TENNESSEE STATE UNIVERSITY DEPARTMENT OF CHEMISTRY

LABORATORY HYGIENE PLAN

MARCH 2005

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GENERAL SAFETY TRAINING

1. **PURPOSE:**

This section describes safety training to all employee and student working in the laboratory. All new employees and students should receive a safety training designed to enable their active participation in the Laboratory hygiene plan. The information provided to employees and student will promote their awareness and understanding of the possible hazards at work, as well as the methods to be used to control such hazards.

2. **TRAINING AREAS**:

2.1 GENERAL SAFETY TRAINING:

Safety training needed to all new students registered for laboratory and new employees hired in the department. Instructors and staff shall ensure that safety information and training are provided at the time of a students initial assignment to a work area where hazardous chemicals are present. The general Safety training shall include:

- 2.1.1. Awareness on the laboratory hygiene plan to all laboratory personnel includes hazard identification, methods to minimize exposure and hazard information.
- 2.1.2. Video presentation on general safety
- 2.1.3. Other training which aimed to all new employee or/and students

2.2 SPECIFIC SAFETY TRAINING:

Safety training geared to selected individual or group of people who work in a specialized laboratory setting that might poses particular health hazards.

- 2.2.1. Radioactivity Safety training (Authorized person or PI)
- 2.2.2. Biological agents Safety training (Authorized person or PI)
- 2.2.3. Other specialized training on safety and health (Authorized person or PI)

3. OSHA REGULATIONS:

Under OSHA standard all laboratory personnel have the right to request information regarding known or suspected hazard of chemicals. And all laboratory personnel have the responsibility to adhere the good laboratory practice for safe handling, transportation, and storage of hazardous agents.

4. STUDENT EVALUATION:

- 4.1 Student should attend safety training in the beginning of the course. Those who attended the training should sign laboratory safety regulations student verification list. Those who did not attend the safety training should not be allowed to take the course. At the end of the course the student verification list should be submitted to safety officer for documentation.
- 4.2 Student should pass departmental safety quiz with at least 70% score in order to seat for the laboratory class. If the student gets less than 70% he or she should be retrained to take the exam. The scores of the departmental safety quiz should be document.

- 4.3 Student should be given Material safety data sheet (MSDS) assignment as part of their lab safety training.
- 4.4 Safety is integral part of scientific education, questions related safety should appear in the examinations. Mid term exam and final exam should have at least 10 % of the question related to safety.
- 4.5 The instructor has the authority to enforce the safety rules by lowering grades and/ or ejecting a student from the laboratory. Any continue bad behavior such as horse play, fight and or any other activity that could lead to danger or hazard should be tolerated and it should be reported to safety committee.

6. EMPLOYEE EVALUATION :

New employee should receive proper training on laboratory safety. The employee should be supervised until he or she demonstrates good laboratory hygiene practice. If needed the supervisor should recommend or provide additional training to the employee.

RESPONSIBILITY

PURPOSE

This section describes the responsibility of Department Head, Safety Committee, Safety Officer, Ad-hoc committee, Principal Investigator and Laboratory Personnel with regard to Laboratory Safety.

2. **RESPONSIBILITY**

2.1 Department Head

- 2.1.1 Ensures the overall health and safety of employees under his /her supervision.
- 2.1.2 Ensues that all work are conducting under laboratory hygiene plan.
- 2.1.3 Assigns safety committee members and assign safety committee chair.
- 2.1.4 Request written safety protocol for all research projects that involve hazardous agents.
- 2.1.5 In some circumstance the department head might appoint ad-hoc committee to investigate injury/illness report and related matters.

2.2 Safety Committee

- 2.2.1 Assists the head and employees in defining hazardous operations, designating safety practices and selecting protective equipment.
- 2.2.2 Obtains from principal investigators, reviews and protocols on handling hazardous agents and recommends hazardous agent protocols detailing all aspects of proposed research activities and procedures to prevent employee exposure.
- 2.2.3 Develops and reviews rules and procedures for safe work practices; provides advice and recommendations on laboratory safety.
- 2.2.4 Develops safety training plans and programs.
- 2.2.5 Conduct special studies or evaluations as necessary to develop or improve techniques

for laboratory safety

- 2.2.6 The committee shall have chair person, secretary and members
- 2.2.7 The chair person shall (a) prepare meeting agendas for all safety committee meeting; (b) conduct meetings of the safety committee; (c) review previous minutes; (d) report status of all recommendations;
- 2.2.8 The secretary shall (a) arrange time and place for the meeting (b) notify all members of the meetings (c) prepares the minutes of the meetings and distributed to all the members
- 2.2.9 The members shall (a) serve as a resource for the review of safety policy (b) attend all meeting (c) report any unsafe practices or conditions; (d) contribute ideas and suggestions for improving safety programs (e) participate in the safety training program (f) work safely so as to influence others to work safely.

3 Department Safety Officer

- 2.3.1 Works with Department Head, Safety Committee and Other Laboratory Personnel to develop and implement appropriate laboratory hygiene policies and practice
- 2.3.2 Monitors procurement, storage, use and disposal of chemicals used in the laboratory
- 2.3.3 Sees that the appropriate audits and records are conducted and maintained
- 2.3.4 Knows the current legal requirements concerning regulated substances
- 2.3.5 Conducts periodic reviews to improve the laboratory hygiene plan
- 2.3.6 Conducts formal laboratory inspections at least once a year to ensure compliance with the existing university or department policy.
- 2.4 Principal Investigator (PI)
 - 2.4.1 Submit written safety plan that involves hazardous agents in his research and the protocol must be approved before the research can begin.
 - 2.4.2 Ensure all employees are properly trained and instructed in safe practice and aware of all hazards associated in his or her work.
 - 2.4.3 Conducts periodic reviews to meet the laboratory hygiene plan.
 - 2.4.4 Monitor the daily operation of this laboratory.
- 2.5 Ad-hoc Committee
 - 2.5.1 Review the human techniques or actions and uses of equipment or instrumentation involved in the accident.
 - 2.5.2 Investigate the circumstances and underlying factors leading to the accident
 - 2.5.3 Identify methods or actions to prevent similar accidental events.
 - 2.5.4 The ad hoc committee will neither assign responsibility nor recommend any disciplinary action.
 - 2.5.5 The findings of the ad hoc committee will be presented to the head, safety committee and other appropriate officials.
- 2.6 Laboratory Personnel (Faculty, staff and graduate assistant)
 - 2.6.1 Plan and conduct all activities in accordance with the university and the department safety policy and guidelines.
 - 2.6.2 Conduct training for new incoming student (s) on laboratory safety rule.
 - 2.6.2 Work safely so as to influence others to develop good personnel laboratory hygiene

habits.

- 2.6.4 Utilized all safeguards in anticipation with work related hazards.
- 2.6.5 Recognize all laboratory personnel have the right to know the safety of each chemical in his or her working area
- 2.6.6 Compliance with safety policy and guidelines. Compliance is a mandatory for all employees and students working in laboratory due to requirements of OSHA standards.

2.7 Laboratory Personnel (students)

- 2.7.1 Plan and conduct all activities in accordance with the university and the department safety policy and guidelines.
- 2.7.2 Utilized all safeguards in anticipation with work related hazards.
- 2.7.3 Compliance with safety policy and guidelines. In addition comply with all instructions given by your instructor or supervisor. Compliance is a mandatory for all students working in laboratory.
- 2.8 Supportive departments and Staff
 - 2.8.1 *Human Resource* provides information on federal and state personnel policies, practice, benefits and ser vices including basic information to new employees and explains employee's rights, benefits and university requirement in the event of occupational injury or illness.
 - 2.8.2 *TSU Health Center* gives first aid treatment for employees or students injured in the work place and provides or disseminates health information to employees and students.
 - 2.8.3 *Facility management* provides support for maintaining, installing or repairing equipment and facility. These include but not limited to the following : electrical, electronic equipment, cooling room, air condition, water supply, furniture, walls, roofing, floor, elevator, key etc. The facility management performs in house inspection or provides support for external inspections on engineering controls and safety equipments which includes, safety hood, fire alarm, signs, exit doors, smoke detectors, fire-extinguishers etc. Provides support for disposing of hazardous chemicals and biological waste and glass wares. Provides support for moving equipments that are absolute.
 - 2.8.4 *Police* provides support in case of emergency situation, offers safety and security in the university campus and enforces all governmental laws as well as rule of regulation of the university.
 - 2.8.5 *House Keeper* or cleaning personnel shall clean **only** those areas designated by the department or Laboratory Authority. The users or their qualified laboratory personnel shall be responsible for the remainder of the housecleaning.

STANDARD OPERATING PROCEDURE

1. PURPOSE

This section describes the Standard Operating Procedure. The information provides employees and students to promote their awareness and understanding in addressing emergency event as well as the methods to be used to control hazards in work place.

