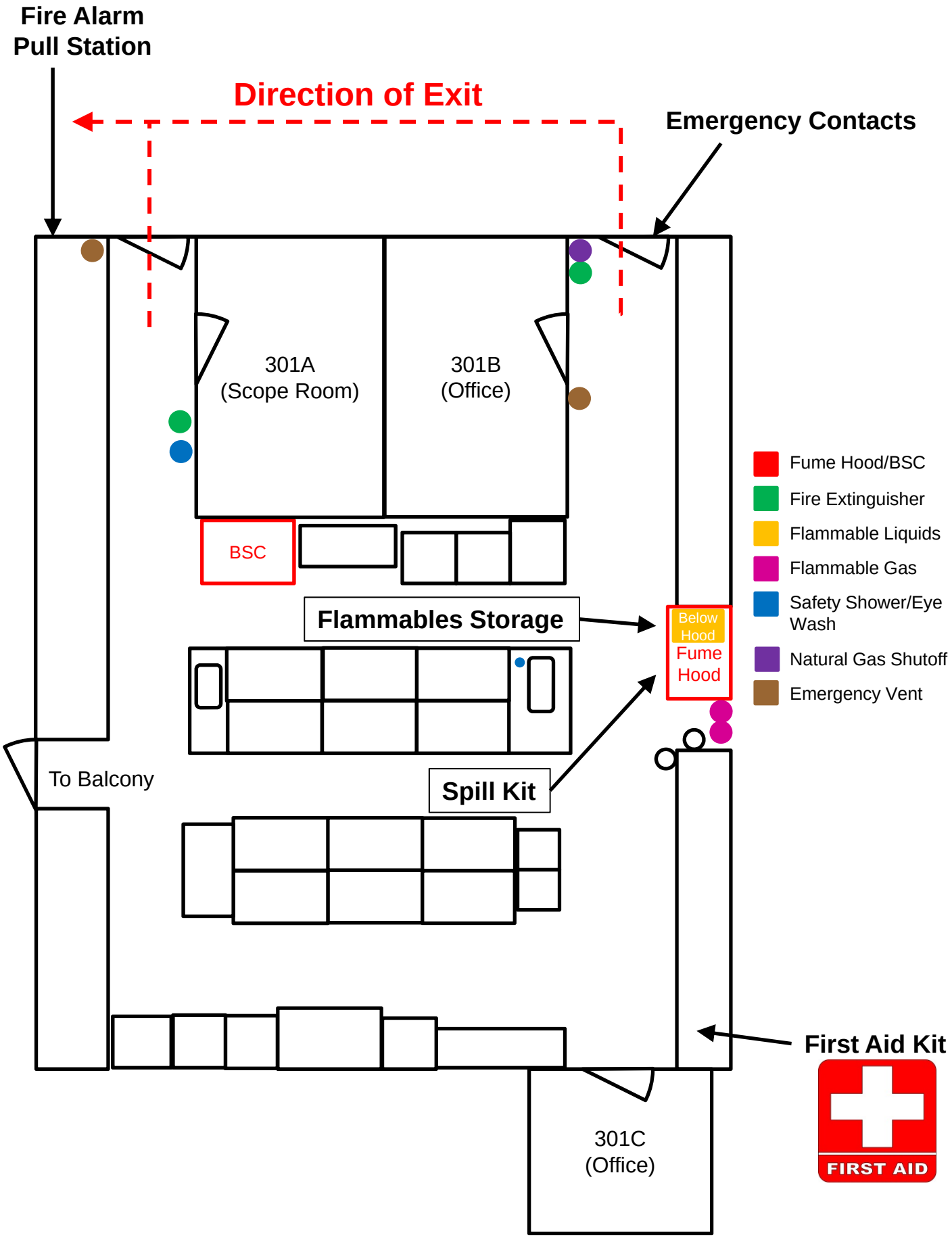
Eyewash: Behind biosafety cabinet on far side of lab

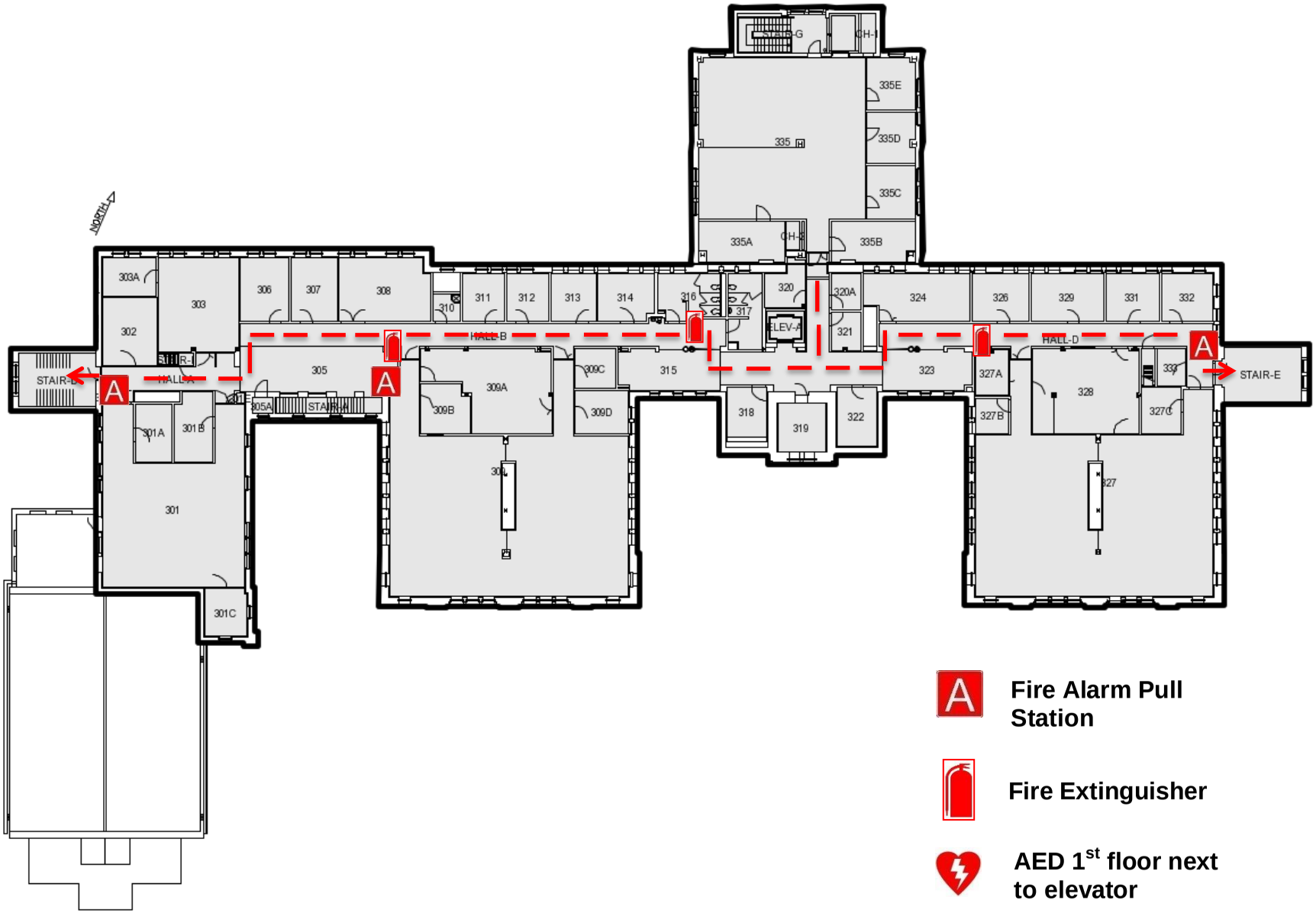
Safety Shower: Behind biosafety cabinet on far side of lab

Chemical Spill Kit: Under chemical fume hood

AED: First floor of Keck, near elevator

Fire Alarm Pull: Outside lab near stairwell door


Fire Alarm
Pull Station
Direction of Exit
Emergency Contacts
301A
(Scope Room)
301B
(Office)
BSC
Flammables Storage
Below Hood
Fume Hood
To Balcony
Spill Kit
First Aid Kit
301C
(Office)
Fume Hood/BSC
Fire Extinguisher
Flammable Liquids
Flammable Gas
Safety Shower/Eye Wash
Natural Gas Shutoff
Emergency Vent
FIRST AID



Fire Alarm Pull Station

Fire Extinguisher

AED 1st floor next to elevator

Evacuation and Safety Equipment Map

Keck Hall

Third Floor

GENERAL EMERGENCY PROCEDURES

1. **Notify everyone around you of the emergency situation.**

2. **Call Rice University Police Department at 713-348-6000.** Do not call 911

- By calling RUPD they will dispatch officers to scene and Rice EMS (if needed).
- In case Houston Fire Department trucks or ambulances are needed, RUPD will meet at entrance gate and guide vehicles directly to location.
- Be sure to tell the dispatcher of your location, and clearly describe the incident.
- If the incident involves chemicals, biological materials, or radioactive materials, you should also call Rice Environmental Health & Safety at 713-348-4444.

3. **Administer First Aid, if necessary.**

4. **Evacuate the area, if necessary.**

MAJOR MEDICAL EMERGENCIES

- **If it is not practical to move the ill or injured individual**, call the Rice University Police and they will obtain an ambulance and escort it to the location of the emergency.
- **DO NOT PLACE A 911 CALL - THE RICE UNIVERSITY POLICE WILL DO THIS.**
- A First Report of Injury Form must also be filed with the Director of Risk Management, VP for Administration (MS-670).
- When the injury or illness involves a chemical, a Material Safety Data Sheet (MSDS) should accompany the victim to the hospital.
- *The procedure outlined above applies to all individuals receiving pay from Rice University who are injured or become ill while performing an activity that directly benefits Rice University. If transportation is unavailable within the injured's department, a request may be made to the Campus Police to provide such.*

MINOR MEDICAL EMERGENCIES

- On-the-job, minor medical injuries/illness (i.e., falls, cuts, sprains and strains) involving employees should be reported immediately to the injured's supervisor. The supervisor should fill out a First Report of Injury Form (available from Risk

Management or the Environmental Health & Safety Department). If medical attention is required, the injured employee should contact their supervisor as soon as possible.

- Students who incur a minor injury during normal class/working hours should be referred to the **Student Health Services , 713-348-4966.**

PSYCHIATRIC EMERGENCIES

For psychiatric emergencies, call the **Rice Counseling Center Office at 713-348-4867.** Staff members are on-call 24 hours a day.

REPORTING ACCIDENTS

To report an accident, "near miss" or hazardous situation on campus **not involving an injury**, contact the Environmental Health & Safety Department, 713-348-4444. Complete an Accident/Incident Report Form and submit it to your Department Head and the Environmental Health & Safety Department. Forms are available from EH&S.

CAMPUS FIRE EMERGENCIES

The following fire emergency procedures should be followed by all Rice University personnel in the event of a fire or explosion:

If you discover a fire or see smoke:

1. **Remove all personnel** (students, visitors and employees) from the immediate danger area.
2. **Activate the fire alarm system** by pulling the nearest fire alarm.
3. **Report the situation by dialing 713-348-6000** (Rice University Police) and report:
    - EXACT location of the fire (building, floor and room #);
    - Type of fire (electrical, flammable liquid, trash, etc.);
    - Extent of fire (severity of fire and/or amount of smoke);
    - Your name and telephone number.

4. If you feel comfortable with the situation, attempt to extinguish the fire using the proper fire extinguisher.
5. **Confine the fire** and smoke by closing all windows and doors.
6. DO NOT LOCK THE DOOR. LEAVE THE CORRIDOR AND ROOM LIGHTS ON.
7. If possible, shut off all non-essential oxygen, gas and electrical appliances in the area and remove any hazardous materials.
8. **Evacuate the building** using the nearest enclosed stairway or ground exit if fire and smoke cannot be controlled, or when advised by the Building Safety Officer, Building Director or if YOU think it is necessary.
9. **Re-enter the building only after the all clear is signaled** by repeated intermittent sounds on the building alarm system.

Building personnel should work as a team to accomplish the above procedures.

Every lab should appoint a person who is responsible for advising fire fighters or Environmental Health & Safety personnel of any hazardous materials (toxins, explosives, flammables, radioactive materials) that may be involved in the fire.

If the fire alarm sounds in your building:

1. The Building Safety Officer should contact the Rice University Police to ensure the alarm was received.
2. **Evacuate the building** using the nearest enclosed stairway or ground exit. Be sure to take personal belongings such as purses, briefcases and keys with you.
3. **Re-enter the building only after the all clear is given by RUPD or EHS.**

FIRE EXTINGUISHERS

Fire extinguishers in academic buildings are inspected and maintained by Rice Environmental Health & Safety personnel. If a fire extinguisher is discharged in your area, please contact EH&S so the extinguisher may be replaced. Call Housing and Dining to report discharge or misuse of fire extinguishers in colleges.

Rice University Policy No. 313

LABORATORY SAFETY POLICY

I. Policy Statement

Rice University has a commitment to provide and maintain a safe laboratory environment for faculty, students, staff and visiting scholars. To this end, the University has created a laboratory safety policy, the goal of which is to minimize the risk of injury or illness to laboratory researchers and workers. To accomplish this goal, the University will endeavor to provide the facilities, equipment, training and support necessary to maintain safe laboratories.

II. Roles and Responsibilities

Faculty, students, staff and visiting scholars. Faculty, students, staff and visiting scholars have various responsibilities to assure their own safety and for the safety of others. They also must comply with federal, state, local and University regulations.

Deans. Deans shall work with departments and the central administration to provide appropriate facilities, infrastructure and resources to support the safe conduct of research within their school/division. Deans shall participate in the laboratory safety problem resolution process to ensure problems are resolved.

Department Chairs. Department chairs shall facilitate building a culture of laboratory safety in their department and shall provide individuals under their management with the authority and support to implement environmental health and safety programs. Department chairs shall ensure that Principal Investigators (PIs) within their department fulfill their administrative safety obligations.

Department chairs shall collaborate with the Environmental Health & Safety (EH&S) department to facilitate timely resolutions to unsafe conditions when such conditions are reported. They shall also work with the deans and contribute resources and support necessary to resolve safety issues when PIs are unable to comply with safety requirements.

Environmental Health & Safety (EH&S). Rice EH&S shall assist the deans, department chairs and PIs with the implementation of this policy.

EH&S is responsible for reviewing federal, state and local laws and regulations pertaining to laboratory safety and for recommending appropriate policy and procedural changes.

EH&S shall establish and monitor safety practices, training programs and review mechanisms that support safe laboratory practices. EH&S will support the PIs in the preparation of training materials, safety plans and monitoring as requested. To this end, EH&S shall provide guidance and technical assistance to deans, department chairs and PIs in identifying, evaluating and correcting health and safety hazards.

On an ongoing basis EH&S shall develop programs for the safe use of hazardous radiological, biological and chemical substances and radiation producing devices. EH&S shall also oversee and manage hazardous waste disposal services.

Principal Investigator (PI). The PI is a faculty member or research scientist overseeing a research laboratory and has the primary responsibility for maintaining a safe laboratory environment. The PI shall ensure that faculty, students, staff and visiting scholars receive the appropriate training, instruction and mentorship necessary to work safely in his/her laboratory. In addition, the PI shall ensure that equipment and supplies are in place so that research can be conducted safely. Moreover, the PI is responsible for taking the actions necessary for his/her laboratory to comply with Rice Policy as well as with all federal, state and local regulations.