2. STANDARD OPERATING PROCEDURE

- 2.1 Procedure for addressing emergency event such as spills or exposure incidents and other
 - 2.1.1 **Eye Contact**: Promptly flush eyes with water for at least 15 minutes with water and seek medical attention.
 - 2.1.2 **Ingestion**: Consult the National Poison Control Center for recommended treatment and seek medical attention (1-800-222-1222)
 - 2.1.3 **Skin Contact**: Promptly flush the affected area with water for at least 15 min and remove any contaminated clothing; use a safety shower when contamination is extensive. If symptoms persist after washing, seek medical attention
 - 2.1.4 **Spill** : Properly clean up spills, using appropriate protective equipment and proper disposal procedures. Chemical spills are contained using the "Think C.L.E.A.N. Plan".
 - A Contain the spill
 - B. Leave the area
 - C. Emergency: eye wash, shower, medical care etc
 - D. Access Material safety Data Sheet (MSDS)
 - E. Notify supervisor
 - 2.1.5 **Fire to a building**: Immediately leave the lab and proceed down the nearest stairs to exit the building by the 1st floor exit doors. Assemble out front at the open grass near the front entrance gate of the building (Boswell) so that all personnel can be accounted for. Do not use the elevators.
 - 2.1.6 **Fire to a person**: Immediately smother the individual with fire blanket to extinguish flame and seek medical attention. Never wrap the individual with fire blanket.
 - 2.1.7 **Cuts**: Serious bleeding should be controlled by direct pressure on the wound, preferably with a clean gauze or cloth pad and seek medical attention. Minor cuts should be washed with water and then press with a lean cotton pad or piece of gauze. Sever cuts, specially with glass or other foreign objects in the wound, requires medical attention.
- 2.2 Methods for limiting employee or student exposure (engineering controls and personal protective equipment).
 - 2.2.1 Instruct all personnel to wear safety goggle at all times.
 - 2.2.2 Instruct all personnel to use proper personal protective equipment and engineering controls
 - 2.2.2 Perform any chemical reactions under functional safety hood
 - 2.2.3 Know the exact location and operation of all engineering controls
- 2.3 Outlined work methods/procedures for all laboratory personnel which includes chemical handling, waste disposal etc.
 - 2.3.1 Put safety precautions and warning to all the methods/procedures which may pose hazard
 - 2.3.2 Seek information and advice about hazards associated with the method or chemical use before commencing new experiments. Encourage all laboratory personnel to consult the MSDS.
 - 2.3.3 Plan appropriate protective procedures to eliminate the hazard associated with the method or chemicals
 - 2.3.4 Plan the positioning of equipment before beginning any new operation. Use instrument only for intended purpose

- 2.3.5 Make available waste container at the designated area (Biohazard bag, glass disposal box, sharp box, chemical waste containers etc)
- 2.3.6 Seek information about transport, delivery and storage of hazardous chemicals and equipments.

GENERAL SAFETY GUIDELINE

1. PURPOSE

All new employees and students should receive a safety training designed to enable their active participation in the Laboratory hygiene plan. The information provided to new employees will promote their awareness and understanding of the possible hazards at work, as well as the methods to be used to control such hazards from occurring.

2 GENERAL SAFETY

- 1.1 Avoid unnecessary exposure to physical, chemical, biological and radiological agens.
- 1.2 Do not smell or taste chemicals.
- 1.3 Apparatus that can discharge toxic chemicals (vacuum pumps, distillation columns, etc.) should be vented into exhaust devices (laboratory hoods) provided for these purposes.
- 1.3 Inspect gloves before using.
- 1.4 Do not allow release of toxic substances in cold rooms and other confined spaces, since these have contained re-circulated atmospheres.
- 1.5 Use only those chemicals for which the quality of the available ventilation system is appropriate.
- 1.6 Eating, drinking, smoking, applying cosmetics or lip palm, and handling contact lenses in laboratory areas where chemicals are present is prohibited. Wash hands before conducting these activities in appropriate areas.
- 1.7 Storing, handling, or consuming food or beverages in storage areas, refrigerators, glassware, or utensils that are also used for laboratory operation is prohibited.
- 1.8 Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware.
- 1.9 Use equipment only for its designed purpose.
- 1.9 Wash areas of exposed skin thoroughly before leaving the laboratory.
- 1.10 Practical jokes or other behavior that might confuse, startle, or distract another worker are not acceptable.
- 1.11 Do not use mouth suction for pipe ting or starting siphon.
- 1.12 Confine long hair and loose clothing.
- 1.13 Closed toed shoes shall be worn at all times while in the laboratory.
- 1.14 Keep the work area clean and uncluttered, with chemicals and equipment properly labeled and stored; clean up the work area on completion of an operation and at the end of each day.
- 1.15 Ensure that the appropriate eye protection, where necessary, is worn by all personnel, including visitors, in areas where chemicals are stored or handled.
- 1.16 Wear appropriate gloves when the potential for contact with toxic materials exists.
- 1.17 Use any other protection and emergency apparel and equipment as appropriate.
- 1.18 Avoid use of contact lenses in the laboratory unless necessary.
- 1.19 Remove lab coats immediately upon significant contamination and place it in a disposal plastic bag for further handling.
- 1.20 Seek information and advice about hazards, plan appropriate protective procedures, and plan the positioning of equipment before beginning any new operation.
- 1.21 Use a hood or operations the might result in the release of toxic chemical vapors or dust.

- 1.20.1 As a rule of thumb, use hood or other local ventilation device when working with any appreciably volatile substance with a TLV of less than 50 ppm.
- 1.20.2 Confirm adequate hood performance before use. Keep hood sash closed at all times except when adjustments within the hood are being made. Keep materials stored in hoods to a minimum and do not allow materials to block vents or air flow.
- 1.20.3 Leave the hood "on" if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when hood is "off".
- 1.22 Be aware of unsafe conditions and see that they are corrected immediately when detected by bringing them to the attention of a supervisor or the Safety Officer.

GENERAL SAFETY GUIDELINE FOR LABORATORY PERSONNEL

1. PURPOSE

This section describes general safety guideline of laboratory personnel. The safety of all students, staff, and faculty is a high priority and the responsibility of everyone in the laboratory. Safety practices are an integral part of learning chemistry laboratory. You will be expected to know and follow these safety practices to ensure your safety and the safety of those around you in the laboratory. It is, therefore, important that you pay special attention to, and abide by, this guidelines and other departmental or university safety rule. You must comply with any additional safety instructions given by supervisor, principal investigator, instructor or laboratory assistant.

2. GENERAL SAFETY GUIDELINES:

- 2.1 **Safety** is common sense, but you must understand the hazards you face in the laboratory. The chemistry laboratory is a dangerous place when proper safety precautions are not observed.
- 2.2 You MUST read and understand the "Safety guidelines" in the laboratory manual and laboratory hygiene plan. You are responsible for all safety information contained in the manual. New employee and students should attend the general and specific safety training organized by the department or the university.
- 2.4 Avoid unnecessary exposure to physical, chemical, biological and radiological agents.
- 2.5 Conduct yourself in a responsible manner at all times. Horseplay, practical jokes, and pranks are dangerous and prohibited.
- 2.6 The appropriate Personal Protective Equipment (PPE) should be worn at all times. PPE must include, but is not limited to goggles. Face mask, gloves, helmet etc. You **must** wear goggles at all times in the laboratory. The goggle should provide splash and blast protection.
- 2.7 **No** open-toed shoes, sandals, high-heeled or platform shoes, shorts, short skirts, excessively loose or baggy clothing can be worn in the laboratories. Long hair must be tied back and finger jewelry removed.
- 2.8 DO NOT eat, drink, smoke, chew gum, or apply cosmetics in the laboratory. Also, do not store any of these items in the laboratory refrigerators, cabinets, etc.

- 2.9 **Never** smell or taste chemicals. **Never** pipet by mouth.
- 2.10 All work with chemicals should be done in a fume hood. Never place your head into the fume hood. Apparatus that can discharge toxic chemicals (vacuum pumps, distillation columns, etc.) should be vented into exhaust devices (laboratory hoods) provided for these purposes. All chemical reaction should be formed under hood. Do not use more materials than directed. Never return chemicals to their original containers, dispose of unwanted solids or liquids in a labeled solid or liquid waste container.
- 2.11 Do not allow release of toxic substances in cold rooms and other confined spaces, since these have contained re-circulated atmospheres.
- 2.12 Be well-prepared to work in the laboratory; read procedures, Material Safety Data Sheets (MSDS), chemical labels, and prepare for any hazards prior to starting any experiment.
- 2.13 The Material Safety Data Sheets (**MSDS**) are in Room 003. You may also find some MSDS on line from manufacturer (www. Fishersci.com, Hazard.com or other source). Familiarize yourself with the information on MSDS for any chemical you intend to use in the laboratory.
- 2.14 If you are unsure of any procedure, potential chemical hazard, or proper precautions for chemical handling, ask your Supervisor, Instructor or Laboratory Assistant before proceeding.
- 2.15 Be aware of, understand, and obey all warning and caution labels on chemicals and equipment.
- 2.16 Students are permitted in the laboratory only during laboratory hours. Students must have permission from the Laboratory Instructor to be in the laboratory during a lab section other than their own. Students are not permitted in the chemical stockroom or storage area except in the presence of a faculty or staff member.
- 2.17 Shared spaces and equipment such as balances, sinks, counters, and hoods must be kept clean and in working order.
- 2.18 Dispose waste chemicals as Halogenated organic, Non-Halogenated organic, Solid waste, Acid/ base, or Toxic metals waste or others as appropriately indicated in each lab procedure. Always record the amount and identity of the waste on the appropriate recording form.
- 2.19 Dispose of broken glass in broken glass containers; sharps in sharps boxes.
- 2.20 Safe operation of specialty equipment such as rotary evaporators ("rotavaps"), mercury thermometer, centrifuge, UV lamps etc will be demonstrated as needed. Each equipment should **only** be used for intended purpose.
- 2.21 Do not wear contact lens in the laboratory. Solvent vapors can partially dissolve the lens and leading to permanent eye damage.
- 2.22 Wear latex gloves at all time when dealing with biological or toxic chemical. Remember that latex gloves react with sulfuric acid and give you very little protection from organic materials. **Do not leave the laboratory with the gloves on**. Always wash your hands at the end of period.
- 2.23 Keep your workspaces neat, clean, and orderly. An organized lab bench will avoid breakages, spills and all other accidents; do not crowd your work area with unnecessary glassware. Do not sit on the laboratory bench. Assume that the bench is dirty even if you can not see any spilled chemicals.
- 2.24 Some chemical have adverse effect on the fetus. If pregnant you are adviced to consult with a physician regarding the completion of the laboratory course or research. A list of chemicals will be furnished to your physician upon your request and filling pregnant report form.
- 2.25 Care must be exercised to use hot plate. Be careful not to burn your self and the hot plates electric cord when performing evaporations. Heat resistant gloves must be worn

when moving hot objects. At the end of the experiment you must unplug it. When get cool, clean up the hot plate .