The PI, with assistance from EH&S, shall ensure that the training programs available to people under his/her supervision address the hazards posed by the specific materials and equipment in his/her laboratory.

Provost or his/her designee. The Provost, or his/her designee, shall review recommendations related to Rice's laboratory safety policy and set laboratory safety policy priorities. He/she will also collaborate with deans, department chairs and PIs to resolve key outstanding safety matters as required.

Safety Committee(s). Rice will maintain safety committees to review and monitor the use of recombinant DNA (rDNA), bio-hazardous agents, select agents, controlled substances, and other hazardous materials proposed for use in PI laboratories or shared laboratory spaces. These safety committees will work with EH&S to review and refine procedures associated with this policy. These committees will also work with EH&S regarding safety issues arising through new facility construction and building remodeling as well as through changing federal, state and local safety guidelines and requirements.

Faculty, Students, Staff and Visiting Scholars. Faculty, students, staff and visiting scholars are responsible for successfully completing required training and adhering to safe practices while working or doing research in laboratories. They must use the required work practices, personal protective equipment and engineering controls. Additionally, they are responsible for properly using university-supplied materials and equipment and for exercising good judgment in safely carrying out their work by following established procedures.

Faculty, students, staff and visiting scholars are responsible for promptly notifying and reporting potentially unsafe conditions and environmental health hazards, as well as injuries and illnesses in the laboratory, to the PI or to the PI's designated laboratory representative.

III. Safety Plan (e.g. Occupational Safety and Health Chemical Hygiene Plan)

Every PI must develop a laboratory-specific safety plan consistent with the guidelines issued by the Occupational Safety and Health Administration and EH&S for his/her laboratory. A current plan outlining individuals responsible for training, ordering and laboratory management must be available and accessible to laboratory personnel at all times. Safety Plan templates are available from EH&S.

IV. Ensuring a Safe Work Environment

The PI or a designated laboratory representative must conduct laboratory self-inspections using an EH&S checklist at least once a year. The purpose of these inspections is to identify, evaluate and remedy potential hazards and unsafe laboratory practices. These self-inspections are also required whenever new substances, processes, procedures or equipment are introduced into the laboratory that might present new health and safety hazards. These inspections must be documented and records must be available for review upon request.

In addition, EH&S shall conduct independent inspections of all laboratory space at least once a year to identify, evaluate and remedy potential hazards and unsafe laboratory practices. The PI, in coordination with EH&S, will remedy any deficiencies identified during the inspection in a timely manner.

Rice University encourages employees and students to report health and safety hazards to their supervisors, managers, or EH&S. Employees and students shall not be disciplined, retaliated against or discriminated against for reporting in good faith health and safety hazards to Rice or to appropriate governmental agencies. Additionally, it is considered a serious infraction of this safety policy to intentionally cover up a safety matter that may lead to serious injury.

V. Safety Problem Resolution Process

The Director of EH&S has the authority to curtail or shut down any University activity considered to constitute an immediate or serious danger to health or safety. In the event of such curtailment or shutdown, the PI, department chair, dean and provost (or designate) shall be immediately notified. If reasonable, effective and prompt action is not taken to remedy the condition satisfactorily, the curtailment or shutdown shall continue until the PI, department chair, dean and provost (or designee) meet and agree on a plan of action to remedy the situation.

EH&S will provide the provost (or designee), deans and department chairs a summary of significant outstanding safety issues semi-annually. Department chairs will work with PIs to address issues that are identified as significant. Unresolved significant issues will be systematically escalated up the administrative chain of command.

Safety problems that are not adequately resolved may result in the shut down of the laboratory or restrictions on the spending of research funds or submitting grant proposals.

VI. Training

All individuals working or performing research in laboratories are required to participate in annual safety training.

All undergraduate students who will be taking courses that include a laboratory component will receive safety training from their instructor or EH&S staff.

All students, laboratory staff and visiting scholars working in a research laboratory must take general laboratory safety training offered by EH&S.

Depending on the nature of the research and the hazards present in the laboratory, additional laboratory-specific training must be taken. Successful completion of training must be documented before individuals start working or performing research in the laboratory and again any time new hazards or procedures are introduced.

The PI or a designated laboratory representative will be responsible for providing laboratory-specific training. This training must include special handling and documentation procedures for each type of hazard present, specific operating procedures for laboratory equipment and experiments, personal protective equipment required for the work area and emergency procedures.

EH&S will coordinate with instructors to prepare training programs for teaching laboratories.

VII. Personal Protective Equipment

All faculty, students, staff and visiting scholars must adhere to a laboratory dress code and use personal protective equipment (PPE) when working in potentially hazardous situations or around potentially hazardous materials and/or equipment.

VIII. Minors in laboratories

Tours that include laboratory facilities must be coordinated in advance with EH&S. Minors under the age of 14 are not permitted access to any research laboratory where hazards are present.

Regardless of their status (student, volunteer, visitor or paid), minors ages 15-18 are restricted from working or conducting research with the following materials:

- BSL-2 agents
- Human, nonhuman primate, or other mammalian cells and tissues
- Select agents and toxins
- Animal research with ABSL-2 agents
- Explosives
- Chemical hazards (acute hazards)

Minors are not permitted to enter radiation areas unless the radiation safety officer (RSO) provides prior approval. In addition, minors are not permitted to handle any radiation source material, and must be issued a radiation badge for the duration of the work.

Minors are not permitted to enter laser laboratories using class 3B or 4 lasers unless the laser safety officer (LSO) has approved them to do so.

The U.S. Department of Labor and the National Institutes of Health (NIH) oversee the regulations that control activities of minors in laboratories.

IX. Research Involving Recombinant DNA (rDNA) Molecules

Research conducted by faculty, students, staff and visiting scholars involving rDNA molecules shall only be conducted with the prior approval and under the cognizance of the Institutional Biosafety Committee (IBC). The research must be conducted in accordance with the Guidelines for Research Involving Recombinant DNA Molecules, published by the National Institutes of Health.

X. Research Involving Select Agents

Any application for proposed sponsored research involving any select agents and toxins (such as Shiga toxin and tetrodotoxin) must be submitted to, and approved in writing by, the department chair, dean and EH&S director before that application is submitted to a potential sponsor. The PI is responsible for applying for the use of any such materials and for complying with the Rules of the U.S. Department of Health and Human Service.

XI. Research Involving Hazardous and Toxic Materials

The purchase, use, handling and disposal of all hazardous and toxic materials must comply with all provisions and rules of the Texas Commission on Environmental Quality, the Environmental Protection Agency, the Occupational Safety and Health Administration and the City of Houston Fire Department rules and guidelines. Rules and guidelines cover, but are not limited to, the handling, ordering, allowable quantity, container size, container labeling, exposure to, recordkeeping and disposal of the material.

XII. Research Involving Controlled Substances

Controlled substances are any drugs or chemical substances whose possession and use are regulated under the United States Controlled Substances Act. Management and possession criteria differ depending on the controlled substances "schedule". All controlled substances must be purchased in accordance with the Rice Purchasing Policy and possession and management of the substance(s) must be as outlined under the Texas Controlled Substance Guidelines and the Drug Enforcement Administration office of Division Control. Researchers using these materials must possess a license for the scheduled material, adhere to required safeguards for storing and using such materials securely and maintain records on their use and disposal.

XIII. Precursor Chemicals and Equipment

The Texas Department of Public Safety (DPS) and the Texas Higher Education Coordinating Board (THECB) have a memorandum of understanding (MOU) establishing the responsibilities of the DPS, the THECB and institutions of higher education for the purchase, use, possession and disposal of precursor chemicals and equipment; precursor chemicals include those used in the manufacturing of illegal drugs. The purpose of the memorandum is to implement and maintain a program for reporting information concerning controlled substances, controlled substance analogues, chemical precursors and chemical laboratory apparatus used in education or research activities of institutions of higher education. The PI is responsible for ensuring that these materials are used only for their intended research purposes and adhering to required safeguards for storing and using such materials securely, as well as for reporting any misuse, theft or loss of chemicals, equipment or glassware to EH&S.

XIV. Lasers, X-Rays and Radioactive Materials

The procedures for the purchase, use and disposal of lasers, X-rays and radioactive materials are outlined in the Texas Department of State Health Services' Radiation Control Program guidelines. All use of these materials and equipment must comply with current rules, regulations, licensing and registration requirements. Prior approval to purchase or use these materials and devices must be obtained from EH&S. Everyone working with these materials must be properly trained on the use of the material/equipment, as well as on the use of personal protective equipment and the disposal of materials.

XV. Procedures

Additional laboratory safety information can be found in the Laboratory Safety Procedures section of the EH&S website. The Vice Provost for Research may update these materials as necessary.

XVI. Additional Resources

29 CFR 1910.1200 OSHA Hazard Communication Standard; Subpart Z

29 CFR 1910.1450, Toxic and Hazardous Substances, Occupational Exposure to Hazardous Chemicals in the Laboratory

The Texas Health and Safety Code, Section 481.0621 (b)

Memorandum of Understanding between the Texas Department of Public Safety and the Texas Higher Education Coordinating Board

XVII. Responsible Officer: Vice Provost for Research

XVIII. Related Policies

Rice University Policy 301, Management and Administration of Sponsored Projects

Rice University Policy 314, Care and Humane Treatment of Animals Used in Research, Testing, and Education

Rice University Policy 326, Human Health and Safety in the Performance of Research

Rice University Policy 805, Safety Policy

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David W. Leebron, President

Policy No. 313
January ____, 2014 (to incorporate Policy No. 833, Chemical Hygiene Plan)

Laboratory Safety Procedures
Associated with Laboratory Safety Policy 313

I. Introduction

University Policy No. 313 outlines the requirements and responsibilities for maintaining a safe laboratory environment. These laboratory safety procedures provide more detailed information about safety training, personal protective equipment and safety practices for the use and maintenance of hazardous materials and equipment.

The Rice faculty, staff, students, visitors and the Environmental Health and Safety (EH&S) department work in partnership with to promote safe and healthful laboratory environments in support of the university's teaching and research missions. As part of this partnership members of the Rice community have certain responsibilities to ensure their safety and that of others as well as complying with federal, state and local regulations.

II. Training

General and specialized in person training is required before individuals can work or perform research in Rice University laboratories. Substituting training from other organizations or institutes is not acceptable since operational guidelines, emergency procedures, waste management protocols and other aspects of safety may be unique to Rice.

In Person Training

EH&S provides a number of in person training sessions. Use the following table as a guideline to determine the types of training you are required to complete:

Description of Activities	**Training Requirements**	**Frequency**
Conducting experiments in a laboratory where chemicals, biological agents, and/or physical hazards are present. Physical hazards include radiological, lasers or intense pulsed light, industrial machinery, and nanomaterials.	General Laboratory Safety	Annually

Conducting experiments in any laboratory where the following is being used: • human blood or body fluid, • unfixed human or animal tissue or organ • Potentially infectious material (unscreened cell lines, tissue cultures)	Biosafety Training Bloodborne Pathogens	Annually
Conducting experiments with potentially viable biological materials, including: • microorganisms (Biosafety Level 2) • cells or cell lines • tissue cultures • viruses Any active users listed on an approved IBC protocol for work that is not exempt by NIH guidelines as provided in Section III-F.	Biosafety Training	Annually
Conducting experiments in any laboratory where radiological hazards exist. Radiological hazards can include radioactive material (RAM), source materials, or x-ray generating machines. If your research does not use any radiological hazards but is located in a RAM use area you should attend training.	Radiation Safety	Annually
Conducting experiments in any laboratory where class 3B or 4 lasers are used.	Laser Safety	Annually

Schedules and registration information for EH&S in person safety training can be found at the "EH&S" site in OwlSpace. Instructions for signing up for safety training can be found at EH&S Safety Training Sign Up.

Laboratory Specific Training

Principal Investigators (PIs) or a designated laboratory representative must provide and document laboratory specific training to all laboratory personnel before they can start work or perform research in the PI's laboratory. Annual refresher training is also required of each member of the lab group. This training must include instruction and use of personal protective equipment required for the work area, hazards present in the laboratory, and emergency procedures. EH&S will provide a laboratory specific training outline and can support the development of the training program.

CITI Training

The Responsible Conduct of Research training includes safety related modules that are part of the Collaborative Institutional Training Initiative (CITI). PIs shall ensure that all graduate students and postdoctoral scholars take this training as well as undergraduate students funded by NSF awards. Trainees, fellows, participants and scholars supported by NIH career development awards, research education T-series grants and NRSA awards must complete the academic course UNIV 594 in addition to the CITI training.

Communication about Safety Matters

Supervisors, both faculty and staff, shall establish, implement, and maintain a system for communicating with employees and students about health and safety matters. Information must be presented in a manner readily understood by the affected employees and students.

All training sessions must be documented and include the date of the session, the topic and attendees.

Rice University *Office of Research Compliance* (ORC) monitors certain research activities in order to comply with federal regulations and university policies. Compliance information can be found at the Research Compliance Website.

The applicable government regulations and guidelines pertaining to these requirements are as follows:

General laboratory training guidelines: OSHA 29 CFR, HAZCOM
Biological hazards: Center for Disease Control, BMBL
Laser use: ANSI Z136
Radioactive use: Texas Department of State Health Services-Radiation Control Program 25 TAC 289
Waste: Texas Commission on Environmental Quality

III. Personal Protective Equipment

All faculty, students, staff and visitors must adhere to a safety-oriented dress code and use personal protective equipment (PPE) when working in hazardous situations or around

hazardous materials. Both the dress code and appropriate PPE will depend on the type of hazards present and the nature of the work.

Faculty, students, staff and visitors are expected to escalate their use of PPE with an increase in the potential for an accident or increase in hazards. The PI or designated laboratory representative must provide appropriate PPE so that the faculty, students, staff and visitors can be adequately protected for any situation they might reasonably encounter while conducting their work or research. Appropriate facility design, safety equipment and institutional precautions must be taken to ensure a safe working environment.

The Rice standard personal protective equipment guidelines can be found at the EH&S Standard Personal Protective Equipment website.

The applicable government regulations pertaining to these requirements are as follows:
General laboratory PPE guidelines: OSHA 29 CFR 1910.132
Biological hazards: CDC-BMBL
Laser use: ANSI Z136
Radioactive use: Texas Department of State Health Services-Radiation Control Program 25 TAC 289

IV. Incidents and Accident Procedures

In the event of an accident in which an injury was sustained the Rice University Police Department should be notified immediately at 713-348-6000 to dispatch the appropriate medical attention. The Environmental Health and Safety Department and the Risk Management Office should also be notified.

If a Rice employee sustains an injury, an Employer's First Report of Injury or Illness form as well as an Accident/Injury Report should be completed and submitted. If the injured person is not a Rice employee, only an Accident/Injury Report needs to be completed.

If there is an accident or near miss in which an injury was not sustained, EH&S should be contacted at 713-348-4444 and an Accident/Injury Report should be completed.

Contact the Risk Management Office for more information.

V. Emergency Response and Preparedness

The Environmental Health and Safety department shall provide guidelines for emergency response plans. Every department shall have individual emergency response plans. The plan shall include evacuation and assembly procedures, posted evacuation maps, reporting and communication practices, training, and drills. Exits shall remain free of obstructions and materials that could render the exit hazardous.

VI. Shutdown Procedure

In the event of a fire alarm or power loss, all laboratory personnel must stop all laboratory work, shut off all ignition sources such as Bunsen burners, close the sash on all fume hoods and biosafety cabinets, remove all personal protective equipment and evacuate the building.

VII. Documentation, Record Keeping and Compliance

Required documentation and records shall be kept to demonstrate compliance with statutes, regulations and standards. Examples of records that need to be maintained include:

- Records of training that must include who was trained, who provided the training, what did the training cover, and what date the training took place
- Records of workplace inspection and hazard correction which must include who conducted the inspection, the inspection date, any unsafe conditions or practices found, and the corrective measures taken
- Records of disciplinary action for failure to comply with health and safety policies and practices

VIII. Specific Resource Materials

A. Bloodborne Pathogen Program
B. Safety Plan (Occupational Safety and Chemical Hygiene Plan) Template
C. Chemical Segregation Guidelines
D. Chemical Spills
E. EH&S Inspection Checklist
F. Facility Design
G. Hazardous Chemicals
H. Laboratory Door Sign Generator
I. Laboratory Specific Radiation Training Checklist
J. Laboratory Specific Training Checklist
K. Laboratory Safety Training Matrix
L. Laser Safety Manual
M. Microbiological Waste Management
N. Minors in Labs
O. Radiation Safety Manual
P. Recombinant DNA
Q. Select Agents and Toxins
R. Standard Personal Protective Equipment

THE OSHA LABORATORY STANDARD
AND
THE RICE UNIVERSITY CHEMICAL HYGIENE PLAN

THE OSHA LABORATORY STANDARD

Laboratories typically differ from industrial operations in their use and handling of hazardous chemicals. The Occupational Safety and Health Administration (OSHA) Laboratory Standard (29 CFR 1910.1450) defines a laboratory as a facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a nonproduction basis. As a requirement of the OSHA Laboratory Standard, each employer, department, or laboratory must formulate and implement a Chemical Hygiene Plan (CHP). The CHP must include the necessary work practices, procedures and policies to ensure that employees are protected from all potentially hazardous chemicals used or stored in their work area. Hazardous chemicals as defined by the final standard include not only chemicals regulated in 29 CFR part 1910, subpart Z, but also any chemical meeting the definition of hazardous chemical with respect to health hazards as defined in OSHA's Hazard Communication Standard, 29 CFR 1910.1200(c).

Among other requirements, the final standard provides for employee training and information, medical consultation and examination, hazard identification, respirator use and record keeping. To the extent possible, the standard allows a large measure of flexibility in compliance methods.

Employee information and training

Employer must provide employees with information and training to ensure that they are aware of chemical hazards present in their work area. Employees must also be informed of:

- The contents of the Laboratory Standard (29CFR 1910.1450) its appendices which shall be made available to employees
- The location and availability of the employer's Chemical Hygiene Plan
- The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard
- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory
- The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the

laboratory including, but not limited to, Safety Data Sheets received from the chemical supplier.

Employee training shall include:

- Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.)
- The physical and health hazards of chemicals in the work area
- The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.
- The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

HAZARDOUS CHEMICALS

The Laboratory Standard defines a hazardous chemical as any element, chemical compound, or mixture of elements and/or compounds which is a physical or health hazard.

A chemical is a **physical hazard** if there is scientifically valid evidence that it is a flammable, a combustible liquid, a compressed gas, an explosive, an organic peroxide, an oxidizer, pyrophoric, unstable material (reactive), or water-reactive.

A chemical is a **health hazard** if there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. Included are:

- carcinogens
- reproductive toxins
- sensitizers
- neurotoxins (nerve)
- hepatotoxins (liver)
- agents that act on the hematopoietic system (blood)
- irritants
- corrosives
- radioactive material
- biohazards
- nephrotoxins (kidney)
- agents that damage the lungs, skin, eyes, or mucous membranes

In most cases, the label will indicate if the chemical is hazardous. Look for key words like **caution, hazardous, toxic, dangerous, corrosive, irritant, carcinogen**, etc. Older containers of hazardous chemicals (before 1985) may not contain hazard warnings.

If you are not sure a chemical you are using is hazardous, review the **Safety Data Sheet (SDS)** or contact your supervisor, instructor, or the Department of Environmental Health and Safety.

Designated areas must be established and posted for work with certain chemicals and mixtures, which include **select carcinogens**, **reproductive toxins**, and/or substances which have a **high degree of acute toxicity**. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

SAFETY DATA SHEETS (SDSs)

A Safety Data Sheet (SDS, also known as Material Safety Data Sheet) is a document containing chemical hazard and safe handling information prepared in accordance with the OSHA Hazard Communication Standard.

Chemical manufacturers and distributors must provide a SDS the first time a hazardous chemical is shipped to a facility. However, you can request a SDS for any laboratory chemical from the manufacturer or distributor.

CHEMICAL INVENTORIES

The OSHA Laboratory Standard does not require chemical inventories; however, it is prudent to adopt this practice. Maintaining and annually reviewing a chemical inventory can reduce the number of unknowns and the tendency to stockpile chemicals. The Department of Environmental Health and Safety may require that a chemical inventory for particular hazardous chemicals including acute toxins and flammable materials for reporting purposes.

THE RICE UNIVERSITY CHEMICAL HYGIENE PLAN

The *Rice University Chemical Hygiene Plan and Hazardous Materials Safety Manual* serves as the written Chemical Hygiene Plan (CHP) for laboratories using chemicals at Rice University. The CHP is an ongoing process requiring at least annual revisions and revisions as hazards and personnel change. **Departments, individual laboratories, or other work units engaged in laboratory work whose hazards are not sufficiently covered in this written manual must customize it by adding their own sections as appropriate (e.g. standard operating procedures, emergency procedures, and identifying activities requiring prior approval).**

ROLES AND RESPONSIBILITIES

Rice Policy No. 313 Laboratory Safety Policy States the following:

> Faculty, students, staff and visiting scholars have various responsibilities to assure their own safety and for the safety of others. They also must comply with federal, state, local and University regulations.
>
> *Environmental Health & Safety (EH&S).* Rice EH&S shall assist the deans, department chairs and PIs with the implementation of this policy. EH&S is responsible for reviewing federal, state and local laws and regulations pertaining

to laboratory safety and for recommending appropriate policy and procedural changes. EH&S shall establish and monitor safety practices, training programs and review mechanisms that support safe laboratory practices. EH&S will support the PIs in the preparation of training materials, safety plans and monitoring as requested. To this end, EH&S shall provide guidance and technical assistance to deans, department chairs and PIs in identifying, evaluating and correcting health and safety hazards.

On an ongoing basis EH&S shall develop programs for the safe use of hazardous radiological, biological and chemical substances and radiation producing devices. EH&S shall also oversee and manage hazardous waste disposal services.

Principal Investigator (PI). The PI is a faculty member or research scientist overseeing a research laboratory and has the primary responsibility for maintaining a safe laboratory environment. The PI shall ensure that faculty, students, staff and visiting scholars receive the appropriate training, instruction and mentorship necessary to work safely in his/her laboratory. In addition, the PI shall ensure that equipment and supplies are in place so that research can be conducted safely. Moreover, the PI is responsible for taking the actions necessary for his/her laboratory to comply with Rice Policy as well as with all federal, state and local regulations.

The PI, with assistance from EH&S, shall ensure that the training programs available to people under his/her supervision address the hazards posed by the specific materials and equipment in his/her laboratory.

Safety Committee(s). Rice will maintain safety committees to review and monitor the use of recombinant DNA (rDNA), bio-hazardous agents, select agents, controlled substances, and other hazardous materials proposed for use in PI laboratories or shared laboratory spaces. The safety committee(s) will work with EH&S to review and refine procedures associated with this policy; ensure checklists and templates are useful and appropriate; interactions with faculty are constructive and enhance compliance with this policy; and safety issues arising through new facility construction and building remodeling as well as through changing federal, state and local safety guidelines and requirements are addressed.

Faculty, students, staff and visiting scholars are responsible for promptly notifying and reporting potentially unsafe conditions and environmental health hazards, as well as injuries and illnesses in the laboratory, to the PI or to the PI's designated laboratory representative.

For a full listing of roles and responsibilities, see the Rice University Laboratory Safety Policy (No. 313) on the EH&S website at http://safety.rice.edu

EXPOSURE LIMITS

For laboratory uses of hazardous substances, employers must ensure that laboratory employees' exposures to these substances do not exceed either the permissible exposure limits (PELs) specified in OSHA regulation 29 CFR 1910, subpart Z, or the Threshold Limit Values (TLVs) published by the American Conference of Governmental Industrial Hygienists (ACGIH), whichever is lower.

EMPLOYEE INFORMATION AND TRAINING

Employers must provide employees with information and training to ensure that they are aware of the hazards of chemicals present in their work area including the steps they should take to protect themselves from these hazards. Training may take the form of individual instruction, group seminars, audio-visual presentations, handout material, or any combination of the above. However, the training must include the specific hazards associated with the chemicals in the work area when generic training is insufficient (e.g., extremely toxic materials, carcinogens, reproductive hazards) to address specific hazards.
Such information must be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignment involving new exposure situations. Employees should receive periodic refresher information and training.

Information provided by employers to employees must include:

1. The contents of the OSHA standard 29 CFR 1910.1450 and its appendices which shall be available to employees (available from EH&S and at www.osha.gov)
2. The location and availability of the Rice University Chemical Hygiene Plan (available from EH&S)
3. The permissible exposure limits for OSHA regulated substances or published exposure limits for other hazardous chemicals where there is no applicable OSHA standard (available from EH&S)
4. Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory (available on container labels and Material Safety Data Sheets)
5. The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the supplier.

Training provided to employees must include:

1. Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the University, continuous

monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

2. The physical and health hazards of chemicals in the work area;
3. The measures employees can take to protect themselves from these hazards, including specific procedures the University or department has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used;
4. The applicable details of the Rice University Chemical Hygiene Plan.

MEDICAL CONSULTATIONS AND EXAMINATIONS

Employers must provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

1. Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee must be provided an opportunity to receive an appropriate examination.
2. Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.
3. Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation. Such consultations shall be for the purpose of determining the need for a medical examination.

All medical examinations and consultations must be performed by or under the direct supervision of a licensed physician and must be provided without cost to the employee, without loss of pay and at a reasonable time and place.

HAZARD IDENTIFICATION

With respect to labels and Material Safety Data Sheets:

1. Employers must ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.
2. Employers must ensure that laboratory containers of chemicals are labeled where required. Laboratory containers, including bottles, flasks, sample vials, etc., must be marked, labeled, or coded **in all cases**. (If codes or markings other than chemical names are used, a code key or legend must be available in the workplace where it may be found quickly and easily by emergency responders or other interested parties.)

3. Employers must maintain any Material Safety Data Sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.

Note: Material Safety Data Sheets are available from the supplier. Material Safety Data Sheets for chemicals in use should be maintained in the laboratory on in an online form that is readily accessible in the event of an emergency.

CHEMICALS DEVELOPED IN THE LABORATORY

The following requirements apply to chemical substances developed in the laboratory:

1. If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the principal investigator must determine if it is a hazardous chemical (e.g., by literature search). If the chemical is determined to be hazardous, the principal investigator must provide appropriate training to protect employees.
2. If the chemical produced is a by-product whose composition is not known, the principal investigator must assume that the substance is hazardous and must comply with the requirements of the CHP.
3. If the chemical substance is produced for another user outside of the laboratory, the principal investigator must comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of Material Safety Data Sheets and labeling.

Note: Item 1 does not require the principal investigator to conduct toxicological testing. However, if a Material Safety Data Sheet or hazard information is available for the chemical, the information must be made available to employees.

USE OF RESPIRATORS

Where the use of respirators is necessary to maintain exposure below permissible exposure limits (PELs) or the Threshold Value Limits (TLVs), whichever is lower, the employer must provide, at no cost to the employee, the proper respiratory protective equipment. Respirators must be fit tested and the appropriate cartridges maintained.

STANDARD OPERATING PROCEDURES

Standard Operating Procedures (SOP's) must be written and maintained as a part of the laboratory chemical hygiene plan. Provide copies of the SOP's for each hazardous procedure in the laboratory. Examples include, but are not limited to chemical storage methods, waste disposal procedures, and SOP's regarding work with hazardous chemicals. Each SOP should describe any necessary control measures including the use of Personal Protective Equipment (PPE), the use of control measures such as fume hoods or localized exhaust, laboratory safe refrigerators, and good hygiene practices for the use of hazardous materials. An SOP template is available for modification as necessary on the EH&S website, http://safety.rice.edu.

For work involving extremely toxic chemicals, select carcinogens, and reproductive toxins, standard operating procedures must include the following provisions where appropriate:

1. Establishment of a designated area;
2. Use of containment devices such as fume hoods or glove boxes;
3. Procedures for safe removal of contaminated waste
4. Decontamination procedures.

CONTROL MEASURES

Whenever employee exposures exceed the action level (or in the absence of an action level, the lower of the PEL or TLV), the employer must implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices. Exposures to extremely toxic materials, select carcinogens, and reproductive toxins must be maintained as low as reasonably achievable.

PROTECTIVE EQUIPMENT

Fume Hoods/Ventilation Systems

Every laboratory ventilation hood used for the control of air contaminants shall be monitored to assure that adequate airflow is being maintained in order to provide continued protection against employee over-exposure. Laboratory hood airflow shall be considered adequate when the average face velocity equals a minimum of a 60-80 feet/minute with the hood sash at a working height (14 to 18 inches).
Other local exhaust ventilation, such as instrument vents, will also be tested. The criteria for minimal acceptable flow shall be determined by the Office of Environmental Health and Safety. **All hoods should be inspected and tested at a minimum of every three years.** Check date of last inspection (sticker placed on front of hood) and call Facilities and Engineering (713-348-2485) or the Office of Environmental Health and Safety at (713-348-4444) to schedule a hood inspection.

If fume hood is malfunctioning call Facilities and Engineering (713-348-2485).

Personal Protective Equipment

Personal protective equipment (PPE) is specialized equipment meant to protect researchers from hazards in the laboratory. PPE begins with the right type of clothing for the laboratory. Long pants and closed toed shoes are required when working with hazardous materials. Avoid clothing that is too loose and can knock items over. Clothing should fit well and be made of sturdy natural fabrics such as cotton or wool. Long hair should also be tied back when working with open flames such as a Bunsen burner.

Eye protection must be worn upon entering the laboratory where hazards are present. Safety glasses, goggles and goggles with face shield should be worn in the laboratory based upon the physical state, the operation or the level of toxicity of the chemical used. Safety glasses effectively protect the eye from solid materials (dusts and flying objects) but are less effective at protecting the eyes from chemical splash to the face. Goggles should be worn in situations where bulk quantities of chemicals are handled and chemical splashes to the face are possible. Goggles form a liquid proof seal around the eyes, protecting them from a splash. When handling highly reactive substances or large quantities of hazardous chemicals, corrosives, poisons, and hot chemicals, goggles with face shield should be worn. Prescription glasses are not always impact resistant so safety glasses are required to be worn over these glasses. Contact lenses can increase the risk of eye injury if worn in the laboratory - particularly if they are of the gas permeable variety. Gases and vapors can be concentrated under such lenses and cause permanent eye damage. Chemical splashes to the eye can get behind all types of lenses. Once behind a lens the chemical is difficult to remove with a typical eye wash. For these reasons it is recommended that contact lenses not be worn in laboratories.

A laboratory coat should be worn over street clothes and be laundered regularly. Laboratory coats are intended to prevent contact with dirt, chemical dusts and minor chemical splashes or spills. If it becomes contaminated, it should be removed immediately and affected skin surface washed thoroughly.