- 2.26 Always pour concentrated solutions slowly into water or less concentrated solutions. Add a re agent mixture slowly, never dump it in. observe what takes place when the first amount is added and wait a few moments before adding more.
- 2.27 When delivering solids be careful not to allow dust to get into the air.
- 2.28 Carefully read the label before removing a reagent from its container, using the wrong substances can lead to accidents.
- 2.29 Do not use more materials than directed. Never return chemicals to their original containers, dispose of unwanted solids or liquids in a labeled solid or liquid waste container.
- 2.30 Alert your Supervisor or Instructor immediately and get help for any medical or environmental emergency. Any injury must be reported immediately to instructor, an accident report form must be filled out by the student and/or witness. Humane resource should be consulted for proper follow up.
- 2.31 Know the locations and operating procedures of all safety equipment, including first aid kits, spill kits, eyewash stations, safety showers, and fire extinguishers.
- 2.32 Know the location of the fire alarms and exits.
- 2.33 Emergency telephones and numbers are located on board each lab.
- 2.34 In the event of a building evacuation or other emergency, remain calm and listen to instructions from your Instructor or Laboratory Assistants.
- 2.35 In the event of a building evacuation, use the nearest exit. Congregate in the open space near or front of the Boswell building on the north entrance of the building and check in with your Instructor.
- 2.36 Always consider these questions before beginning an experiment:
 - 2.36.1 What are the hazards?
 - 2.36.2 What are the worst possible things that could go wrong?
 - 2.36.3 How will I deal with them?
 - 2.36.4 What are the best practices, protective facilities, devices, and/or equipment necessary to minimize exposure to hazards?

BIOHAZARD GUIDELINE

- 1.1 Protective clothing and PPE such as coats, gloves and goggles must be available and worn properly in the lab. Lab coats and gloves that have been worn in the lab should not be worn outside the lab. Gloves and lab coats that are suspected to be contaminated must be removed immediately.
- 1.2 All contaminated or infectious liquid or solid waste must be decontaminated before disposal.
- 1.3 All spills in work surface or floor must be decontaminated after any spill of potentially hazardous substance.
- 1.4 All individuals must follow the university and department procedures for disposal of sharps and biohazard waste including transportation.
- 1.5 Contaminated glass can be decontaminated in a bath of 10%(v/v) household bleach or suitable disinfectant for 30 minutes. Baths of house hold bleach should be changed every week. Contaminated glassware can also be autoclaved but must be transported to autoclave in such a away as to prevent aerosol contamination of the room . Contaminated glass pipettes must be immersed in a bath of 10% bleach or suitable

disinfectant with in the laboratory before transfer into the glass washing area. Contaminated Pasteur pipettes are to be disposed as sharps.

- 6 Solid contaminated disposal waste must be placed in a red biohazard bag. Bags for decontamination in autoclave must be placed in the available trays. Any bag that is punctured or leaking must be double or triple bagged.
- 1.7 Most bio hazard liquid generated from research must be disinfected. The decontaminated liquid is suitable for sewer disposal.
- 1.8 Animal carcasses must be placed in 6 mil plastic bags (body bags) and frozen prior to being sent for incineration. All infected animal should be treated as biohazard.

RADIOISOTOPE HAZARD GUIDELINE

- 1.1 Radioisotope rules: The university, state and federal rules and regulations related to the use of radioactive materials should be followed to work with radioisotopes in the laboratory. It is the responsibility of each worker to abide by these rules.
- 1.2 Radiation exposure: Each worker is expected to maintain his or her exposure as low as reasonably achievable.
- 1.3 Posting and labeling: All users of radioactive materials are responsible for strong radiation work area and properly identifying these materials and any contaminated equipment.
- 1.4 Knowledge of radioisotopes: All users should be familiar with the characteristics of the radioisotopes they are using. This can be obtained for radiation safety officer.
- 1.5 Survey meters. Radiation workers are responsible for understanding how the survey meter work the need for their checking and calibration and which survey meters will measure the isotope(s) with which they are working.
- 1.6 Radiation survey: Radiation worker must be familiar with radiation survey procedure and resposibility for checking work areas for contamination periodically and after each radioisotope procedure. Works are also responsible for checking hands , body and clothing for radioactivety and removing any contamination befire leaving the lab.
- 1.7 Waste disposal: each person who works with radioisotopes is responsible for proper disposal of radioactive waste and

3. CHEMICAL HAZARD GUIDELINE

- 3.1 *Chemical hazard rules*: The university, state and federal rules and regulations related to the safe use of chemicals should be followed in the laboratory. It is the responsibility of each worker to abide by these safety rules.
- 3.2 *Chemical hazard exposure*: Each worker is expected to maintain his or her exposure as low as reasonably achievable. Protective clothing and PPE such as coats , gloves and goggles must be available and worn properly in the lab. Gloves and lab coats that are suspected to be contaminated must be removed immediately.
- 3.3 *Posting and labeling*: All users of chemicals are responsible for posting hazard work area and properly identifying these materials and any contaminated equipment.
- 3.4 *Knowledge of chemicals*: All users should be familiar with the characteristics of the chemical hazard they are using. MSDS should be consulted before using any chemical agent
- 3.5 *Waste disposal*: Each person who works with chemical hazard is responsible for proper disposal of waste.

- *3.6 Decontamination*: Each individual who works with chemical hazard must be familiar with the basic elements of decontamination procedures and is responsible for cleanup of any contamination which he or she has created.
- 3.7 *Chemical hazard incidents*: Incidents involved contamination of personnel, un-contained spills, theft or loss of chemical hazard, and suspected overexposures must be reported immediately . University policy requires that an incident/accident report must be completed and signed by supervisor with in 24 hours for all personal accidents.

4. BIOHAZARD GUIDELINE (Responsibility of Bio Safety committee)

Any question with regard to biohazard should be forwarded to Bio Safety committee or biosafety officer)

- 4.1 *Biohazard rules*: The university, state and federal rules and regulations related to the safe use of biohazard materials should be followed in the laboratory. It is the responsibility of each worker to abide by these safety rules.
- 4.2 *Biohazard exposure*: Each worker is expected to maintain his or her exposure as low as reasonably achievable. Protective clothing and PPE such as coats , gloves and goggles must be available and worn properly in the lab. Lab coats and gloves that have been worn in the lab should not be worn outside the lab. Gloves and lab coats that are suspected to be contaminated must be removed immediately.
- 4.3 *Posting and labeling*: All users of biohazard materials are responsible for posting hazard work area and properly identifying these materials and any contaminated equipment.
- 4.4 *Knowledge of biohazard*: All users should be familiar with the characteristics of the biohazard they are using.
- 4.5 *Waste disposal*: Each person who works with biohazard is responsible for proper disposal of infectious waste.
- 4.6 *Decontamination*: Each individual who works with biohazard must be familiar with the basic elements of decontamination procedures and is responsible for cleanup of any contamination which he or she has created.
 - 4.6.1 All contaminated or infectious liquid or solid waste must be decontaminated before disposal.
 - 4.6.2 All spills in work surface or floor must be decontaminated after any spill of potentially hazardous substance.
 - 4.6.3 All individuals must follow the university and department procedures for transportation and disposal of sharps and biohazard waste.
 - 4.6.4 Contaminated glass can be decontaminated in a bath of 10%(v/v) household bleach or suitable disinfectant for 30 minutes. Baths of house hold bleach should be changed every week. Contaminated glassware can also be autoclaved but must be transported to autoclave in such a away as to prevent aerosol contamination of the room . Contaminated glass pipettes must be immersed in a bath of 10% bleach or suitable disinfectant with in the laboratory before transfer into the glass washing area. Contaminated Pasteur pipettes are to be disposed as sharps.

- 4.6.5 Solid contaminated disposal waste must be placed in a red biohazard bag. Bags for decontamination in autoclave must be placed in the available trays. Any bag that is punctured or leaking must be double or triple bagged.
- 4.6.6 Most bio hazard liquid generated from research must be disinfected. The decontaminated liquid are suitable for sewer disposal.
- 4.6.7 Animal carcasses must be placed in 6 mil plastic bags (body bags) and frozen prior to being sent for incineration. All infected animal should be treated as biohazard.
- 4.7 *Biohazard incidents*: Incidents involved contamination of personnel, uncontained spills, theft or loss of biohazard material, and suspected overexposures must be reported immediately. University policy requires that an incident/accident report must be completed and signed by supervisor with in 24 hours for all personal accidents.

5. RADIOISOTOPE HAZARD GUIDELINE (Responsibility of Bio Safety committee)

Any question with regard to radioactive agents or radioisotope should be forwarded to Bio Safety committee or radiation safety officer)

- 5.1 *Radioisotope rules*: The university, state and federal rules and regulations related to the use of radioactive materials should be followed to work with radioisotopes in the laboratory. It is the responsibility of each worker to abide by these rules.
- 5.2 Radiation exposure: Each worker is expected to maintain his or her exposure as low as reasonably achievable.
- 5.3 *Posting and labeling*: All users of radioactive materials are responsible for posting radiation work area and properly identifying these materials and any contaminated equipment.
- 5.4 *Knowledge of radioisotopes*: All users should be familiar with the characteristics of the radioisotopes they are using. This can be obtained for radiation safety officer.
- 5.5 *Survey meters*: Radiation workers are responsible for understanding how the survey meter work the need for their checking and calibration and which survey meters will measure the isotope(s) with which they are working.
- 5.6 *Radiation survey*: Radiation worker must be familiar with radiation survey procedure and responsibility for checking work areas for contamination periodically and after each radioisotope procedure. Works are also responsible for checking hands , body and clothing for radioactivity and removing any contamination before leaving the lab.
- 5.7 *Waste disposal*: each person who works with radioisotopes is responsible for proper disposal of radioactive waste and for maintaining records for all disposals.
- 5.8 *Decontamination*: Each individual who works with radioisotopes must be familiar with the basic elements of decontamination procedures and is responsible for cleanup of any contamination which he or she has created.
- 5.9 *Radiation incidents*: Incidents involved contamination of personnel, un-contained spills, theft or loss of radioactive material, and suspected overexposures must be reported immediately to radiation safety officer. University policy requires that an incident/accident report must be completed and signed by supervisor with in 24 hours for all personal accidents.

CHEMICAL INVENTORY

1. PURPOSE

This section describes the chemical inventory. The chemical inventory will help to keep a detailed and accurate record on purchase history as well as a way to properly reorder inventory. The section promote awareness on hazards agents at work place.

2. **CHEMICAL INVENTORY**

- **2.1** Listing all chemicals in the laboratory. All chemicals should be listed including chemicals classified as hazardous by the Department of Transportation (DOT), the Environment Protection Agency (EPA), or displaying a number greater the 2 in any section of the National Fire Protection Association (NFPA) diamond. The chemical inventory information should provide a high-performance, relational database tracking and accurate record.
- **2.2** Chemicals shall be listed alphabetically by section according to the most commonly used names. Include the average quantity in storage, and if possible physical state (e.g. solid, liquid, gas). The NFPA hazard classification, if unknown, should be listed along with the manufacturer's name. A comment section should be provided to further identify the chemical's location (e.g. under the sink, third shelf in the safety cabinet, etc.).
- **2.3** A chemical inventory of the main store should be performed annually. Chemicals in storage area must be kept as low as practical.
- **2.4** A chemical inventory of the upper and lower divisions store should be performed semi annually. Chemicals in preparation area must be kept as low as practical.

MATERIAL SAFETY DATA SHEET

1. PURPOSE

This section describes the material safety data sheet (MSDS).

2. MATERIAL SAFETY DATA SHEETS (MSDS)

MSDS is a document prepared by chemical manufacturers and distributors The information provides precautions and warning for protecting against known hazards and recommends best practice necessary to control or minimize exposure to hazards.

- 2.1 MSDS provides, suggests and recommends necessary information about:
 - 2.1.1 toxicological properties and hazards associated with subject products
 - 2.1.2 chemical, and physical
 - 2.1.3 handling, storage and transportation conditions
 - 2.1.4 method of disposing chemical etc
- 2.2 Under OSHA standard Employers shall:
 - 2.2.1 maintain copies of any material safety data sheets that are received with incoming shipments of the sealed container of hazardous chemicals
 - 2.2.2 obtain a material safety data sheet as soon as possible for sealed containers of hazardous chemicals received without a material safety data sheet if an employee

requests the material safety data sheet, and

2.2.3 ensure that the material safety data sheets are readily accessible during each work shift to employees when they are in their work area(s)

REQUIRMENTS

All reagents on the chemical inventory shall have an MSDS. Manufacturers or distributor are required by law to prepare and transmit MSDS with the initial shipment of all hazardous chemicals.

2.1 Request missing MSDS's from the manufacturer or distributor. A catalog number may be required by some manufacturers for MSDS.

CHEMICAL STORAGE

1. PURPOSE

This section describes how to class chemical in the storage room. The information provides awareness and understanding of the possible hazards at work.

2. CHEMICAL STORAGE

- 2.1 Segregate chemicals by hazard class and compatibility. Never arrange chemicals alphabetically as general storage area.
- 2.2 Chemicals should be store in a designated place. Chemical store should not be clutter
- 2.3 No big solvent/corrosive bottles should be stored over 5 ft from floor. No glass bottle should be store on the floor
- 2.4 No food items should be stored in the laboratory
- 2.5 Chemical inventory must be kept as low as practical. Storage on bench tops and in hoods may cause potential exposure to fire or spills and must be avoided.
- 2.6 Ventilated cabinets and specially monitored refrigerators are used for chemical storage only. No food is permitted in these cabinets or refrigerators.
- 2.7 Flammable liquids are stored in flammable storage cabinets with self closing doors or in properly ventilated room in accordance with NFPA recommendations. Flammable substance shall be handled only in area free of ignition
- 2.8 Safety cans with a spring-loaded spout shall be used for transporting flammable liquids.
- 2.9 A safety bucket shall be used when carrying large bottles of hazardous chemicals (i. e. gallon bottle of hydrochloric acid).
- 2.10 Toxic chemicals, including carcinogens, shall be stored in ventilated storage areas in unbreakable chemical-resistant secondary containers. These containers shell be labeled "CAUTION: HIGH CHRONIC TOXICITY OR CANCER-SUSPECT AGENT". A separate inventory list of carcinogens and suspected carcinogens shall be maintained by the safety Officer according to federal and state regulations.
- 2.11 Cylinders of compressed gases must be strapped or chained to prevent their falling and shall be capped when not in use.
- 2.12 No chemical shall be stored without label. Any chemical with out label shall be tagged as "unknown" and should be disposed

2.12 Chemical agent that may be abused should be monitored and controlled. Narcotic and psychotropic agents should be locked under metal cabinet.

LABELING

1. PURPOSE

This section describes labeling requirements. Labeling will assist identify chemical agents and in turn help avoid hazards in work place.

2. LABELING

- 2.1 OSHA requires chemical manufactures to transmit chemical safety information by means of label and MSDS. Original manufacturer's containers shall have appropriate labeling
- 2.2 Primary Chemical labeling shall have but not limited to the following information Chemical name Health hazard
 - Affected organs
 - Manufacture name and address
- 2.3 All secondary containers of hazardous materials must be labeled with a minimum of the identity of the reagent as its name appears on the MSDS. Furthermore all secondary container labeling should include the NFPA hazard rating, if known, and any unique warnings such as "ACID", "CARCINOGEN", etc. Labels shall not be removed or de faced.
- 2.4 Secondary Chemical labeling shall have but not limited to the following information Chemical name Concentration or morality
 - Date of preparation
- 2.5 Pipes carrying chemicals, such as compressed gas lines, must be labeled as to type of chemical, i.e. nitrogen, air, etc.
- 2.6 Waste disposal container must be properly labeled, The identity and amount of each chemical must be entered into the waste disposal form.
- 2.7 No chemical shall be stored without label. Any chemical with out label shall be tagged as "unknown" and should be disposed.

ADMINSTRATIVE CONTROLS

1. PURPOSE

This section describes the use of administrative control during daily laboratory operation.

2. ADMISTRATIVE CONTROLS

Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals

3 PRINCIPAL INVESTIGATOR

- 3.1 Ensure that the Lab personnel receive proper training in personal protective equipment.
- 3.2 Substitute less Hazardous chemicals for hazardous chemicals.
- 3.3 Ensure Lab personnel is trained to respond to laboratory emergencies and spills.

4 LAB INSTRUCTOR

- 4.1 Ensure that the Lab personnel receive proper training in personal protective equipment.
- 4.2 Substitute less Hazardous chemicals for hazardous chemicals.
- 4.3 Ensure Lab personnel is trained to respond to laboratory emergencies and spills.

5. SAFETY OFFICER

Ensures laboratory personnel work under good laboratory practice and laboratory hygiene plan and make annual safety audit or inspection

PERSONNEL PROTECTIVE EQUIPMENTS

1. PURPOSE

This section describes the use of personal protective equipments during daily laboratory operation. Personal Protective Equipment include protective equipment for eyes, face, head and extremities.

2. **PERSONAL PROTECTIVE EQUIPMENT (PPE)**

- 2.1 Appropriate personal protective equipment should be worn at all time.
- 2.2 All PPE shall be of safe design and construction for the work to be performed.
- 2.2 Safety goggles must always be worn in the laboratory. The goggle should provide splash and blast protection.
- 2.3 Employees are required to wear gloves when there is a potential for direct skin contact with hazardous chemicals or infections agents. Heat resistant gloves should be worn when dealing with hot objects.
- 2.4 In areas where the potential for chemical splashes is significant an impervious apron appropriate for the task must be worn.
- 2.5 Masks and eye protection or chin length face shields shall be worn to prevent splashes or sprays of blood infectious materials, or hazardous chemicals if there is a potential for eye, nose, or mouth contamination.
- 2.6 No open-toed shoes, sandals, high-heeled or platform shoes, shorts, short skirts, excessively loose or baggy clothing can be worn in the laboratory.
- 2.7 Pipette fillers should always available in the laboratory. Never attempt pipette by mouth.
- 2.8 If needed laboratory coats are to be worn in the laboratory area and are to be buttoned to protect the employee's clothing.
- 2.9 Consult MSDS if special personnel protective equipment is required to handle a chemical, biological or radiation hazards.

PROPER HANDLING & DISPOSAL OF SHARPS

1. PURPOSE

This section describes the proper handling and disposal of sharps

2. PROPER HANDLING AND DISPOSAL OF SHARPS

Special care and caution must be exercised by all research and animal care personnel in the use and disposal of sharps. Needle sticks or cuts from contaminated sharps present a significant occupational health risk because such injuries may directly introduce pathogens, chemicals, or radioactive materials into the body. Sharps include needles, syringes, razor blades, slides, scalpels, pipettes, broken plastic or glassware, and other devices capable of cutting or piercing the skin.

- 3. The following practices must be observed when handling and disposing of these items:
 - 3.1 If possible, use devices other than a needle and syringe to perform laboratory procedures.
 - 3.2 **DO NOT** recap, bend, break, or manipulate needles by hand. Discard these items intact.
 - 3.3 Place sharps immediately after use in a puncture-resistant, leak-proof container for sharps disposal
 - 3.4 **DO NOT** place sharps in regular trash receptacles. Containers for sharps disposal must be located in the work area at the point of use.
 - 3.5 Containers for sharps disposal must be closed (lid or cover closed and sealed with tape) and submitted for waste pickup when they are no more than ³/₄ full. Never overfill or force items into these containers. Broken glass should be placed into appropriate broken glassware container.
 - 3.6 Submit sharps containers for waste pickup according to the guidelines of the university .

WASTE REMOVAL AND DISPOSAL

1. PURPOSE

This section explains the method of disposing dry, chemical, radiological and biological waste.