Gloves should be worn when working with hazardous materials such as hazardous chemicals, mutagens, carcinogens, and toxins. Before working with these materials, a chemical compatibility chart should be consulted to ensure protection. Gloves should be removed before exiting the lab. Never touch common surfaces such as door handles or elevator buttons with gloved hands. Gloves should never be reused once removed.

SPECIAL HAZARDS

The Laboratory Supervisor or Principal Investigator will define which if any activities, operations, or procedures constitute circumstances under which prior approval must be obtained by employees before implementation.

ANNUAL REVIEW

The employer must review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

Chemical Hygiene Plan Outline

Date of Plan: November 1, 2014
Department: Biosciences
Building: Keck Hall
Laboratory Room Number: 301 (Including 301A, 301B, 301C)
Prepared by: Andrew J. Hirning
PI: Professor Matthew R. Bennett, Ph.D.

Reviewer: _____

All plans must contain the following information. This outline has been developed to assist you in developing the plan for the laboratory.

1. Provide a copy of the Standard Operating Guidelines (SOG's) for each hazardous procedure in the laboratory. Chemical storage methods, waste disposal procedures, and special personal protective equipment should be included in the plan. Also, describe any necessary control measures, including the use of fume hoods, localized exhaust, personnel protective equipment, laboratory safe refrigerators and good hygiene practices for the use of hazardous materials.

2. Fume hood exhausts are monitored by: __X_ electronic controls and or ____ visual aids to ensure the equipment is functioning properly.

3. Prior to working in the laboratory, employees are trained on the proper handling and use of hazardous chemicals. Safety officer is responsible for documenting and conducting laboratory training. Training will be conducted at least quarterly. In addition to specific laboratory safety training, all students and employees have attended a laboratory safety training class provided by the PI, Lab Manager or the class which is provided annually by the Rice University Environmental Health and Safety Department. If biosafety level 2 (BL2) research is conducted in the laboratory all personnel must have also attended BL2 training provided by EHS.

4. Labels are to remain on all containers at all times. If the original label is no longer affixed, the chemical hazards information is provided on the container. All chemical information is in the English language. Safety officer is responsible for ensuring the labels remain on the containers.

5. All incoming containers are dated upon receipt and re-dated when opened. Peroxide forming compounds are not kept in the laboratory for a period longer than six months. Ordering person is responsible for ensuring that all containers are dated.

5. When a chemical is no longer needed in the laboratory, the Environmental Health and Safety Department is contacted to remove the chemical from the laboratory. All spent chemical containers located in the laboratory are properly labeled. Only compatible materials are placed in like containers. Every effort is made to order and keep the minimum amount of materials necessary for use during research. Safety officer is responsible for chemical disposal in the laboratory.

7. Secondary containers are used for the transportation of chemicals when being hand-carried.
   Approved secondary containers available are **plastic bottle carrier**, which is located on top of tall -20 freezer. Safety officer is responsible for maintaining the availability of secondary containers.

8. Eye wash stations are tested at least quarterly. A record of this testing is maintained in EHS.

9. Spill kits are available in the laboratory. The kits are appropriate for each type of spill that may occur. Chemical spill kits are located under the fume hood and are maintained by the safety officer.

10. An Emergency Contact List is posted on **each** door of the laboratory. The Rice template for emergency contact or similar form is in place (https://ehs.rice.edu). The phone numbers are updated as necessary. The Safety officer is responsible for maintaining and updating the phone list. In addition to the emergency contact numbers, all special information about the laboratory is also posted.

Standard Operating Procedure

Chemical name/class:	Piranha Etch	**CAS #:**	Hydrogen Peroxide: 7722-84-1 Sulfuric Acid: 7664-93-9
PI:	Professor Matthew Bennett, Ph.D.	**Date:**	November 5, 2014
Building:	Keck Hall	**Room #:**	301
Designated Work Area:	**Fume Hood**		

1. **Circumstances of Use:**

Piranha etch is used to remove polymerized photoresist from silicon wafers. The mixture consists of three (3) to five (5) parts fuming sulfuric acid mixed with one (1) part 30% hydrogen peroxide. This mixture is highly exothermic, and will self-heat to over 100C, as well as evolve a large amount of gaseous oxygen from the decomposition of the hydrogen peroxide.

2. **Potential Hazards:**

Piranha is has many potential physical and health hazards. A less hazardous solution/process should be used if possible.

- Piranha solutions will react violently with organic compounds to produce heat and gases. The temperature of the solution may be higher than 100°C.
- Hot Piranha solutions must NEVER be placed in a capped container as explosion could result.
- **Piranha is an oxidizer**. Oxidizers are agents that initiate or promote combustion in other materials, generally through the release of oxygen.
- **Piranha solutions are extremely corrosive**. Corrosive materials can cause destruction of living tissue by chemical action at the site of contact and can be solids, liquids, or gases. Corrosive effects can occur not only on the skin and eyes, but also in the respiratory tract and, in the case of ingestion, in the gastrointestinal tract as well.
- Piranha solutions are used to remove *residual* photoresist or organics from glassware. Ensure that the glassware is as clean as you can make it and dry before using the Piranha solution.
- If Piranha is not handled properly, an explosion, skin burns, or eye/respiratory tract irritation may result.

3. **Engineering Controls (fume hoods/biosafety cabinet etc.):**

- All work is performed on a hotplate in a fume hood that contains NO organic material. This includes clearing the hood of any chemical wash bottles containing organic solvents.
- Keep the sash down while reactions are in progress

4. **Work Practice Controls:**

- Never prepare or manipulate Piranha while alone in the laboratory.
- Only prepare the amount you need for immediate use.
- Work with the smallest practical amount of Piranha needed to perform your task.
- Always add the hydrogen peroxide to the sulfuric acid slowly. **Never add the acid to the peroxide**
- Do not add any organic solvents (including ethanol) to the piranha mixture
- All work is performed in glass containers. Piranha will melt plastic containers.
- Wafers removed from the bath should be immersed in deionized water, and then rinsed with more deionized water. **DO NOT** rinse with organic solvents, as these will react violently with any remaining Piranha mixture.
- **Do not allow the hydrogen peroxide to become more than 50% of the piranha mixture. Ideal concentration is no greater than 30% of the mixture (i.e. the volume of 30% hydrogen peroxide added should be 40-60% of the volume of sulfuric acid, and always less than the sulfuric acid.**
- Do not put Piranha in a closed container
- Never take Piranha out of the fume hood.
- Place a warning sign on the fume hood to warn others of the presence of Piranha and to prevent the use of organic material in the designated fume hood.
- You must have a spill kit readily available when working with Piranha.

5. **Personal protective equipment (PPE):**

- Polyester-coated acid resistant gloves over latex or nitrile gloves
- 3mm thick polyester acid apron
- Safety glasses
- Face shield

6. **Transportation and Storage:**

Transportation: Piranha etch should not be transported, as the reacting mixture is highly exothermic, and evolves a large amount of gaseous oxygen. The mixture should be created in the fume hood before use, used, and left to react in place.

Storage: Piranha is only useful while reacting, so storage is not possible. After use, the mixture should be left to react in place for an extended period (8-12 hours).

- Never put a container of Piranha near flammables or combustibles
- Ensure primary and secondary containment is free from organic chemicals/solvents

7. **Waste Disposal:**

1. After use, the Piranha should be left to react in place for an extended period of time (8-12 hours).
2. After resting overnight, the used Piranha solution can be collected in a glass container with a vented cap. Do not use a glass bottle that was previously used for organic solvents as organic residue may be present and unintended reactions can occur.
3. Label the waste bottle as "Piranha Waste". Never add any other kinds of waste to Piranha waste.
4. Piranha waste can be added to older piranha waste. However, the last addition to a piranha waste bottle should be made no later than 3 months after the first addition.
5. Do not allow the bottle to become more than 2/3 full.
6. Go to http://safety.rice.edu to put in a waste pick up request.

Piranha waste should never be mixed with organic waste, as this will cause a violent reaction and possible explosion.

7. **Exposures/Unintended contact:**

- **ANY accidents involving Piranha solutions must be reported to EHS.**
- **In case of *skin contact*:** Flush the skin with copious amounts of water for at least 15 minutes. Seek medical attention. May cause skin burns
- **In case of *eye contact*:** Flush contaminated eye(s) immediately with copious amounts of water for at least 15 minutes. Seek medical attention immediately. Piranha is corrosive and can cause irreversible damage to the eyes.
- **In case of *inhalation*:** Assist conscious persons to an area with fresh, uncontaminated air. Seek medical attention if experiencing respiratory irritation, cough, or tightness in the chest.
- **In the case of *accidental ingestion*** of the Piranha solution, seek medical attention immediately! After seeking medical attention, go to http://safety.rice.edu and complete an Accident report form and return to EHS.

8. **Spill Procedure:**

- Do not use dry paper towels, rags or sawdust to soak up any spilled Piranha as these materials may spontaneously ignite.
- If less than 200ml of spent solution (no longer evolving gases) is spilled in the fume hood, neutralize the solution with sodium bicarbonate. The spill can be cleaned up with wet paper towels.
- Dispose of absorbent material as hazardous waste. Neutralize the area where the spill occurred using sodium bicarbonate until foaming no longer occurs. Clean the area thoroughly.
- If reactive solution (still evolving gases) is spilled in the fume hood, close the sash and call 713-348-6000 or 713-348-4444 to alert RUPD and EHS of the spill.

9. **Training of personnel:**

All personnel are required to complete the online General Lab Safety session. This session includes an introduction to general chemical safety.
Furthermore, training on the lab-specific procedures must be performed by the PI or knowledgeable designee for all personnel working with Piranha etch, and must be documented (topics covered, date, employee names and signatures). All personnel shall read and fully adhere to the laboratory-specific SOP for Piranha etch, and shall document that they have read it by signing and dating the SOP.

"I have read and understand this SOP. I agree to fully adhere to its requirements. By signing below, I also acknowledge that I have received hands-on training for use of Piranha Etch."

Last	First	Signature	Date	Trainer Initials

:

Laboratory Biosafety Manual

1. Introduction

This Manual is intended to be a resource for information, guidelines, policies, and procedures that will enable and encourage those working in the laboratory environment to work safely and reduce or eliminate the potential for exposure to biological hazards.

Most of the information in this section is taken from the book *Biosafety in Microbiological and Biomedical Laboratories* (U.S. Health and Human Services Publication No. CDC99-8395, Public Health Service, Centers for Disease Control and Prevention, and National Institutes of Health, 4th edition, April 1999).

It is intended that the Department Directors will supplement this information with instruction and guidance regarding specific practices and procedures unique to the work being done in their labs.

2. Scope

This Section is applicable to all laboratory, research, service and support activities that may involve exposure to biohazardous agents or materials.

Activities which are specifically addressed are those involving:

- Various bacterial, fungal, and parasitic agents
- Recombinant DNA
- Exposure to research animals containing biohazardous agents
- Human blood and tissues
- Receipt, handling, and disposal of biological materials.

3. Containment Methods

The term containment is used to describe safe methods for managing infectious agents in the laboratory environment. The purpose of containment is to reduce exposure of laboratory workers and others to potentially hazardous agents and to prevent their escape into the outside environment. The three elements of containment are laboratory practice and technique, safety equipment, and facility design.

Laboratory Practice and Technique

The most important element of containment is strict adherence to standard microbiological practices and techniques. Persons working with infectious agents or infected materials shall be aware of potential hazards and shall be trained and proficient in the practices and techniques required for safely handling such material. When standard laboratory practices are not sufficient to control the hazard associated with a particular agent or laboratory procedure, additional measures may be needed involving safety equipment and facility design.

Safety Equipment (Primary Barriers)

Safety equipment includes biological cabinets, enclosed containers, and other engineering controls designed to prevent or minimize exposures to hazardous biological materials. The use of vaccines may in some cases provide an increased level of personal protection.

Biological Safety Cabinets (BSCs)

The biological safety cabinet is the principal device used to provide containment of infectious splashes or aerosols. When properly maintained and operated, they effectively contain and capture microbial contaminants and infectious agents using HEPA (High Efficiency Particulate Air)

There are three types of biological safety cabinets: Class I, Class II, and Class III.

- Class I is an open-fronted, negative-pressure, vented cabinet with HEPA filtered exhaust. It may be equipped with a front closure and gloves for use as a glove box. The inward

face velocity is a minimum of 75 linear feet per minute. Suitable for work with low-or moderate-risk biological agents, it provides protection for personnel and the environment but not for the product.

- Class II cabinets are open-fronted laminar-flow cabinets with a minimum inward face velocity of 75 linear feet per minute. Class II design resembles that of a fume hood but with HEPA-filtered, re-circulated mass airflow within the workspace. Exhaust air is also filtered. Class II cabinets provide protection for personnel, product, and the environment. They are designed for work with low-or moderate-risk biological agents.
- Class III cabinets provide the highest level of protection. Class III is a totally enclosed glove-box cabinet of gas-tight construction. The cabinet is maintained under negative air pressure of at least 0.5 inches of water gauge. Supply air is drawn into the cabinet through HEPA filters, and the exhaust air is filtered by two HEPA filters in series before it is discharged to the outside. Generally, the ventilation system is separate from the facility's ventilation system. Class III cabinets are suitable for high-risk biological agents.

Biological safety cabinets used to protect workers from hazardous biological agents shall be tested and certified after installation and before use, any time they are moved, and at least annually.

For more detailed information about BSCs, refer to the 1995 CDC/NIH publication "Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets."

Guidelines for the Safe Use of Class II Biological Safety Cabinets

A Class II biological safety cabinet, combined with proper microbiological technique, provides primary containment for low to moderate risk microorganisms. This containment is accomplished by laminar air flow and HEPA (high efficiency particulate air) filtration. The Class II biological safety cabinet provides protection to the product, the worker and the environment.

The biological safety cabinet is not a substitute for good laboratory practice. Aerosols can escape. Chemical vapors will pass through HEPA filters and most biological safety cabinets do not provide protection from toxic chemicals or radionuclides.

Preparations

- The biological safety cabinet should be left on at all times. If the unit is not left running continuously, turn the blower on and air purge for at least five minutes to remove airborne contamination before the next use. If the biological safety cabinet is vented to the outside of the building, both the remote motor and the internal blower should be left on at all times.
- Turn off the UV light. Never work in the unit with the UV light illuminated. (UV light will damage the human eye very quickly).
- The work surface should be wiped down with the appropriate disinfectant; 70% alcohol is usually suitable (if a burner is present, make sure it is not lighted). Do not depend on the UV germicidal lamp to provide a sterile work surface. Place everything needed to complete the particular procedure inside the cabinet prior to beginning work. Remove unnecessary items; excessive materials may disrupt the air flow. Arrange implements in a logical manner to segregate clean and dirty materials.
- Remember to provide a container for wastes on the inside of the cabinet. Nothing should pass in or out through the air barrier until the procedure is complete.
- Remove any items on the intake grilles that may block or disrupt the air supply.
- Try to restrict the opening and closing of lab doors and walking traffic in the work area when the cabinet is being used. These activities will disturb the cabinet's air flow.

Use of the Cabinet

- Always wear a lab coat and gloves.
- Conduct your work at least 4" back from the glass view panel. The middle third of the work surface is the ideal area to be used.
- Limit arm movements and do not make fast, pumping motions. If a burner is required, use the "Touch-O-Matic" type with a pilot light. (Since a burner will produce air turbulence, place

it to the rear of the workspace.) Most procedures should not require use of a flame when combined with good aseptic technique and proper cabinet use. Place a disinfectant-soaked towel on the work surface to contain any splatters or small spills that may occur during the procedure. Do not use flammable solvents in a biological safety cabinet (disinfecting with small amounts of 70% ethanol is acceptable).