2. DRY WASTE

All dry laboratory wastes (non hazardous) must be double-bagged and removal from the area. Disposable protective garments which are not contaminated by a spill shall be discarded in the bin provided for this purpose. All dry non hazardous waste should be disposed according to the university guideline. Broken glassware shall be placed into an appropriate broken glassware container. Do not place broken glassware or other sharp-edged materials of any type into the regular trash.

3. CHEMICAL WASTE

Chemical waste are organic and inorganic compound generated in the laboratory

3.1 Certain chemicals are permissible for drain disposal. The local sanitary sewer district

must be contacted to determine which chemicals can be disposed of into the sanitary sewer. Only those chemicals reasonably soluble in water and not toxic are suitable for drain disposal. The following wastes shall not be discarded into the drain system: The drain system connects to the sanitary sewer system that ultimately flows to a wastewater treatment facility.

- A. Organic compounds with boiling points less than 50° C.
- B. Hydrocarbons, halogenated hydrocarbons, nitro compounds, mercaptans, and most oxygenated compounds that contain more than five carbon atoms (e.g. xylene, hexane).
- C. Organic compounds that are explosives such as azides and peroxides.
- D. Concentrated acids and bases.
- E. Highly toxic, malodorous, or lachrymatory substances.
- F. Chemical Solid waste
- 3.2 Incineration, in an environmentally acceptable manner, is the most practical disposal method for combustible laboratory waste. Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable.
- 3.3 Hoods should not to be used as a means of disposal for volatile chemicals. Disposal by recycling or chemical decontamination is used when possible.
- 3.4 Liquid wastes shall be collected in labeled containers. No waste shall be poured down the drains. Container should be used for holding all liquid and solid chemical until picked up date is arranged. Proper waste pick-up form must be filled out and submitted to safety officer to initiate pick up request.
- 3.5 Proper personal protective equipment (PPE) should be worn when moving or disposing chemical hazard.

4. **BIOHAZARD WASTE**

Biohazard wastes are human, animal or plant tissue or fluids that are contaminated with pathogenic organisms. Any question with regard to biohazard should be forwarded to bio hazard safety committee or bio hazard safety officer

- 4.1 All biohazard wastes must be clearly marked with biohazard label. If biohazard waste also contains chemical hazard or radioactive material, it must be identified as containing both materials; this type of waste should not be generated if at all possible.
- 4.2 Materials that contain viable organisms and require incineration should be placed in leakproof sealed biohazard Red Bags.
- 4.3 Materials that are to be sterilized and rendered non-pathogenic are to be placed in red biohazard waste bags. All sharps materials (needles, syringes, scalpels, etc.) must be placed in marked biohazard sharps buckets.
- 4.4 Biohazard waste should be picked up regularly. For specific guidelines on handling and disposing of biohazard waste, please consult biohazard safety officer or refer to the university guideline.
- 4.5 Biohazard waste must also be decontaminated before disposal. Follow the general guideline to decontaminate biohazards.
- 4.6 Proper personal protective equipment (PPE) should be worn when moving or disposing biohazard. And follow the safety guideline of biohazard

5. RADIOACTIVE WASTE

Radio active waste are alpha, beta and gamma particles. A fourth kind, neutron radiation,

generally only occurs inside a nuclear reactor. Any question with regard to radioactive waste should be forwarded to bio hazard safety committee or radiation safety officer

- 5.1 General principle employed in the management of these radioactive wastes is delay-anddecay. The rate of decay of an isotope is inversely proportional to its half life; a short half life means that it decays rapidly.
- 5.2 All persons who are permitted to work with radioactive materials shall be fully aware of the procedures needed to dispose radioactive waste. It is the responsibility of the supervisor to ensure that all personnel in his or her area be made fully aware of the Radiation Safety. Different types of radiation require different forms of protection:
 - 5.2.1 Alpha radiation cannot penetrate the skin and can be blocked out by a sheet of paper, but is dangerous in the lung.
 - 5.2.2 Beta radiation can penetrate into the body but can be blocked out by a sheet of aluminum foil.
 - 5.2.3 Gamma radiation can go right through the body and requires several centimeters of lead or concrete, or a meter or so of water, to block it.
- 5.3 Proper personal protective equipment (PPE) should be worn when moving or disposing radioactive hazard. Appropriate protective clothing and other equipment, such as gloves, lab coats, goggles and respirators, dependent on the conditions, shall always be worn when handling any radioactive waste. In all such cases, as a minimum, gloves are required.
- 5.4 All containers of radioactive waste shall be properly labeled in conformance with the radiation safety guideline.
- 5.5 The disposal of radioactive wastes, other than those classified above as mixed radioactive, will be handled exclusively by the Radiation Safety office. Any questions should be directed to the Radiation Safety office.

6. MIXED WASTES (Chemical and Radioactive)

The most common type of mixed waste is scintillation vials that contain flammable (toluenebased) scintillation cocktail and a small amount of radioactive isotope. The creation of mixed waste that contains toxic or corrosive materials, or high levels of radioactivity is strongly discouraged.

7. **GAS CYLINDERS**

Rental and return of gas cylinders to gas vendors is the recommended practice for the management of cylinders. This eliminates the creation of a hazardous waste. The purchase of **lecture bottles** or other non-returnable pressurized gas cylinders is strongly discouraged because of the difficulty and cost of disposing of the empty containers. Disposal of empty or partially filled cylinders is handled by the out side contractors.

8. WASTE OILS AND LUBRICANTS

Waste oils and petroleum lubricants are not classified as hazardous waste by EPA. However, the department has chosen to manage these products in an environmentally-conscious manner. For proper disposal, fill out a hazardous waste disposal form.

9. EMPTY CONTAINERS

Containers that have held hazardous materials should have their labels defaced, should be triple rinsed with water or a suitable solvent to remove any residue, and then should be disposed of in the regular trash.

10. EQUIPMENT

All equipment used shall be maintained in safe manner. Only necessary, properly functioning and safe equipment shall be kept in work area. All malfunction equipment shall be repaired. If the malfunction is beyond repair that equipment should be discarded. Pick-up request shall be completed. Equipment shall be free from hazardous materials before repair or discard. Malfunction of electronic equipments such as computer hardware shall be certified by authorized computer specialist or technician.

11. TRANSPORTING

Guidelines when transporting hazardous chemicals, radioisotopes or biological materials wastes throughout the Institute corridors, stairwells and elevators.

- 11.1 All caustic or corrosive chemicals not packaged in a shatter-resistant container should be transported in an approved shock-resistant carrying device such as the Nalgene safety bottle carriers available for use in the Self-Service Store.
- 11.2 Small samples (vials, test tubes) of chemical, radioisotope or biological materials should be placed inside a secondary container, such as sealable break-resistant plastic tubes (i.e., 50 ml centrifuge tubes with screw caps).
- 11.3 Labels should be affixed on waste container of all hazardous materials. These labels should include the names and amounts of all hazardous materials.
- 11.4 When transporting hazardous chemicals, radioisotope or biological materials by laboratory carts, all materials must be placed in secondary containers. The carts used to transport these materials must have sides high enough to retain the containers and wheels large enough to prevent the carts from being caught in floor tiles and elevator thresholds. Additionally, the carts should have solid bottoms to contain any accidental leaks or spills.
- 11.5 Since stairways serve as primary emergency exits, they should be avoided whenever possible when transporting hazardous materials.
- 11.6 If an accidental spill does occurs during transportation, please contact the supervisor or safety officer immediately .
- 11.7 Your cooperation in following these guidelines for safe transportation of hazardous materials will reduce the potential for unnecessary personnel exposures to spills in public access/emergency exit areas

12. WASTE PICK UP REQUEST

12.1 Chemical Hazard waste pick up request is carried out every semester. The pick up will be carried out by external contractors. Fill out hazardous waste pick up form and forward to department safety officer. Department of facility management office of environmental service of the university will initiate pick up request on their routine pickup schedule. Express hazard waste pick up might be requested if only if the waste is believed to pose health or safety risk if not pick up immediately. Express hazard pick up request should

be discouraged unless justified.

- 12.2 Waste pick up request for chemical, biological and radioactive wastes must follow the university guideline.
- 12.3 The disposal of radioactive wastes, will be handled exclusively by the Radiation Safety office. Any questions should be directed to the Radiation Safety office or bio safety committee.
- 12.4 The disposal of biohazard wastes, will be handled exclusively by the bio Safety office. Any questions should be directed to the bio safety committee or bio safety officer.

HOUSE KEEPING

1. PURPOSE

This section provides guideline for house keeping in the laboratory area. Lack of good housekeeping reduce work efficiency and may result accidents.

2. **EMERGENCIES**

- 2.1 Floors shall be cleaned regularly by housekeeping.
- 2.2 Stairwells and hallways shall be free of obstruction
- 2.3 Keep the work area (working benches, hood, balance room etc) clean and uncluttered, with chemicals and equipment properly labeled and stored; clean up the work area on completion of an operation and at the end of each day. Proper storage shall be accomplished to minimize clutter. Chemicals shall not be stored on the desks, laboratory bench tops, floors hood, balance room etc.
- 2.4 Waste shall be deposited in appropriate receptacles and properly removed from the laboratory. (waste collection container, glass disposal box, biohazard bags etc). Each laboratory shall have a glassware disposal box. Chemical spills shall be cleaned according the established protocol.
- 2.5 Access to emergency equipment, showers, eye washes, fire extinguishers, exit doors and circuit breakage shall never be blocked or obstructed.
- 2.6 Chemical containers shall be regularly monitored for proper labeling and container integrity. There should be no unlabeled container in the lab at any time. Improperly labeled or unlabeled chemicals make hazard identification and disposal difficult and may create a hazard.
- 2.7 Waste Collection containers must be clearly labeled. Always record the amount and identity of the waste on the appropriate recording form.
- 2.8 The Safety Officer shall perform random inspection of the laboratory.

EMERGENCIES

1. PURPOSE

This section describes the procedure to be followed during an emergency situation. This provides useful information to employees and students on what to do in case of hazard.

2. EMERGENCIES

- 2.1 In all cases, the protection of personnel is of primary concern and evacuation of an area of questionable safety shall always be conducted. Immediately notify 9-911. Stay on the phone with the 911 operator until all the necessary information is obtained.
- 2.2 Accidents shall be reported to the section supervisor or Safety Officer immediately. An incident/accident report shall be completed and reviewed by the Safety Committee at their periodic meetings to determine if the accident could be prevented or the extent of injury could be reduced. If the accident is serious the department head may assign Ad-hoc committee to investigate the mater.

3. FIRE OR EXPLOSION

- 3.1 Pull alarm
- 3.2 Call 9-911 calm down give all the details
- 3.3 Call campus police 9–5171to escort the rescue unit and inform supervisor
- 3.4 Close doors evacuate to near by area make sure no body is inside.
- 3.5 Follow the instructions by authorized person (fire Marsha, Instructor, supervisor, safety officer, fire Marsha etc)
- 3.6 Don't use elevator for exit
- 3.7 Wait in one designated area until every body is counted

4. CHEMICAL SPILLS (LIFE THREATINING)

- 3.1 Call 9-911 calm down give all the details
- 3.2 Call campus police 9-5171 to escort the rescue unit and inform supervisor
- 3.3 Evacuate the victim to nearby area
- 3.4 Remove victim clothing
- 3.5 Wash with water for 15 min
- 3.6 Follow the instructions by authorized person
- 3.7 Close doors, and Notify neighboring area
- 3.8 Wait in one designated area until every body is counted

5. CHEMICAL SPILL(NON LIFE THRETENING)

- 4.1 Call supervisor or Campus police 9–5171
- 4.1 Secure spill area
- 4.2 Close doors
- 4.3 Notify neighboring area
- 4.4 Handle spill in accordance with section of STANDARD OPERATING PROCEDURES " clean plan" method.

6. RADIOACTIVE SPILL

- 6.1 Call Radiation safety officer
- 6.1 Evacuate to near by area

- 6.2 Detain those contaminated
- 6.3 Consult the radiation safety guideline or manual

7. CARDIAC ARREST

- 7.1 Call 9-911
- 7.2 Ensure access to the area
- 7.3 Begin CPR if only qualified

8 ODD ODOR

- 8.1 Identify the source if possible
- 8.2 Report to safety officer

9 MEDICAL ASSISTANCE

9.1 Complete the report form (incident/accident report)

MEDICAL CONSULTATION AND EXAMINATION

1. PURPOSE

2.4

This Section describes the Medical consultation and examination procedures.

2. MEDICAL CONSULATION AND EXAMINATION

- 2.1 Alert your Instructor or supervisor immediately and get help for any medical or environmental emergency. Any injury must be reported immediately to supervisor or instructor, an incident/accident report form must be filled out by the student or employee or witness within 24 hrs.
- 2.2 Employees needing medical attention as the results of exposure to a hazardous chemical should immediately notify their supervisor or Safety Officer who will assist in directing the employee to the nearest approved medical facility.
- 2.2 All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall fulfill the university rules and regulations.
- 2.3 The employee is sent for medical evaluation:
 - 2.3.1 Whenever signs and symptoms associated with a hazardous chemical develop.
 - 2.3.2 Whenever an event takes place in the work area such as spill, leak or explosion resulting in hazardous chemical exposure.
 - The physician shall be provided with the following information:
 - 2.4.1 Identity of the hazardous chemical(s) to which he employee might have been exposed.
 - 2.4.2 A description of the conditions under which the exposure occurred including quantitative exposure data (if available).
 - 2.4.3 A description of the signs and symptoms of exposure.
 - 2.4.4 A copy of the MSDS for the chemical(s) involved.
- 2.5 The physician shall provide to the department or personnel office a written opinion that will not reveal specific findings of diagnosis unrelated to the exposure, but will include:
 - 2.5.1 Any recommendations for medical follow-up.

- 2.5.2 Results of the medical examination and any associated tests.
- 2.5.3 Any medical conditions that may be revealed in the course of the examination that may place the employee at increase risk as a result of a hazardous chemical found in the workplace.
- 2.5.4 A statement by the physician that the employee has been informed of the consultation-examination results and any medical condition that may require further examination or treatment.

REPRODUCTIVE HAZARD EVALUATION

1. **PURPOSE**

This section describes the Reproductive Hazard Evaluations protocol for laboratory personnel.

2. REPRODUCTIVE HAZARD EVALUATIONS

The Department is committed to protecting the reproductive health of all laboratory personnel in order to minimize the risks of damage to the unborn fetus. Under the Laboratory hygiene plan supervisor and/or members of safety committee evaluate workplace hazards to reproduction, inform employees and students about these hazards and identify methods for protecting employees and students from these hazards. The committee members are available for consultation to help with concerns about workplace reproductive hazards and to perform evaluations.

3. STEPS FOR REPRODUCTIVE HAZARD EVALUATIONS

The following steps should be taken by all female laboratory personnel who are anticipating pregnancy or who are known to be pregnant:

- 3.1 Female laboratory personnel, upon learning of their pregnancy should inform their immediate supervisor, lab coordinator or instructor. The laboratory personnel is required to fill Reproductive Hazard Evaluation Form. Confidentiality will be maintained at the employee's or student request.
- 3.2 The instructor, laboratory coordinator or supervisor should provide a list of chemicals and hazards agent in their working area.
- 3.3 The safety committee thru safety officer or its members will survey the normal working areas of the employee or student for potential occupational hazards.
- 3.4 If hazard detected, together with the supervisor, a mutually agreed upon work schedule for the employee or student will be established for the duration of the pregnancy. Students may be advised to postpone their study for certain period of time, until completion of their pregnancy.
- 3.5 The employee or student should, in turn, inform their personal physician of workplace conditions and limitations so that proper medical surveillance may be instituted. If requested, Material Safety Data Sheet (MSDS) could be supplied to the physician.
- 3.6 Female radiation workers who become pregnant should consult the Radiation Safety Guide for information on pregnancy declaration and radiation dose limits for the fetus of a declared pregnant worker. Please review the radiation safety guideline by the state.

RECORD KEEPING

1. PURPOSE

This section describes documentation of any activity with regard to employee or student safety or health issue for future references.

2. **RECORDKEEPING**

- 2.1 All employee records of safety training, environmental monitoring, medical consultations and examinations and reproductive health evaluation etc including tests or written opinions shall be retained for duration of employment or five years. Any incident/accident report shall be retained for the duration of employment plus thirty years.
- 2.2 Any correspondence, waste disposal, decontamination, servicing shall be documented for future use.
- 2.3 MSDS of all chemicals in the department shall be maintained.
- 2.4 Safety committee recommendations, approval, disapproval or other written opinion shall be recorded.
- 2.5 Inventory shall be made to all chemicals annually. The data base should be maintained regularly. All purchase requisition (PR) and purchase order (PO) shall be documented.
- 2.6 All equipment used shall be maintained in safe manner. Only necessary, properly functioning and safe equipment shall be kept in work area. All malfunction equipment shall be repaired. If the malfunction is beyond repair that equipment should be discarded. Pick-up (moving and service work) request shall be completed. Equipment shall be free from hazardous materials before repair or discard.
- 2.7 Malfunction of electronic equipments such as computer hardware shall be certified by authorized computer specialist or technician. Computer hardware disposition form must be signed and documented.

CENTRIFUGE OPERATION

1. PURPOSE

This section describes the safe operation of Centrifuge.

2. **DEFINITION**

- 2.1 Laboratory centrifuge: An apparatus used in the laboratory for separating substances of different density or particle size, when suspended in a fluid, by spinning them about an axis in a suitable container.
- 2.2 Rotor: Primary component of a centrifuge which holds the material to be subjected to centrifugal force (in some form of tube/container) and which is rotated by the drive system.

3. HAZARDS

- 3.1 Mechanical failure of rotating parts (often violent).
- 3.2 Contact with rotating parts.
- 3.3 Sample leaks causing aerosols, stress corrosion, contamination.

- 3.4 Sample imbalance causing machine movement / walking (or stress failure of component parts).
- 3.5 Fire or explosion.
- 3.6 Health (contact with contaminated components / vapors).

4. **OPERATIONS**

- 4.1 Only suitably trained persons shall operate a centrifuge.
- 4.2 Where necessary, the machine log book must be filled in (a log book must be kept for ultra centrifuge rotors as the hours run determine the life of the rotor).
- 4.3 Before use the rotor, its lid and seals must be examined for cleanliness and damage (a build-up of chemicals from spillages may cause a tube to jam in the rotor or cause corrosion that could lead to a rotor failure). Damaged rotors must not be used and should be reported to the Supervisor, dirty rotors must be cleaned by the approved method. (see rotor care).
- 4.4 Never fill centrifuge tubes above the maximum recommended by the manufacturer. (see manufacturers manual).
- 4.5 Never exceed the maximum stated speed for any rotor.
- 4.6 Balance the rotor to within the limits specified (take care that materials of similar densities are in opposite positions of the rotor).
- 4.7 Do not operate the centrifuge without the appropriate rotor cover securely fitted and its seals in place.
- 4.8 Check compatibility of tube material to solvent medium. (some solvents may cause the tubes to swell or crack in the rotor)
- 4.9 Use only correctly fitting tubes.
- 4.10 Clean up spillages immediately. (use appropriate PPE if necessary).
- 4.11 Do not use chemicals that are explosive, highly flammable or have vigorous chemical interaction without observing the appropriate safety precautions to minimize risk of vapor build-up.
- 4.12 Never attempt to open the lid of a centrifuge or slow the rotor by hand or open the lid while rotor is in motion as serious injuries may be incurred.
- 4.13 Only authorized and suitably trained persons may service or repair a centrifuge, report all faults promptly, do not attempt repairs yourself. Do not use the centrifuge until the fault has been inspected or repaired.