- Control tissues, needle packages and other small loose paper or plastic products which may be caught in the air stream and pulled to the motor or HEPA filter .

Completion of a Job

- Decontaminate the surface or enclose any items which have been in direct contact with the agent.
- Cover waste containers.
- Allow the cabinet to operate for five minutes with no activity in order to purge airborne contaminants from the work area.
- Remove all equipment from the cabinet.
- Decontaminate interior work surfaces. If desired, the UV light may be turned on.
- Thoroughly wash your hands and arms with warm, soapy water.

Biohazardous Spills in the Cabinet

- Perform decontamination steps while the cabinet is operating to prevent the escape of contaminants.
- Spray or wipe all potentially contaminated walls, work surfaces, and implements with an appropriate disinfectant detergent. (Make sure to wear gloves while doing this.)
- If the spill is large, flood the work surface with disinfectant and allow to stand 10 to 15 minutes before absorbing and wiping clean.

Vertical Laminar Flow "Clean Bench"

Vertical laminar flow clean benches are not BSCs. They discharge HEPA-filtered air down onto the work surface and toward the user. These devices only provide product protection. They can be used for certain clean activities, such as the dust-free assembly of sterile equipment or electronic devices. These benches should never be used when handling potentially infectious materials. The worker can be exposed to materials (including proteinaceous antigens) being manipulated on the clean bench, which may cause hypersensitivity. Clean air benches should never be used as a substitute for a biological safety cabinet in research, biomedical or veterinary laboratories and/or applications.

Other Safety Equipment

Other safety equipment includes enclosed containers. An example of an enclosed container is the safety centrifuge cap, designed to prevent release of aerosols during centrifugation.

Safety equipment also includes personal protective clothing and equipment such as gloves, coats, gowns, shoe covers, boots, respirators, face masks or shields, and safety glasses or goggles. This clothing and equipment is generally used in combination with biological safety cabinets and other devices that contain the agents, animals, or materials in use.

In situations in which it is impractical to work in biological safety cabinets, personal protective devices may form the primary barrier between personnel and the infectious materials. Examples of such situations include certain animal studies, animal necropsy, and activities relating to maintenance, service, or support of the laboratory facility.

Facility Design (Secondary Barriers)

Secondary barriers protect the environment within the facility but outside the laboratory-and the community outside the facility-from exposure to infectious materials. The design of the facility provides the secondary barrier. The three facility designs are the basic laboratory, the containment laboratory, and the maximum containment laboratory.

The Basic Laboratory provides general space where work is done with viable agents that are not associated with disease in healthy adults; it includes Biosafety Levels 1 and 2 facilities. This laboratory is also appropriate for work with infectious agents or potentially infectious materials when the hazard levels are low and laboratory personnel can be adequately protected by standard laboratory practice. While work is commonly conducted on the open bench, certain operations are confined to biological safety cabinets. Conventional laboratory designs are adequate.

4. Biosafety Levels

The following guidelines are recommended by the Centers for Disease Control and Prevention and the National Institutes of Health and have been adopted as required procedure at RICE UNIVERSITY. They are drawn from the book *Biosafety in Microbiological and Biomedical Laboratories.* The descriptions of Biosafety Levels 1-4 parallel those in the NIH Guidelines for Research Involving Recombinant DNA (Risk Groups 1-4).

Experience has demonstrated the prudence of the Biosafety Level 1-4 practices, procedures, and facilities described for manipulations of etiologic agents in laboratory settings and animal facilities. Although no national reporting system exists for reporting laboratory-associated infections, anecdotal information suggests that strict adherence to these guidelines does contribute to a healthier and safer work environment for laboratory workers, their co-workers, and the surrounding community. To further reduce the potential for laboratory-associated infections, the guidelines presented here should be considered minimal guidance for containment. They must be customized for each individual laboratory and can be used in conjunction with other available scientific information.

Four biosafety levels (BSLs) are described in Section III of the BMBL, which consist of combinations of laboratory practices and techniques, safety equipment, and laboratory facilities. Each combination is specifically appropriate for the operations performed, the documented or suspected routes of transmission of the infectious agents, and the laboratory functions or activity. Currently, only BSL 1 & 2 agents are being used at RICE UNIVERSITY, therefore, only these guidelines will be described here.

Information on handling BSL 3 & 4 agents can be found at http://www.cdc.gov/od/ohs/biosftv/bmbl4/bmbl4toc.htm

Biosafety Level 1

Biosafety Level 1 (BSL-1) is suitable for work involving agents of no known or minimal potential hazard to laboratory personnel and the environment. The laboratory may be integral to general traffic patterns in the building. Work may be conducted on open bench tops. Special containment equipment is neither required nor generally used. Laboratory personnel shall have specific training in procedures conducted in the laboratory.

Standard Microbiological Practices for BSL-1

- At the discretion of the lab supervisor, access to the laboratory shall be limited or restricted while experiments are in progress.
- A biohazard sign shall be posted at the entrance to the laboratory whenever infectious agents are present.
- Work surfaces shall be decontaminated once a day and after any spill of viable material.
- All contaminated liquid or solid wastes shall be decontaminated before disposal. Contaminated materials that are to be decontaminated at a site outside the laboratory shall be placed in a durable, leak proof, closed container before being removed from the laboratory.
- The laboratory shall have an established policy for the safe handling of sharps.
- Mechanical pipetting devices shall be used; mouth pipetting is prohibited.
- Eating, drinking, and applying cosmetics are not permitted in the work area. Food may be stored in cabinets and refrigerators designated and used for this purpose only. Food storage cabinets and refrigerators shall be located outside the work area.
- Laboratory personnel shall wash their hands after they handle viable materials and animals and before leaving the laboratory.
- All procedures shall be performed carefully to minimize the creation of aerosols.
- An insect and rodent control program is in effect.

Safety Equipment for BSL-1

- Special containment equipment is generally not required for manipulation of agents assigned to Biosafety Level 1.
- It is recommended that laboratory coats, gowns, or uniforms be worn to prevent contamination or soiling of street clothes.
- Gloves should be worn if skin is broken or afflicted by a rash.

Laboratory Facilities for BSL-1

- The laboratory shall be designed so that it can be easily cleaned.
- Bench tops shall be impervious to water and resistant to acids, alkalis, organic solvents, and moderate heat.
- Laboratory furniture shall be sturdy. Spaces between benches, cabinets, and equipment shall be accessible for cleaning.
- Each laboratory shall contain a sink for hand washing.

Biosafety Level 2

Biosafety Level 2 is similar to Level 1 and is suitable for work involving agents of moderate potential hazard to personnel and the environment. It differs in that (1) laboratory personnel are specifically trained to handle pathogenic agents and are directed by scientists who are experienced in working with these agents, (2) access to the laboratory is limited when work is being conducted, (3) extreme precautions are taken with contaminated sharp items, and (4) certain procedures that may result in the creation of infectious aerosols or splashes are conducted in biological safety cabinets or other physical containment equipment.

The following standard and special practices, safety equipment, and facilities apply to agents assigned to Biosafety Level 2.

Standard Microbiological Practices for BSL-2

- At the discretion of the laboratory supervisor, access to the laboratory is limited or restricted while experiments are in progress.
- Laboratory personnel are to wash their hands after they handle viable materials and animals, after removing gloves, and before leaving the laboratory.
- Eating, drinking, smoking, handling contact lenses, and applying cosmetics are not permitted in the work areas. Food is stored outside the work area in cabinets or refrigerators designated and used for this purpose only.
- The laboratory shall have an established policy for the safe handling of sharps.
- Mouth pipetting is prohibited; mechanical pipetting devices are used.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Work surfaces are decontaminated at least once a day and after any spill of viable material.
- All cultures, stocks, and other regulated wastes are decontaminated by an approved decontamination method, such as autoclaving before disposal. Materials to be decontaminated outside the immediate laboratory are to be placed in a durable, leak proof container that is closed for transport from the laboratory.
- An insect and rodent control program is in effect.

Special Practices for BSL-2

- Access to the laboratory is limited or restricted by the supervisor when work with infectious agents is in progress. In general, persons at increased risk of acquiring infection or for whom infection may be unusually hazardous are not allowed in the laboratory or animal rooms. Persons who are immunocompromised or immunosuppressed may be at unusual risk of acquiring infections.
- The lab supervisor establishes policies and procedures whereby only persons who have been

advised of the potential hazard and meet specific requirements (e.g., immunization) enter the laboratory or animal rooms.

- When an infectious agent requires special provisions (e.g., immunization) for entering a laboratory where it is in use, a hazard warning sign incorporating the universal biohazard symbol is posted on the access door to the laboratory work area. The hazard warning sign identifies the infectious agent, and indicates the special requirements for entering the laboratory.
- Laboratory personnel receive appropriate immunizations for the agents handled or potentially present in the laboratory.
- When appropriate, baseline serum samples for laboratory and other at-risk personnel are collected and stored. Additional specimens may be collected periodically.
- Laboratory personnel are advised of special hazards and are REQUIRED to read and follow instructions on practices and procedures.
- Laboratory personnel receive appropriate training on the potential hazards associated with the work involved, the necessary precautions to prevent exposures, and the exposure evaluation procedures. Personnel receive annual retraining and receive additional training when procedures or policies change.
- A high degree of precaution must always be taken with any contaminated sharp items, including needles and syringes, slides, pipettes, capillary tubes, and scalpels. Needles and syringes should be used in the laboratory only when there is no alternative, such as when parenteral injection, phlebotomy, or aspiration of fluids from laboratory animals and diaphragm bottles are conducted. Plastic ware should be substituted for glassware whenever possible.
- Only needle-locking syringes or disposable syringe-needle units (i.e. the needle is integral to the syringe) are used for injection or aspiration of infectious materials. Used disposable needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal; rather they must be carefully placed in conveniently located puncture resistant containers used for sharps disposal. Non-disposable sharps must be placed in a hard-walled container for transport to a processing area for decontamination, preferably by autoclaving.
- Broken glassware must not be handled directly by hand but must be removed by mechanical means such as a brush and dustpan, tongs, or forceps. Containers of contaminated needles, sharp equipment, and broken glass are decontaminated before disposal.
- Cultures, tissues, and specimens of body fluids are placed in a container that prevents leakage during collection, handling, processing, storage, transport, or shipping.
- Laboratory equipment and work surfaces should be decontaminated with an appropriate disinfectant on a routine basis as well as after work with infectious material is finished and, especially, after overt spills, splashes, or other contamination by infectious materials. Contaminated equipment must be decontaminated before it is sent for repair or maintenance or packaged for transport.
- Spills or accidents that result in overt exposures to infectious materials are immediately reported to the laboratory director. Medical evaluation, surveillance, and treatment are provided as appropriate at no cost to employees, and written records are maintained.

Safety Equipment for BSL-2

- Properly maintained biological safety cabinets, preferably Class II, or other appropriate personal protective equipment or physical containment devices are used whenever:
    1. Procedures with a potential for creating infectious aerosols or splashes are conducted. These may include centrifuging, grinding, blending, vigorous shaking or mixing, sonic disruption, opening containers of infectious materials in which internal pressure may differ from ambient pressure, inoculating animals intra-nasally, and harvesting infected tissues from animals or eggs.
    2. High concentrations or large volumes of infectious agents are used. Such materials

may be centrifuged in the open laboratory if sealed rotor heads or centrifuge safety cups are used and if these rotors or safety cups are opened only in a biological safety cabinet.

- Face protection (goggles, mask, face shield, or other splatter guards) is used for anticipated splashes or sprays of infectious or other hazardous materials to the face when the microorganisms must be manipulated outside the biological safety cabinet.
- Protective laboratory coats, gowns, smocks, or uniforms designated for lab use are worn in the laboratory. This protective clothing is removed and left in the laboratory before lab personnel leave for non-laboratory areas (e.g., cafeteria, library, or offices). All protective clothing is either disposed of in the laboratory or sent to the laundry service (only after being decontaminated). It is never taken home.
- Lab personnel wear gloves when handling infected animals and when hands may come in contact with infectious materials or contaminated surfaces or equipment. Wearing two pairs of gloves may be appropriate; if a spill or splatter occurs; the hand will be protected after the contaminated glove is removed. Gloves are disposed of when contaminated, removed when work with infectious materials is completed, and not worn outside the laboratory. Disposable gloves are not washed or reused.

Laboratory Facilities (Secondary Barriers) for BSL-2

- Provide lockable doors for facilities that house restricted agents
- Each laboratory contains a sink for hand washing.
- The laboratory is designed so that it can be easily cleaned. Rugs are not appropriate in laboratories.
- Bench tops are impervious to water and resistant to acids, alkalis, organic solvents, and moderate heat.
- Laboratory furniture is sturdy, and spaces between benches, cabinets, and equipment are accessible for cleaning.
- An eyewash facility is readily available.
- Biological safety cabinets shall be installed in such a manner that fluctuations of the room supply and exhaust air do not cause them to operate outside their parameters for containment. Biological safety cabinets shall be located away from doors, from windows that can be opened, from heavily traveled laboratory areas, and from other potentially disruptive equipment so as to maintain the biological safety cabinets' air flow parameters for containment.
- Illumination shall be adequate for all activities, avoiding reflections and glare that could impede vision.

5. Biological Spills

A biological spill shall be followed by prompt action to contain and clean up the spill. When a spill occurs, warn everyone in the area and call for assistance as needed. The degree of risk involved in the spill depends on:

- the volume of material spilled
- the potential concentration of organisms in the material spilled
- the hazard of the organisms involved
- the route of infection of the organisms, and
- the diseases caused by the organisms.

Spills of biological agents can contaminate areas and lead to infection of laboratory workers. Prevention of exposure is the primary goal in spill containment and cleanup, exactly as in chemical spills. In evaluating the risks of spill response, generation of aerosols or droplets is a major consideration.

If an accident generates droplets or aerosols in the laboratory room atmosphere, especially if the agent involved requires containment at Biosafety Level 2, the room shall be evacuated immediately.

Doors shall be closed and clothing decontaminated. Call the Biological Safety Officer to supervise the cleanup. In general, a 30-minute wait is sufficient for the droplets to settle and aerosols to be reduced by air changes. Longer waiting periods may be imposed depending on the situation.

If a spill of a biological agent requiring containment at Biosafety Level 2 occurs in a public area, evacuation of the area shall be immediate. The Supervisor shall be responsible for designating the extent of evacuation until Biosafety Safety Officer or emergency personnel arrive. Prevention of exposure to hazardous aerosols is of primary importance.

Anyone cleaning a spill shall wear personal protective equipment (for example, laboratory coat, shoe covers, gloves, and possible respiratory protection) to prevent exposure to organisms. An air-purifying negative-pressure respirator with **P-100** filter cartridges is generally adequate protection against inhalation of most biological agents. However, there may be exceptions. Contact the Biological Safety Officer for advice in choosing the correct respiratory protection and for information regarding the requirements that must be met to wear a respirator.

An appropriate chemical disinfectant should be chosen that is effective against the organisms involved in the spill

Sterilization, Disinfection, and Decontamination

The Environmental Protection Agency recognizes the following categories of chemical germicides (a germicide is an agent that kills pathogenic organisms). The information in this section is drawn from *Protection of Laboratory Workers from Instrument Biohazards and Infectious Disease Transmitted by Blood, Body Fluids, and Tissue,* Approved Guideline, NCCIS Document M29-A, Vol. 17, NO.20 (National Committee for Clinical laboratory Standards, December, 1997).