5. **ROTOR CARE**

- 5.1 Stress corrosion is thought to be initiated by certain combinations of stress and chemical reaction. If the rotor is not kept clean and chemicals remain on the rotor, corrosion will result. Also, any moisture left for an extended time can initiate corrosion. It is important that the rotor is left clean and dry. (Wash with mild detergent and warm water, careful use of a nylon bottle brush when necessary). Dry the rotor thoroughly and store upside down with the cover and tubes removed.
- 5.2 Do not autoclave at temperatures above 100°C.
- 5.3 Do not expose rotor components to strong acids or bases, alkaline lab detergents or salts (chlorides) of heavy metals (e.g. cesium, lead, silver or mercury.) Use of these can initiate corrosion.

6. **PRE-RUN SAFETY CHECKS**

6.1 Make sure each tube compartment is clean and corrosion free.

- 6.2 Make sure the rotor itself is clean, corrosion and crack free and that there are no scratches or burrs around its rim.
- 6.3 Check centrifuge chamber, drive spindle and tapered mounting surface of the rotor are clean and free of scratches or burrs.
- 6.4 Wipe drive surfaces prior to installing the rotor.
- 6.5 If the temperature of the chamber is below room temperature, pre-cool the rotor to the lower temperature before securing the rotor (this will minimize the chance of it seizing to the tapered spindle).
- 6.6 Make sure that any rotor lid securing device and any rotor to spindle securing device is fully secured before starting the machine.

7. **TRAINING**

- 7.1 All new users of centrifuges must be trained by an appointed instructor (who may be an appropriately qualified or experienced member of staff) before attempting to use a centrifuge.
- 7.2 Centrifuges are potentially lethal pieces of equipment and care and vigilance need to be exercised at all times. Following the procedures outlined here will reduce risk to a low level.

GAS BURNER USE

1. PURPOSE

This section describes the proper use of burner.

2. **OPERATION OF BURNER**

- 2.1 Gas burners are used in research and teaching laboratories mainly for heating items and sterilization. There are report of fire incidents involving the use of incorrect Bunsen burners and gas nozzles.
- 2.2 Laboratories are supplied with propane gas and the following guidelines must be adhered to prevent any accidental fires within teaching and research facilities.
 - 2.2.1 Flammable liquids in use near burners must be kept in covered containers and at a distance at least 30 cm from the lit burner.
 - 2.2.2 If a fire occurs with a burner, immediately turn off the gas at the gas outlet valve and notify your supervisor.
 - 2.2.3 Be aware when a burner is in use in your laboratory and be extremely careful during this time. Do not leave lit burners unattended. Turn them off before leaving the laboratory or moving to another area of the room.

THERMOMETER USE

1. **PURPOSE**

This section describes the proper use of mercury thermometers.

2. **MERCURY THERMOMETER**

Mercury spills, resulting from thermometer breakage are among the most common accidents laboratories Elemental mercury is unique in that it has no tendency to wet glass, it has a high surface tension, and a uniform expansion over its entire liquid range. Unfortunately, it is also classified as both a toxic and hazardous material Elemental mercury (metallic) has a significant vapor pressure and therefore can easily vaporize and become a potentially serious inhalation hazard. It can also be absorbed through intact skin.

3. THERMOMETER USE

The following steps are to be taken whenever a mercury thermometer is broken:

- 3.1 Prevent the spread of mercury. The droplets can roll around and adhere to the sides of the laboratory casework. The area should be secured and normal activities stopped until the area has been decontaminated. This will keep the mercury from getting tracked around.
- 3.2 Do not allow the mercury to go down the sink drain. Once there, it has the potential to contaminate the water system.
- 3.3 Do not move any of the broken pieces of the thermometer. Your instructor or supervisor who respond to the spill will use the location of the broken glass to determine the extent of the mercury spill.
- 3.5 **DO NOT ATTEMPT TO CLEAN UP THE SPILL.** Your instructor or staff has cleanup material and personal protective equipment that are specifically suited for cleaning up the mercury from a broken thermometer.
- 3.6 There are alternatives to the use of mercury thermometers. Most laboratory supply catalogs feature "safety" thermometers which are filled with a red liquid and are teflon coated. The encapsulation of the thermometer makes the removal of a broken one decidedly easier and safer. If a mercury thermometer is needed because of scientific accuracy, purchase teflon coated ones. If these are dropped, the teflon coating prevents the spread of mercury.

OPERATION OF HEATING DEVICES

1. **PURPOSE**

This section describes the proper use of heating devices and how to avoid spark hazard.

2. **GENERAL SAFETY PRECAUTIONS**

- 2.1 Do not store volatile flammable materials near a hot plate
- 2.2 Limit use of older hot plates for flammable materials.
- 2.3 Check for corrosion of thermostats.
- 2.4 Corroded bimetallic thermostats can be repaired or reconfigured to avoid spark hazards.

3. **HEATING MANTLES**

Heating mantles are commonly used for heating round-bottomed flasks, reaction kettles and related reaction vessels. These mantles enclose a heating element in a series of layers of fiberglass cloth. As long as the fiberglass coating is not worn or broken, and as long as no water or other chemicals are spilled into the mantle, heating mantles pose no shock hazard.

- 3.1 Always use a heating mantle with a variable autotransformer to control the input voltage. Never plug them directly into a 110-V line.
- 3.2 Be careful not to exceed the input voltage recommended by the mantle manufacturer. Higher voltages will cause it to overheat, melt the fiberglass insulation and expose the bare heating element.
- 3.3 If the heating mantle has an outer metal case that provides physical protection against damage to the fiberglass, it is good practice to ground the outer metal case to protect against an electric shock if the heating element inside the mantle shorts against the metal case.

4. OIL, SALT AND SAND BATHS

Electrically heated oil baths are often used to heat small or irregularly shaped vessels or when a stable heat source that can be maintained at a constant temperature is desired. Molten salt baths, like hot oil baths, offer the advantages of good heat transfer, commonly have a higher operating range (e.g., 200 to 425°C) and may have a high thermal stability (e.g., 540°C). There are several precautions to take when working with these types of heating devices:

- 4.1 Take care with hot oil baths not to generate smoke or have the oil burst into flames from overheating.
- 4.2 Always monitor oil baths by using a thermometer or other thermal sensing devices to ensure that its temperature does not exceed the flash point of the oil being used.
- 4.3 Fit oil baths left unattended with thermal sensing devices that will turn off the electric power if the bath overheats.
- 4.4 Mix oil baths well to ensure that there are no "hot spots" around the elements that take the surrounding oil to unacceptable temperatures.
- 4.5 Contain heated oil in a vessel that can withstand an accidental strike by a hard object.
- 4.6 Mount baths carefully on a stable horizontal support such as a laboratory jack that can be raised or lowered without danger of the bath tipping over. Iron rings are not acceptable supports for hot baths.
- 4.7 Clamp equipment high enough above a hot bath that if the reaction begins to overheat, the bath can be lowered immediately and replaced with a cooling bath without having to readjust the equipment setup.
- 4.8 Provide secondary containment in the event of a spill of hot oil.
- 4.9 Wear heat-resistant gloves when handling a hot bath.
- 4.10 The reaction container used in a molten salt bath must be able to withstand a very rapid

heat-up to a temperature above the melting point of salt.

4.11 Take care to keep salt baths dry since they are hygroscopic, which can cause hazardous popping and splattering if the absorbed water vaporizes during heat-up.

5. HOT AIR BATHS AND TUBE FURNACES

Hot air baths are used in the lab as heating devices. Nitrogen is preferred for reactions involving flammable materials. Electrically heated air baths are frequently used to heat small or irregularly shaped vessels. One drawback of the hot air bath is that they have a low heat capacity. As a result, these baths normally have to be heated to 100° C

COMPRESSED GAS CYLINDERS

1. PURPOSE

This section describes the safe handling, use and storage of compressed gas cylinders

2. COMPRESSED GAS CYLINDERS

Compressed Gas Cylinders Use of compressed gases in the laboratory requires anticipating chemical, physical, and health hazards. Cylinders that are knocked over or dropped can be very dangerous. If a valve is knocked off, the cylinder can become a lethal projectile. Accidental releases may result in an oxygen depleted atmosphere or adverse health effects. In short, improper handling and use can cause structural damage, severe injury, and possibly death.

3 **RECEIVING, STORAGE AND USAGE**

The following guidelines will help ensure safe handling, use, and storage of compressed gas cylinders.

- 3.1 Be sure to arrange a return agreement with suppliers prior to purchase since disposal of compressed gas cylinders is difficult and very expensive.
- 3.2 Cylinders should not be accepted unless the cylinder contents are clearly labeled. Color code only should not be accepted, since it does not constitute adequate labeling.
- 3.3 Do not accept cylinders which are damaged or do not have a valve protection cap.
- 3.4 All gas cylinders in use shall be secured in an upright position in racks, holders, or clamping devices. When cylinders are grouped together, they should be individually secured and conspicuously labeled on the neck area.
- 3.5 Oxygen cylinders shall never be placed near highly combustible materials, especially oil and grease, or near stocks of carbide and acetylene or other fuel gas cylinders, nor near any other substance likely to cause or accelerate a fire. Systems and components used for other gases and purposes must never be used for oxygen or interconnected with oxygen.
- 3.6 Cylinders should have current hydrostatic test date (normally less than 5 years old for steel and 3 years old for aluminum) engraved on the cylinder. Cylinders should be returned to the supplier for servicing prior to the expiration date.
- 3.7 Do not place cylinders near heat, sparks, or flames or where they might become part of

an electrical circuit.

- 3.8 Do not store cylinders in exit corridors or hallways.
- 3.9 Only Compressed Gas Association fittings and components are permitted for use with gas cylinders. Only use regulators approved for the type of gas in the cylinder. Do not use adapters to interchange regulators.
- 3.10 Open cylinder valves slowly and away from the direction of people (including yourself). Never force a gas cylinder valve. If the valve cannot be opened by the wheel or small wrench provided, the cylinder should be returned.
- 3.11 No attempt shall be made to transfer gases from one cylinder to another, to refill cylinders, or to mix gases in a cylinder in the laboratory.
- 3.12 All cylinders are to be considered full unless properly identified as empty by the user. Empty cylinders must be returned to the supplier and not accumulated
- 3.13 Compressed gases must not be used to clean your skin or clothing.
- 3.14 Never heat cylinders to raise internal pressure.
- 3.15 Do not use copper (>65%) connectors or tubing with acetylene. Acetylene can form explosive compounds with copper, silver, and mercury.
- 3.16 Always leave at least 30 psi minimum pressure in all "empty" cylinders. Do not leave an empty cylinder attached to a pressurized system.