- Sterilizer or Sterilant: An agent intended to destroy all microorganisms and their spores on inanimate surfaces.
- Disinfectant: An agent intended to destroy or irreversibly inactivate specific viruses, bacteria, or pathogenic fungi, but not necessarily their spores, on inanimate surfaces. Most disinfectants are not effective sterilizers.
- Hospital Disinfectant: An agent shown to be effective against specific organisms such as *Staphylococcus aureus, Salmonel/a choleraesuis,* and *Pseudomonas aeruginosa.* It may also be effective against other organisms and some viruses. The labels of all commercially available hospital disinfectants contain a claim (which must be documented) of effectiveness for specific agents.
- Antiseptic: A chemical germicide formulated for use on skin or tissue. Antiseptics should not be used as disinfectants.
- Decontamination: A procedure that eliminates or reduces microbial contamination to a safe level with respect to the transmission of infection. Sterilization and disinfection procedures are often used for decontamination.

The OSHA Blood borne Pathogens Standard requires that all equipment and environmental and working surfaces shall be cleaned and decontaminated after contact with blood or other potentially infectious materials. The standard also requires decontamination of contaminated work surfaces after completion of procedures, immediately or as soon as feasible after any overt contamination of surfaces or any spill of potentially infectious material, and at the end of the work shift if the work surface has become contaminated. All reusable equipment shall be decontaminated immediately or as soon as feasible upon visible contamination.

It should be emphasized that, for any infectious material, adequate pre-cleaning of surfaces is important for any disinfection or sterilization procedure. Ten minutes of exposure to a disinfectant may not be adequate to disinfect objects that have narrow channels or other areas that can harbor microorganisms. Alcohols, for example, are effective for killing hepatitis B virus (HBV) but are not recommended for this purpose because of their rapid evaporation and the consequent difficulty of maintaining proper contact times.

Chlorine compounds are probably the most widely used disinfectants in the laboratory. You can easily prepare an inexpensive, broad-spectrum disinfectant by diluting common household bleach.

Bleach is a 5.25% sodium hypochlorite solution -this is equal to approximately 50,000 ppm of free available chlorine. This level of chlorine can be harmful to skin and eyes. Lower concentrations are effective in disinfection and are *less* hazardous for *the* worker. *The concentration* to be used is based

on *your* assessment of the severity of the contamination or spill of infectious materials .

For small spills of infectious agents or for contamination on hard, smooth surfaces, a 1:100 dilution of commercial bleach is adequate. This is equivalent to 500 ppm of free chlorine .

In the case of large or concentrated spills of infectious agents, a higher level of chlorine is needed to be effective in destroying the microorganisms. Use a 1:10 dilution (5,000 ppm of free chlorine) and flood the contaminated area with the solution. Alternatively, you can mix the disinfectant with the spilled material. This higher concentration is more suitable for porous surfaces that *may* harbor organisms in tiny cracks or pits.

Make the solution fresh each day. Be aware that chlorine compounds may corrode metals, especially aluminum. While a 10% household bleach solution is a commonly used decontaminant concentration, it is probably stronger than necessary for ordinary uses. It can be extremely irritating to personnel. Therefore, the use of higher concentrations of bleach in chemical fume hoods, and the autoclaving of materials that have been treated with bleach, should be reserved for significant contamination.

Note that bleach will react with water to form hypochlorous acid (HOCI), which will decompose to chlorine (CI2) and hydrogen chloride (HCI). Special care should be taken when autoclaving hypochlorite solutions because the procedure can generate chlorine gas, which will corrode steel. To avoid evolution of chlorine, the hypochlorite solution should be neutralized with sodium thiosulfate prior to autoclaving. The Biological Safety Officer should be consulted prior to autoclaving any items treated with bleach.

Formaldehyde is an OSHA-regulated chemical that is a suspect carcinogen, so its use as a disinfectant is not recommended.

Iodophors that are registered with the EPA may be effective hard-surface decontaminants when used per manufacturer's instructions, but iodophors formulated as antiseptics are not suitable for use as disinfectants.

Peracetic (peroxyacetic) acid and hydrogen peroxide mixtures minimize the negative effects of corrosiveness sometimes seen with chlorine compounds and high concentrations of peracetic acid alone. A limited number of trade-name products containing <0.1% peracetic acid and <1.0% hydrogen peroxide and registered with the EPA as sterilants/disinfectants are available. The benefit of these products is their rapid action and broad-spectrum of germicidal activity, in addition to the reduced corrosiveness.

Quaternary ammonium compounds are low-level disinfectants and are not recommended for spills of human blood, blood products, or other potentially infectious materials.

Decontamination of Spills

The following procedure is recommended for decontaminating spills of agents used at BSL-2.

- Wear gloves and a laboratory coat or gown. Heavyweight, puncture-resistant utility gloves, such as those used for housecleaning and dishwashing, are recommended.
- Do not handle sharps with the hands. Clean up broken glass or other sharp objects with sheets of cardboard or other rigid, disposable material. If a broom and dustpan are used, they must be decontaminated later.
- Avoid generating aerosols by sweeping.
- Absorb the spill. Most disinfectants are less effective in the presence of high concentrations of protein, so absorb the bulk of the liquid before applying disinfectants. Use disposable absorbent material such as paper towels. After absorption of the liquid, dispose of all contaminated materials as waste.
- Clean the spill site of all visible spilled material using an aqueous detergent solution (e.g., any household detergent). Absorb the bulk of the liquid to prevent dilution of the disinfectant.
- Disinfect the spill site using an appropriate disinfectant, such as a household bleach solution. Flood the spill site or wipe it down with disposable towels soaked in the disinfectant.
- Absorb the disinfectant or allow **it** to dry.
- Rinse the spill site with water.

- Dispose of all contaminated materials properly. Place them in a biohazard bag or other leak proof, labeled biohazard container for sterilization.

Biological Spill in the Open Laboratory

For a spill in the open laboratory outside a biological safety cabinet, the spill response depends on the size of the spill and hazard of the material. A minimally hazardous material spilled without generating appreciable aerosols can be cleaned with a paper towel soaked in a chemical disinfectant.

A spill of a larger volume of hazardous material with aerosol generation requires evacuating the room, waiting for aerosol reduction, donning personal protective gear (including appropriate respiratory protection), selecting a disinfectant effective against the organisms involved, and cleaning as described above. Following cleanup, response personnel shall wash or shower with a disinfectant soap.

Biological Spill within a Biological Safety Cabinet

A spill that is confined within a biological safety cabinet generally presents little or no hazard to personnel in the area. However, chemical disinfection procedures are to be initiated at once while the cabinet continues to operate. The disinfectant shall be one that is active against the organisms of potential hazard. Flammable liquids, such as ethanol or isopropanol, shall not be used, even if effective, because of the fire hazard of generating dangerous vapor concentrations within the cabinet that could be ignited by an electrical spark or other source.

Spray or wipe the walls, work surfaces, and equipment with the chosen disinfectant. Allow the disinfectant to remain on the surface for the appropriate contact time (refer to Appendix C Table 3 and 4 for recommended contact times).

Minimize the generation of aerosols and use sufficient disinfectant to ensure that drain pans and catch basins below the work surface contain disinfectant. The front exhaust shall also be wiped and the disinfectant drained into a container.

Biological Spill in a Centrifuge or Other Equipment

A biological spill in a centrifuge has the potential for producing large volumes of aerosols. On becoming aware that a spill may have occurred within a centrifuge or other piece of equipment, turn off the equipment, warn others in the area, notify the principal investigator, allow aerosols to settle, and decontaminate following the principles described above.

Biological Spill on a Person

If a biological material is spilled on a person, emergency response is based on the hazard of the biological agent spilled, the amount of material spilled, and whether significant aerosols were generated. If aerosol formation is believed to have been associated with the spill, a contaminated person shall leave the contaminated area immediately. If possible, (s)he should go to another laboratory area so that hallways and other public areas do not become contaminated.

Contaminated clothing is removed and placed in red or orange biohazard bags for disinfecting. Contaminated skin shall be flushed with water and thoroughly washed with a disinfectant soap. Showering may be appropriate, depending on the extent of the spill.

6. Human Blood, Blood Products, and Other Potentially Infectious Materials

In any laboratory where work involves the use of and/or exposure to human blood, certain other body fluids, or unfixed human tissue, there is the danger of exposure to blood borne pathogens, the disease-causing microorganisms that may be found in such material.

RICE UNIVERSITY is required to comply with the OSHA Occupational Exposure to Blood borne Pathogens Standard found in 29 CFR 1910.1030. The requirements of the standard are covered in the *RICE UNIVERSITY Exposure Control Plan*

You should refer to the *Exposure Control Plan* if your work requires occupational exposure to any of the following human materials:

Blood (human blood, human blood components, and products made from human blood)

These human body fluids:

Semen

amniotic fluid

vaginal secretions

saliva (in dental procedures)

cerebrospinal fluid

any body fluid that is visibly contaminated with synovial fluid

pleural fluid all body fluids in situations where it is difficult or impossible to differentiate between body fluids

pericardial fluid

peritoneal fluid

Any unfixed tissue or organ (other than intact skin) from a human, living or dead.

HIV-containing cell, tissue, or organ cultures; HIV-or HBV-containing culture medium or other solutions;

and blood, organs, or other tissues from experimental animals infected with HIV or HBV.

Occupational exposure means reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties.

7. Recombinant DNA Research

Recombinant DNA research shall comply with the National Institutes of Health's "Guidelines for Research Involving Recombinant DNA Molecules," as published in the Federal Register, July 5, 1994, Volume 59, No. 127, pages 34,496 through 34,547, and any subsequent amendments thereto (latest: Amendment Effective December 28, 2000, FR, January 5, 2001 [66 FR 1146]).

Section III-A Experiments that require Institutional Biosafety Committee approval, Recombinant DNA Advisory Committee (RAC) review, and NIH Director approval before initiation

Section III-B Experiments that require NIH/ORDA and Institutional Biosafety Committee approval before initiation

Section III-C Experiments that require Institutional Biosafety Committee and Institutional Review Board approval and NIH/ORDA registration before initiation

Section III-D Experiments that require Institutional Biosafety Committee approval before initiation

Section III-E Experiments that require Institutional Biosafety Committee notice simultaneous with initiation

Section III-F Exempt experiments

If an experiment falls into section III-A, III-B, or III-C and one of the other sections as well, the rules pertaining to section III-A, III-B, or III-C shall be followed. If an experiment falls into section III-F alone, or into section III-F and into section 111-0 or III-E as well, the experiment is considered exempt from the NIH guidelines.

In general, the containment practices to be used for recombinant DNA research shall follow those described for Biosafety Levels 1 and 2 in the CDC-NIH *Biosafety in Microbiological and Biomedical Laboratories.* However, the NIH Recombinant DNA guidelines take precedence.

8. Animal Studies

When research involves exposure to and handling of animals, there are considerations that must be given to the potential allergens, zoonoses, and physical hazards, e.g., bites and scratches, that may be encountered by researchers and staff. In general, practices for Animal Biosafety Levels 1 and 2 presented in the CDC-NIH manual, *Biosafety in Microbiological and Biomedical Laboratories,* are followed. (See http://bmbl.od.nih.gov/sect4tab1.htm for a good summary of the Animal Biosafety Levels).

9. Management of Biological Waste

The purpose of this section is to provide information, requirements, guidelines and procedures for the handling and disposal of hazardous and non-hazardous biological waste at RICE UNIVERSITY.

In Texas, the disposal of biohazardous waste is regulated by the Texas Department of Health and the Texas Commission on Environmental Quality. Local regulations of the City of Houston, and Brown and Ferris (BFI) also

apply to all waste that will be disposed in their landfills.

BIOLOGICAL WASTE means discarded biological material from teaching, clinical, and research laboratories and operations. This does not include household or office trash, waste from Food Services, Physical Plant, bedding and manure from normal agricultural operations or bedding and litter from noninfectious animals.

BIOHAZARDOUS WASTE means any solid or liquid biological waste that is hazardous because of its physical and/or biological nature. All waste that contains infectious material or which, because of its biological nature, may be harmful to humans, animals, plants or the environment is biohazardous waste. This includes: waste from infectious animals; bulk human blood or blood products; microbiological waste; pathological waste; sharps; and hazardous products of recombinant DNA biotechnology and genetic manipulation.

Treatment of all laboratory biological waste prior to disposal is good laboratory practice, and is highly recommended, but biohazardous waste must be treated prior to disposal. Acceptable treatment methods include thermal or chemical disinfection, encapsulation (solidification), or incineration.

The key requirements for disposal of biohazardous waste are that it must be (1) seqreqated from other waste; (2) securely packaqed; (3) specifically labeled to indicate the method of treatment; (4) transported to the point of treatment or disposal by appropriately trained personnel; (5) treated to eliminate the biological hazard; and (6) documented by maintenance of appropriate records.

Biohazardous waste that is mixed with hazardous chemical waste, radioactive waste, or both must be treated to eliminate the biohazard prior to disposal. After treatment, the waste must be managed as hazardous chemical waste.

'Biohazardous Waste may also be called "medical waste", "special waste", "regulated waste", "red bag waste", "infectious waste", or "pathological waste." For simplicity, the present document will refer to all such material as "BIOHAZARDOUS WASTE". Definitions in this document are derived from Title 25, Texas Administrative Code, Chapter 1.

Segregation

Any waste that could produce laceration or puncture injuries must be disposed of as "sharps". Sharps must be segregated from other waste. Metal sharps, pasture pipettes and capillary tubes may be commingled in an approved plastic sharps container, but not with non-sharp waste.

Waste that is to be incinerated should not be commingled with glass or plastics.

Biological waste must not be commingled with chemical waste or other laboratory trash.

Containers

Containers must: be appropriate for the contents; not leak; be properly labeled; and maintain their integrity if chemical or thermal treatment is used. Containers of biohazardous material should be kept closed.

Metal Sharps --Use a rigid, puncture-resistant container (heavy-walled plastic is recommended) suitable for encapsulation and disposal. Container and encapsulated contents must withstand an applied pressure of 40 psi without rupture.

Pasteur Pipets and Broken Glassware -Use a rigid, puncture-resistant container (e.g., plastic, heavy cardboard or metal) that can be sealed.

Solid Biohazardous Waste --Use heavy-duty plastic "BIOHAZARD BAGS" (autoclave bags) or containers for solid biohazardous waste.

Liquids -Use leak-proof containers able to withstand thermal or chemical treatment.

Storage

Biohazardous waste should be treated and disposed of promptly and not allowed to accumulate. Containers holding biohazardous material must be clearly labeled, including the Biohazard Symbol. Temporary holding areas for biohazardous waste must be clean and orderly with no access to unauthorized persons (warning signs should be posted).

Labeling Biohazardous Waste Containers

Each container of untreated biohazardous waste must be clearly identified as such and must be labeled with the Biohazard Symbol.

Each container of treated biohazardous waste is to be placed in a red plastic container provided by Stericycle, Inc.

(biohazardous waste disposal service provider).

Label autoclave bags with commercially available autoclave tape that changes color upon adequate thermal treatment. Apply this tape across the Biohazard Symbol on the bag before autoclaving.

Handling and Transport

Only properly trained technical personnel can handle or transport untreated biohazardous waste.

Treated waste must also be transported by properly trained technical personnel.

Avoid transporting untreated biohazardous materials or foul or visually offensive material through non-lab or populated areas.

10. Treatment and Disposal Methods

NOTE: Waste should be treated as near the point of origination as possible.

Animal Carcasses, Body Parts and Solid Animal Waste (bedding, feces, etc.):

This waste is sent to a commercial plant for incineration. The landfill will not accept carcasses or recognizable body parts.

Metal Sharps:

Discarded metal sharps MUST be contained and disposed of in a manner that prevents injury to laboratory, custodial and landfill workers. Needles, blades, etc., are considered BIOHAZARDOUS even if they are sterile, capped and in the original container. Never place sharps in a trash container or plastic bag that might be handled by custodial staff.

Pasteur Pipets and Broken glassware:

- Contaminated with Biohazardous Materials: Disinfect by thermal or chemical treatment; place in a cardboard box. When full, tape the box shut and place near trash for custodians
- Not contaminated with Biohazardous Material: Place in a cardboard box. When full, tape the box shut and place near trash for custodians

Plastic Waste

- Contaminated with Biohazardous Material: Disinfect by thermal or chemical treatment; place in a trash dumpster.
- Not Contaminated: Place in a trash can.

Microbiological Waste

- Solid --Disinfect by thermal or chemical treatment; place in a trash can lined with an opaque trash bag.
- Liquid --Disinfect by thermal or chemical treatment; discharge into the sewer system.

Genetic Material

Disposal of materials containing recombinant DNA or genetically altered organisms must be consistent with applicable NIH Guidelines, in addition to complying with the requirements contained in this document.

Radioactive Waste

Biological waste that contains radioactive material must be managed as radioactive waste.

Chemical Waste

Biohazardous waste which also contains hazardous chemicals must be managed as hazardous chemical waste.

11. Training and Hazard Communication

The Department Directors or individual with primary supervisory responsibility must assure that all personnel who work with, or who may contact potentially biohazardous material are informed of the hazards and are trained in the proper procedures and equipment needed to avoid exposure, proper treatment and disposal of biohazardous wastes, and recognition of symptoms of infection or exposure.

Written Procedures and Records

Environmental Health and Safety will maintain written records that, at a minimum, contain the following information:

- Date of treatment
- Quantity of waste treated
- Method/conditions of treatment
- Name (printed) and initials of the person performing the treatment.

Waste Disposal

This document is designed to help the Rice University community distinguish between municipal and hazardous waste and help elucidate how the waste should be disposed of properly.

Municipal Waste

Municipal Waste is waste of a non-hazardous nature that does not inherently pose a threat to people or the environment. Municipal waste items include packing materials, paper, office supplies, non-contaminated lab materials and food or drink containers. Rice University encourages all the members of our community to recycle, reuse or repurpose. Recycle bins are available in all building on campus. http://facilities.rice.edu/Content.aspx?id=2654

Hazardous Waste

Hazardous Waste is unwanted material that poses an inherent danger to personnel or the environment. This waste cannot be disposed in a municipal landfill and requires special handling, manifesting and packaging prior to disposal.

Classrooms and Offices

Offices and classrooms all have ordinary trash cans readily available to all occupants. However, not all waste should be placed into the ordinary trash. Wastes from these areas that are of concern include sharps (razor blades, syringe needles) or broken glass. Sharps in the ordinary trash can create hazardous conditions in an otherwise safe environment. These materials if not disposed of correctly could result in someone being stuck or cut by a piece of glass or needle. If you need to throw away glass or objects that may become sharp if broken please place these items in a cardboard box and close or tape the box shut and mark it as trash. Sharps containers, for needle disposal, are available from the Environmental Safety Department free of charge.

Electronic Disposal

Unwanted/obsolete electronic equipment, machines, or batteries, also known as “E” waste should not be disposed in the ordinary trash. For the disposal of unwanted computer equipment please contact your IT division representative. For the proper disposal of batteries or other e-waste contact EHS by completing a waste pickup form. http://safety.rice.edu/Waste/Waste_Pickup_Request/

Laboratory Waste

Not all laboratory waste should be considered hazardous and disposing of this waste properly can sometimes be confusing. This document is designed to help you distinguish between different types of waste and the proper disposal of each waste stream.

Municipal Laboratory Waste

Municipal lab waste includes office supplies, packing materials, other disposal lab materials and boxes that were received or used in a laboratory. These items can go into the normal trash or recycle bin. Other materials that can be thrown away in the normal trash are non-contaminated gloves and any other non-contaminated disposable lab supplies.

Biological Waste

Biological waste is any infectious material, agent, or toxin that poses a threat to the general public and environment. Biological waste can be derived from bacteria, virus, toxins, bloodborne products, and contaminated materials. All biological waste must be treated before general disposal.

Liquid Biological Waste

All liquid waste must be appropriately treated prior to disposal by either chemical disinfection or thermal sterilization to ensure complete neutralization of the material. The Center for Disease and Control (CDC) provides guidance on sterilization and disinfection protocols published in the *Biosafety in Microbiological and Biomedical Laboratories.* Once neutralized, the solution can be pour down the laboratory sink followed by copious amounts of water.

If the solution contains other hazards such as chemicals or radioactive materials, ensure the neutralization agent is compatible with the underlying hazard first. Once neutralization is complete, the waste can be safely disposed into the appropriate hazardous waste stream.

Solid Biological Waste

Solid biological waste includes plastic-ware, petri dishes, eppendorf tubes or any other materials used to culture or transfer biological materials. Any materials contaminated with a biological hazard must be autoclaved prior to normal disposal or placed in a biohazard box. Solid biological waste can be autoclaved for 30 min at 15psi and 121°C. Before beginning the sterilization process, place a strip of autoclave test tape across the biohazard symbol. Following the cycle if the test strip tape indicates the autoclave reached the appropriate temperatures. Following the autoclave process the material is considered non-hazardous waste and can be disposed in the general trash. Never place red bags in the general trash. All biohazardous symbols must be defaced or marked out prior to disposal. Red bags may be collected in dark plastic bags prior to final disposal.

Wastes to be transported off-site for treatment must be packaged securely in the Bio Hazard box available at the George R Brown loading dock or BRC loading dock. Waste containers must not weight more than 40lbs. The red interior liner must be hand-tied closed and the top of the box must be securely folded shut. If the waste material is frozen or had the potential to leak, you must use two red bed liners before securing the box. Please do not place the box in the collection area until the day of or night before shipment. On campus these boxes should be placed inside the loading dock at George R. Brown and at the BRC they should be placed in the autoclave rooms. Each box should be marked on the outside with the PI name, building and room number.

Ethidium Bromide Waste

The 5 gallon bucket, as described in the chemical waste section, should be used for any gels and other material that comes in contact with the ethidium bromide. Do not use a red biohazard bag to line the buckets. For the liquid ethidium bomide waste such as buffers, please use a 5 gallon carboy and label the container appropriately.

Sharps Waste

Sharps include any razor, scalpel, syringes and needles and must be disposed in a plastic sharps container available in the EHS office. Needles should never be recaped or removed from the syringe when disposing. The entire needle and syringe should be placed in the sharps container for disposal. Once the container is ¾ full, secure the top and place the sealed container in a biohazard waste box. Biohazard waste boxes are available at the George R Brown loading dock or BRC loading dock. Once the biohazard box is full or no longer wanted in the lab secure the containers by following the procedures for solid biological waste disposal.

Broken Glass Waste

Broken glass waste poses a unique hazard to the custodial staff. Broken glass should only be disposed of in designated broken glass containers. These broken glass boxes can be obtained free of charge from the chemistry or VWR stockroom. When assembling the boxes make sure to use packing tape to secure the bottom of the box. Due to the weight of the glass only fill the box ¾ full. If the bottom of the box tears open due to moisture in the box, moisture on the floor or weight of the box laboratory personnel are left with a complicated mess to clean up. It is important to note that glass waste boxes are for broken glass and the whole bottles should not contain any liquid or

residue. Though it is acceptable to place used pipets in these containers, it is not appropriate to dispose of unwanted chemicals, or vials which contain samples. Always use a plastic liner (bag) in the box to prevent any moisture from seeping and possibly compromising the integrity of the box. When the box is ¾ full, seal the bag and box and mark if for disposal. Never place bio hazardous materials in the glass waste boxes. Contact the Rice Facilities Service Center for custodial issues with broken glass.

Vial Waste

Vial waste containing chemicals, usually dissolved in a solvent, that are in small plastic or glass containers or eppendorf tubes should not be placed in the glass trash. Any vial which contains less than 5 ml fits into this category. Vial waste should be placed into 5 gallons buckets for pickup and disposal. Buckets are available from EHS or in the stockroom at the BRC or Space Science. Place a disposal sticker on the container and write "vial waste" on the label. When the container is full and ready for disposal, place a pickup request on the EHS website. http://safety.rice.edu/Waste/Waste_Pickup_Request/

Empty Chemical Containers

Bottles or containers that contained chemicals are not considered hazardous waste; however they should not simply be thrown away in the trash. Amber glass bottles and 20 Liter steel drums should be rinsed a minimum of 3 times with water and allowed to dry before disposal in general trash. If the contents were a solvent that is not miscible with water or should not be poured down the drain, e.g. acetone, chloroform, dichloromethane, acetonitrile etc. please allow the residual contents to evaporate in a chemical hood. Once the residue has evaporated, the label should be defaced and the empty container disposed in the general trash or glass box.

Chemical Waste

Most laboratories on campus routinely generate hazardous waste and therefore are subject to EPA and TCEQ (Texas Commission on Environmental Quality) rules regulating the generation, storage, and disposal of chemical waste. Prudent waste management is necessary for resource conversation and pollution prevention.

Hazardous waste should segregate by reactivity and collected in waste containers supplied by EHS. Segregation of the waste stream should be based on the underlying hazards (flammable, aqueous acids or basic, chlorinated) and never poured down the sink without consultation with EHS.

When generating hazardous waste follow these guidelines.:
All waste containers must be capped or closed when not in use.
All waste containers must be labeled with the word "waste" or "hazardous waste".
Chemical contents of the waste container should be maintained to prevent non compatible waste from being collected together.
All waste containers must have an EHS hazardous waste sticker affixed to the vessel with the following information filled out.

- Name of generator (PI or Lab).
- Date that the waste began accumulating.
- Type of hazard.
- Bulk constituents.

All hazardous waste containers must be in a secondary container that can accommodate 110% the volume of the waste container. EHS will provide these to the laboratory upon request.
All waste ready for pick up must be placed in a designated area and the generator must fill out an EHS waste pickup request form.http://safety.rice.edu/Waste/Waste_Pickup_Request/

Radioactive Material

If your laboratory is licensed to work with radioactive material, proper management of this waste stream is important to prevent unintended exposure and high cost of disposal of mixed waste. Environmental Health and Safety will assist you with the disposal or decay of all radioactive waste. Contact EHS to obtain a cost for the disposal of radioactive materials. The cost of disposal of these materials is the responsibility of the PI. Once the material is removed from the lab or has reached its maximum decay it can be subtracted from your radioactive material inventory.

Memo of Understanding - Unbroken Glassware

Certain glassware and chemicals are considered precursors to the production of controlled substances. These chemicals and glassware have special restrictions due to a memo of understanding between the Texas Department of Public Safety and the Texas Higher Education Coordinating Board. You cannot dispose of any unbroken glassware or apparatus that is considered a controlled item in the trash. You must submit a waste pickup request to dispose of these. You can view the document here to determine if you have any of these materials.

Memorandum of Understanding
between the
Texas Department of Public Safety
and the
Texas Higher Education Coordinating Board

Pursuant to Texas Health and Safety Code, Section 481.0621 (b), the Texas Department of Public Safety (DPS) and the Texas Higher Education Coordinating Board (THECB) enter into this memorandum of understanding in order to establish the responsibilities of the DPS, the THECB, and the public or private institutions of higher education for implementing and maintaining a program for reporting information concerning controlled substances, controlled substance analogues, chemical precursors, and chemical laboratory apparatus used in education or research activities of institutions of higher education.

1 - DEFINITIONS

(a) Agent – any peace officer or other person who is authorized by law to enforce or administer state or federal drug laws.

(b) Central Location – location within an institution of higher education where records are maintained.

(c) 21 CFR, Part 1301 – 21 Code of Federal Regulations, Part 1301 to End, providing for the Registration of Manufacturers, Distributors, and Dispensers of Controlled Substances and any amendments to these regulations hereafter adopted.

(d) Client – any person or entity to which DPS has issued a permit authorizing the purchase, sale, transfer or furnishing of a controlled item.

(e) Controlled Glassware – condensers; distilling apparatus; vacuum dryers; single, two-and three-necked flasks; distilling flasks; Florence flasks; filter funnels; Buchner funnels; separatory funnels; Erlenmeyer flasks; round-bottom flasks; thermometer flasks; filtering flasks; Soxhlet extractors; and adapter tubes made of glass.

(f) Controlled Item – precursor chemicals and laboratory apparatus listed in Texas Health and Safety Code Section 481.002 (51) and 481.002 (53) and as named by rule by the Director of the Department of Public Safety pursuant to the Texas Health and Safety Code Section 481.077(b) and 481.080(c).

The table below lists the controlled items as of September 1, 2005.

Precursor Chemicals	Laboratory Apparatus
1. Methylamine 2. Ethylamine 3. D-lysergic acid 4. Ergotamine tartrate 5. Diethyl malonate 6. Malonic acid 7. Ethyl malonate 8. Barbituric acid 9. Piperidine 10. N-acetylanthranilic acid 11. Pyrrolidine 12. Phenylacetic acid 13. Anthranilic acid 14. Hypophosphorus acid 15. Ephedrine 16. Pseudoephedrine 17. Norpseudoephedrine 18. Phenylpropanolamine 19. Red phosphorus	A. Condensers B. Distilling apparatus C. Vacuum dryers D. Three-necked flasks E. Distilling flasks F. Tableting machines G. Encapsulating machines H. Filter funnels, buchner funnels, and separatory funnels I. Erlenmyer flasks, two-necked flasks, single neck flasks, round-bottom flasks, Florence flasks, thermometer flasks, and filtering flasks J. Soxhlet extractors K. Transformers L. Flask heaters M. Heating mantles N. Adapter tubes

(g) Controlled Substance – a substance, including a drug, an adulterant and a dilutant as defined by the Health and Safety Code, Chapter 481, the Texas Controlled Substances Act.

(h) Controlled Substance Analogue – (1) a substance with a chemical structure substantially similar to the chemical structure of a controlled substance in Schedule I or II or Penalty Group 1, 1-A, or 2 of the Texas Health and Safety Code, Chapter 481, Texas Controlled Substances Act; and (2) a substance specifically designed to produce an effect substantially similar to, or greater than, the effect of a controlled substance in Schedule I or II or Penalty Group 1, 1-A, or 2 of the Texas Health and Safety Code, Chapter 481, Texas Controlled Substances Act.

(i) DPS – Department of Public Safety Narcotics Service Regulatory Program that is charged with the regulation of controlled substances and items listed in this MOU.

(j) Institution of Higher Education or Institution – this term includes an institution of higher education, as defined in Texas Education Code, Section 61.003(8), a private or independent institution of higher education, as defined in Texas Education Code, Section 61.003(15), and a private postsecondary educational institution, as defined in Texas Education Code, Section 61.302(2).

(k) MOU – memorandum of understanding as required by the Texas Health and Safety Code, Section 481.0621(b).

(l) Nar-22 – form prepared and issued by DPS Narcotics Service to clients to report sale, transfer, or furnishing of a controlled substance or item.

(m) Site – a specific location at an institution where controlled items are utilized and/or stored.

(n) THECB – Texas Higher Education Coordinating Board.

(o) Unacceptable Discrepancy – any difference in the amount on hand and the amount documented that cannot reasonably be explained by accidental or normal loss.

2 - PROCEDURES

Institutions of higher education in Texas shall adopt procedures in compliance with this MOU. When requested, the DPS shall provide technical advice to the institution or site, and educational materials or presentations if funds and personnel are available.

3 - RECORDS AND REPORTS

a. The site shall maintain all purchase order records, in accordance with the minimum retention requirements established by the Texas State Library and Archives Commission, of the incoming controlled substances, controlled substance analogues, precursor chemicals and laboratory apparatus (including controlled glassware) covered in this MOU that have been purchased or received by the site or central location.

b. An institution or site that discovers a readily unacceptable discrepancy, loss, pilferage or theft of a controlled substance, controlled substance analogue, precursor chemical or laboratory apparatus (including controlled glassware) shall submit a written report of the incident to the appropriate law enforcement agency no later than 5 business days after the date of discovery of the discrepancy, loss, pilferage or theft. The institution shall forward the report to DPS within 5 additional business days after the report is submitted to the appropriate law enforcement agency.

c. Upon request, the DPS shall assist the law enforcement agency conducting an investigation regarding the pilferage or theft of the controlled substance, precursor chemical, or laboratory apparatus named in this MOU.

d. The DPS may request that an institution or site provide a duplicate of any record(s) covered by this MOU and the institution or site shall provide such record(s) within 10 business days of the request. The record(s) may be provided in electronic or hard copy form.

4 - SALE, TRANSFER OR FURNISHING OF CONTROLLED ITEMS

a. The institution or site shall prohibit the sale, furnishings, or transfer of controlled items, including glassware, covered by this MOU to any person or entity not holding a DPS permit, unless the recipient is specifically exempted by law or rule.

b. The institution shall report to the DPS on a Nar-22 form or any form mutually agreed upon by all parties, every sale, furnishing or transfer of a controlled item leaving the institution. The site shall submit these reports to the DPS within 30 days of the furnishing or transfer of the

controlled items. This report shall include the name, address, telephone number, permit number (if applicable), driver license number, and date of birth of the client receiving the controlled items.

5 - CONTROLLED SUBSTANCES AND CONTROLLED SUBSTANCE ANALOGUES

a. The institution or site is responsible for complying with the established procedures as required in 21 CFR, Part 1301 to End and as required by any amendments to 21 CFR Part 1301.

b. Upon request, the DPS shall provide technical advice to the institution or site regarding the inventories required in 21 CFR, Part 1301 to End.

c. Upon request, the DPS shall assist the law enforcement agency conducting any investigation regarding any significant loss, pilferage or theft of the controlled substances or controlled items contained in this MOU.

6 - AUDITS AND INSPECTIONS

The institution or site shall permit any DPS agent to conduct audits and inspections of all records made in accordance with the MOU at any reasonable time and shall not interfere with the discharge of the agent's duties.

7 - SECURITY AND STORAGE

The institution or site shall ensure the security of the controlled items by cost-effective means that afford a reasonable sense of safety and accountability, such as electronic records keeping and physical security. In addition, the institution or site shall require that the controlled substances and precursor chemicals are stored in accordance with recommendations of the manufacturer, the Texas Commission on Environmental Quality and the Federal Environmental Protection Agency.

8 - CONTACT PERSON(S)

Each institution or site shall appoint one or more individuals, as needed, to be responsible for implementing the security measures established by the institution or site. The institution shall annually provide a list of these individuals to the DPS and shall ensure that these individuals serve as the contact between the institution and the DPS. The initial list of contact persons shall be provided within ninety (90) days after the effective date of this Memorandum of Understanding.

The general provisions of this Memorandum of Understanding shall be effective on the date of signature by representatives of both parties. This agreement, upon review of both parties, may be amended by written agreement whenever such action is necessary.

Date: 6-13-06

[redacted]

Thomas A. Davis, Jr.
Director
Texas Department of Public Safety

Date: 5/24/06

[redacted]

Teri Flack
Deputy Commissioner
Texas Higher Education Coordinating Board

Suggestions for Implementing MOU Procedures

1. Notify all personnel involved with environmental and safety issues about the MOU.

2. Notify all science and health laboratory personnel about the MOU.

3. Provide information to appropriate personnel regarding the potential problem of diversion of laboratory chemicals and apparatus to illegal drug operations.

4. Notify the Department of Public Safety (DPS) of the person designated to act as the liaison between the institution and the DPS.

5. Notify all personnel involved in the sale or transfer of surplus equipment that none of the precursor chemicals or laboratory apparatus, including glassware, listed as controlled items in the MOU should be sold or otherwise transferred to anyone who does not have the proper permit or the specific authority to purchase or accept the controlled items. Personnel involved in the transfer or sale of these items should be provided with copies of the Nar-22 form, which should be used to report the sale, transfer, or furnishing of the listed precursor chemicals or laboratory apparatus. Any party involved in an auction of surplus equipment should be informed of the MOU.

6. Establish procedures to assure an appropriate level of security for controlled items in educational and research laboratories and storerooms. Designate an individual to be responsible for establishing security measures.

7. Encourage all personnel to be alert and attentive to the disappearance of any of the controlled items and to report losses to the institution's contact person for controlled substances.

Sharps Disposal Procedure

Sharps are defined as any device or object that is capable of producing lacerations or puncture injures to the skin. Sharps can include but not limited to:

- razor blades or other cutting blades
- glass (broken or unbroken)
- glass slides
- needles
- capillary tubes

In order to prevent injury to the general public, all sharps waste must be segregated into the designated waste stream and **NEVER** place into trash receptacles with other general trash or paper recycling receptacles.

Contaminated Sharps

Sharps used in procedures with infectious or biohazardous material are classified as regulated medical waste (RMW) and must be segregated from all other waste.

All sharps waste must be placed in a rigid, plastic puncture and leak proof container with the biohazard symbol and the words "Biohazard". Needles and syringes should never be disassembled or recapped prior to disposal and should be disposed of as one completed unit. Coverslips, glass slides, and ampoules may also be placed in these containers if contaminated with infectious material.

Once the sharps container is ¾ full, close and secure the container before disposing in the regulated medical waste container.

Noncontaminated Sharps

Sharps waste can also be generated from other laboratories such as engineering and chemistry facilities. Although these sharps do not have the biohazardous risk of exposure, all sharps must be disposed in same sharps container with the biohazard symbol marked out or covered up.

Glass pipettes and TLC plates should be disposed in the broken glass container. Once the sharps container is ¾ full, close and secure the container before disposing in the broken glass container.

Radioactive Sharps

Sharps that were used for a protocol involving radioactive materials must be handled, collected, and disposed of properly depending on the types of contamination present be it radioactive, chemical, or biological.

For sharps that have radioactive contamination, use a red sharps container with "Caution Radioactive Materials" tape placed on the box. The biohazard symbol must be marked out or covered up if there is no biohazard contamination present. If multiple isotopes are used all waste including sharps must be segregated by isotope.

A protocol must be submitted to the Radiation Safety Officer before any work involving radioactive material can be performed. This protocol must include a sharps disposal procedure.

Uncontaminated Glass

Uncontaminated, glass can be disposed of in a sturdy cardboard box with a plastic liner. These boxes can be obtained from the Chemistry stockroom on campus, and from the VWR stockroom at the BRC. It is important that the box is not overfilled. Dispose of the box when no more than ¾ full and the weight should not exceed 30 pounds. Tape the boxes shut and mark it with the lab room number or lab phone extension and place it with the ordinary trash. The box of glassware can now be placed in a regular trash dumpster.

Petko Ivanov
Environmental Health and Safety

10/09/2014

Dr. Bennett,
Department of Biosciences,
Keck 301, 301A

Laboratory Inspection Corrective Action Letter

This letter serves to inform you of the laboratory safety issues that require correction as noted during the most recent laboratory inspection conducted by Environmental Health and Safety. The following issues must be rectified within 30 days of the receipt of this notification to avoid further action.

1. When operating in a BSL 2 laboratory, all laboratory occupants are required to wear close toed shoes, pants and wear eye protection at all times. Additionally when working with hazardous biological or chemical materials all laboratory personnel are required to wear lab coats, gloves and any other appropriate PPE.

301A

2. No storage of materials within 18 inches of the ceiling in buildings which have sprinklers.

Thank you for your continued dedication to safety. If you have any questions or concerns feel free to contact me at X8801 or EHS at X4444.

Sincerely,

Petko Ivanov

Petko L. Ivanov
Safety Specialist
Rice University EHS-MS 650
P.O. Box 1892
Houston, Tx 77251-1892
Email: pi3@rice.edu
Office: (713) 348-8801
Cell: (832) 370-7797
BRC 141B

RICE UNIVERSITY
Environmental Health and Safety
BIOSAFETY EVALUATION

BUILDING	Keck	ROOM	301, 301A
PI	M. Bennett	ROOM DESIGNATION	

SPECIFY AGENTS AND/OR MATERIALS USED IN THIS AREA

Microorganisms	✓	rDNA	✓	Select Agent or Toxin	X
Cell lines / Tissue culture	X	Animal Tissues	X	Human blood / tissues / OPIM	X

GENERAL MICROBIOLOGICAL REQUIREMENT

LABORATORY PRACTICES	Y	N	NA
All personnel wash their hands after working with potentially hazardous materials and before leaving the laboratory.	✓		
Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human consumption are not allowed in the laboratory.	✓		
Mouth pipetting is prohibited; mechanical pipetting devices are available.	✓		
All procedures are performed to minimize the creation of splashes and/or aerosols.	✓		
All lab personnel wear close toed shoes that cover the entire foot, and long garment that covers the legs completely.	✓		
Safety glasses are always worn while in the laboratory especially by persons wearing contact lenses.	✓		
Protective laboratory coats and gowns are available.	✓		
Gloves are worn to protect hands from exposure to hazardous materials and based on appropriate risk assessment.	✓		
Spills and accidents that result in potential exposure to infections materials are Immediately reported to the laboratory director.	✓		

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NEEDLES AND SHARPS PROTECTION	Y	N	NA
Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware are implemented.	✓		
Needles are not bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal.	✓		
Used disposable needles and syringes are carefully placed in conveniently located puncture-resistant containers used for sharps disposal.	✓		

Non-disposable sharps are placed in a hard walled container.	✓		
Broken glassware is not handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plasticware is substituted for glassware whenever possible.	✓		

WASTE DISPOSAL AND DECONTAMINATION	Y	N	NA
Materials to be decontaminated offsite are place in a Regulated Medical Waste (RMW) container with a red liner provided by EHS.	✓		
All cultures, stocks, and other potentially infectious materials are decontaminated before disposal using approved disposal methods listed in the biosafety manual.	✓		
Work surfaces are decontaminated after completion of work and after any spill or splash of potentially infectious material with appropriate disinfectant.	✓		
Sharps containers are sealed when ¾ full and placed in the RMW container with a red liner for disposal.	✓		
All biological waste, including aspirators, is stored in a secondary container.	✓		
BSCs are regularly decontaminated with an approved disinfectant listed in *Appendix B of the Biosafety in Microbiological and Biomedical Laboratories (BMBL) 5th Edition*.	✓		
Laboratory has a spill response plan.		✓	

LABORATORY FACILITIES	Y	N	NA
A sign incorporating the universal biohazard symbol and the name of any infectious agents present is posted at the entrance to the laboratory.	✓		
A biohazard symbol is posted on all equipment i.e., refrigerators, centrifuges, incubators, etc. that store and/or are used in the manipulation of biohazardous agents.		✓	
All laboratories are required to have a door sign created with the EHS sign generator that it kept up to date.	✓		
Laboratory has doors that are self-closing and lockable for access control.	✓		
Laboratory has a sink for hand washing.	✓		
Laboratory windows that open to the exterior are fitted with screens. An insect and rodent control program is also in effect.	✓		
Bench tops must be impervious to water and resistant to chemicals used to decontaminate the work surfaces and equipment.	✓		
Eyewash station is readily available.	✓		
Access to the laboratory is restricted to only personnel who have been fulfilled all necessary training requirements (refer to *Training Section*)	✓		

TRAINING REQUIREMENTS	Y	N	NA
All lab personnel have taken general lab safety training provided by Rice EHS within the last year.	✓		
All lab personnel working in BSL 2 labs or with nonexempt rDNA have taken *Biosafety/ Bloodborne Pathogens* training provided by Rice EHS within the last year.	✓		
The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, potential hazards present in the laboratory, and exposure evaluation procedures. This training must also be documented.	✓		
All personnel must receive additional training when new hazards are introduced to the lab.	✓		

BIOSAFETY LEVEL 2 SPECIAL PRACTICIES	Y	N	NA
Biosafety cabinets (BSC) are used when procedures may create infectious aerosols or splashes	✓		
BSCs are used when working with large volumes or high concentrations of infectious materials	✓		
Equipment must be decontaminated before repair, maintenance, or removal from the laboratory	✓		
Vacuum lines are protected with in line HEPA filters and liquid disinfectant trap	✓		
Animals and plants not intended for research are not present in BSL-2 laboratories.	✓		
Protective lab coats are worn while working and laundered by an outside commercial contractor. Lab coats should not be worn or removed outside the laboratory and never taken home to be cleaned.	✓		
High concentrations or large volumes of infectious agents may only be centrifuged in an open lab in sealed rotor heads or safety cups.	✓		
Laboratory personnel must be provided medical surveillance, as appropriate, and offered available immunizations for agents handled or potentially present in the laboratory.			✓
A laboratory-specific biosafety manual must be prepared and adopted as policy. The biosafety manual must be available and accessible.	✓	N/A	

Petko Ivanov
Environmental Health and Safety

10/25/2013

Dr. Bennett,
Department of Biochemistry and Cell Biology
Keck 301

Laboratory Inspection Corrective Action Letter

This letter serves to inform you of the laboratory safety issues that require correction as noted during the most recent laboratory inspection conducted by Environmental Health and Safety. The following issues must be rectified within 30 days of the receipt of this notification to avoid further action.

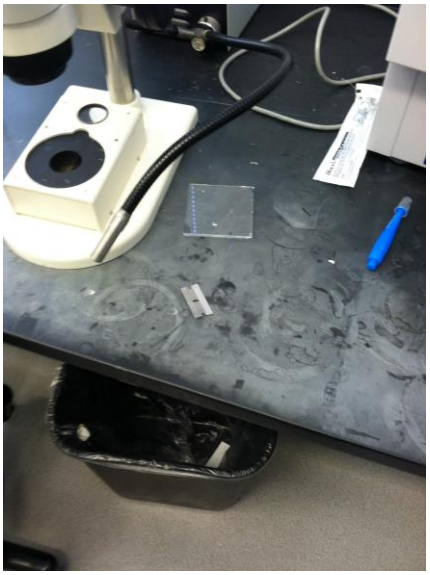
1. To maintain your BSL 2 status, all lab personnel must take the EHS Biosafety class. We can schedule a specific session for your entire lab.

2. There were sharps out on the lab bench. Please place any reusable sharps in a plastic container or tray. Do not leave sharps on the counters. Dispose of sharps in sharps containers.

3. All waste containers must be labeled with the word waste. Red biohazard bags are sufficient for this.

4. All refrigerators must have signs posted that states “not for flammable storage”.

2



3

Suggestions:

Waste should not be stored in the lab for more than 90 days.

Thank you for your continued dedication to safety. If you have any questions or concerns feel free to contact me at X8801 or EHS at X4444.

Sincerely,

Petko Ivanov

Petko L. Ivanov
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