CRYOGENIC LIQUIDS

1. PURPOSE

This section describes the safe handling, use and storage of cryogenic liquids cylinders.

2. COMPRESSED GAS CYLINDERS

Cryogenic liquids have boiling points less than -73°C (-100°F). Liquid nitrogen, liquid oxygen and carbon dioxide are the most common cryogenic materials used in the laboratory. Hazards may include fire, explosion, embrittlement, pressure buildup, frostbite and asphyxiation. Many of the safety precautions observed for compressed gases also apply to cryogenic liquids. Two additional hazards are created from the unique properties of cryogenic liquids:

3. HAZARDS ASSOCIATED WITH CRYOGENIC LIQUIDS

Many of the safety precautions observed for compressed gases also apply to cryogenic liquids.

3.1 Extremely Low Temperatures –

The cold boil-off vapor of cryogenic liquids rapidly freezes human tissue. Most metals become stronger upon exposure to cold temperatures, but materials such as carbon steel, plastics and rubber become brittle or even fracture under stress at these temperatures. Proper material selection is important. Cold burns and frostbite caused by cryogenic liquids can result in extensive tissue damage.

3.2 Vaporization -

- 3.2.1 All cryogenic liquids produce large volumes of gas when they vaporize. Liquid nitrogen will expand 696 times as it vaporizes. The expansion ratio of argon is 847:1, hydrogen is 851:1 and oxygen is 862:1. If these liquids vaporize in a sealed container, they can produce enormous pressures that could rupture the vessel. For this reason, pressurized cryogenic containers are usually protected with multiple pressure relief devices.
- 3.2.2 Vaporization of cryogenic liquids (except oxygen) in an enclosed area can cause asphyxiation. Vaporization of liquid oxygen can produce an oxygen-rich atmosphere, which will support and accelerate the combustion of other materials. Vaporization of liquid hydrogen can form an extremely flammable mixture with air

4. HANDLING OF CRYOGENIC LIQUIDS

- 4.1 Most cryogenic liquids are odorless, colorless, and tasteless when vaporized. When cryogenic liquids are exposed to the atmosphere, the cold boil-off gases condense the moisture in the air, creating a highly visible fog.
- 4.2 Always handle these liquids carefully to avoid skin burns and frostbite. Exposure that may be too brief to affect the skin of the face or hands may damage delicate tissues, such as the eyes.
- 4.3 Boiling and splashing always occur when charging or filling a warm container with cryogenic liquid or when inserting objects into these liquids. Perform these tasks slowly to minimize boiling and splashing. Use tongs to withdraw objects immersed in a cryogenic liquid.
- 4.4 Never touch un insulated pipes or vessels containing cryogenic liquids. Flesh will stick to extremely cold materials. Even nonmetallic materials are dangerous to touch at low temperatures.
- 4.5 Cylinders and Dewar's should not be filled to more than 80% of capacity, since expansion of gases during warming may cause excessive pressure buildup. Check cold baths frequently to ensure they are not plugged with frozen material.

5. **PROTECTIVE CLOTHING**

- 5.1 Face shields worn with safety glasses or chemical splash goggles are recommended during transfer and handling of cryogenic liquids.
- 5.2 Wear loose fitting, dry insulated or leather gloves when handling objects that come into contact with cryogenic liquids and vapor. Trousers should be worn on the outside of boots or work shoes.

6. COOLING BATHS AND DRY ICE

- 6.1 Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture in the presence of air, because oxygen can condense from the air, leading to an explosion hazard.
- 6.2 Wear insulated, dry gloves and a face shield when handling dry ice.
- 6.3 Add dry ice slowly to the liquid portion of the cooling bath to avoid foaming over. Do not lower your head into a dry ice chest, since suffocation can result from carbon dioxide buildup.

7 LIQUID NITROGEN COOLED TRAPS

Traps that open to the atmosphere condense liquid air rapidly. If you close the system, pressure builds up with enough force to shatter glass equipment. Therefore, only sealed or evacuated equipment should use liquid nitrogen cooled traps.

SOME COMMONLY FOUND POTENTIALLY EXPLOSIVE AND SHOCK SENSTIVE CHEMICALS

- 1. Acetylides of heavy metals
- 2. aluminum arphorite
- 3. amatol
- 4. ammonal
- 5. Ammonium nitrate
- 6. Ammonium perchlorate
- 7. Ammonium picrate
- 8. Ammonium salt lattice
- 9. Butyl tetyl
- 10. Calcium nitrate
- 11. Copper acetylide
- 12. Cyanuric triazide
- 13. Cyclotrimethylenetranitramine
- 14. Cyclotetramethylenetetranitramine
- 15. Dinitroethyleneurea
- 16. Dinitroglycerine
- 17. Dinitrophenol
- 18. Dinitrophenolates
- 19. Dinitrophenyl hydrazine
- 20. Dinitroesorcinol
- 21. Dinitrotoluene
- 22. Dipicryl sulfone
- 23. Dipicrylamine
- 24. Erythritol nitrate
- 25. Fulminate of mercury
- 26. Fulminate of silver
- 27. Fulminate of gold
- 28. Gelatinized nitrocellulose
- 29. Guanyl nitrosamino guanyl tetrazene
- 30. Guanyl nitrosamino guanyllidene hydrazine
- 31. Heavy metal azides
- 32. Hexanite
- 33. Hexanitrostilbene
- 34. hexanitrodiphenylamine
- 35. hexogen
- 36. Hydraziniumnitrate
- 37. Hydrazoic zcid
- 38. Lead azide

- 39. Lead mannite
- 40. Lead monoitroresorcinate
- 41. Lead picrate
- 42. Lead salt
- 43. Lead styphnate
- 44. Mercury tartate
- 45. Mononitrotoluene
- 46. Nitrated carbohydrate
- 47. Nitrated glucoside
- 48. nitrogen trichloride
- 49. Nitrogen tri-iodide
- 50. Nitroglycerin
- 51. Nitroglycide
- 52. Nitroglycol
- 53. Nitroguanidine
- 54. Nitroparaffins
- 55. Nitronium perchlorate
- 56. Nitrourea
- 57. Organic amine nitrates
- 58. Organic nitramines
- 59. Organic peroides
- 60. Picramic acid
- 61. Picramide
- 62. Picratol
- 63. Pocroc acid
- 64. picryl chloride
- 65. Picryl fluoride
- 66. Silver acetylide
- 67. Silver azide
- 68. Silver tetranzene
- 69. Sodatol
- 70. Sodium amatol
- 71. Sodium nitrate
- 72. Sodium Picramide
- 73. Tetrazene
- 74. Trinitroanisole
- 75. Trinitrobenzene
- 76. trinitrocresol
- 77. Trinitronaphthalene

80. Urea nitrate

EXAMPLES OF SOLID IRRITANTS:

Caustic Alkalis:

Alkaline sulfides Sodium hydroxide Sodium carbon Sodium silicate Potassium carbonate Ammonium carbonate Barium hydroxide Barium carbonate Trisodium phosphate Lime (both hydrated and dehydrated) Calcium cyanamide Phenol

Elements and Salt:

Elemental sodium Elemental potassium Elemental phosphorus Antimony and its salt Arsenic and its salt Chromium/alkaline chromates Copper sulfate Copper cyanide Mercuric salts Zinc chloride Silver nitrate

CONCLUSION:

The control of corrosive-irritants must include proper protective equipment, proper emergency response training, properly designed and maintained ventilation equipment and periodic exposure surveys. When irritants are used, carefully study must be made to evaluate the problem and to design control equipment.

In addition to control of process exposure, provisions must be made to protect all persons during usual conditions as spills or explosions. This requires thorough safety training in the proper use of respirators and other protective equipment. It is important that all persons be trained in proper first aid and evacuation techniques.

Water-Reactives and Pyrophorics:

A number of chemicals react with water or moisture in the air producing heat or toxic gases (alkali metals, hydrides, peroxides, phosphides and aluminum halides).

Pyrophorics: Chemicals that react spontaneously and violently on exposure to air leading to spontaneous ignition.

EXAMPLES OF WATER REACTIVE CHEMICALS:

Alkali Metals:

Potassium metal (K) Sodium (Na)

Lithium (Li)

Alkali Metal Amides:

Silver amides (Ag2NH) Cuprous nitride (Cu3N) Cadmium amide (Cd(NH2)2) Sodium amide (NaNH2) Potassium amide (KNH2) (NOTE: the latter two chemicals under certain conditions).

Halides of Non-Metals:

Boron trichloride (BCI3) Boron trifluroide (BF3) Phosphorus trichloride (PCI3) Silicon tetrachloride (SiCl4) Sulfur monochloride (S2Cl2) Phosphorus oxychloride (OPCl3)

Others:

Phosphorus pentaoxide (P2O5)

Calcium carbide (CaC2) Organic acid halides and hydrides of low molecular weight.

Alkali Metal Hydrides:

Lithium aluminum hydrides (LAH) Sodium borohydride (NaBH4) Sodium hydride (NaH) Potassium hydride (KH) Calcium hydride (CaH)

Metal Alkyls:

Alkylithiums Aryllithiums Trialkylaluminums

Anhydrous Metal Halide:

Aluminum chloride (AlCl3) Titanium tetrachloride (TiCl4) Zirconium tetrachloride (ZrCl4) Stannic chloride (SnCl4)

EXAMPLES OF PYROHORIC CHEMICALS:

Grignard Reagents: (RMgX)

Metal Alkyls and Aryls:

(RLi) (RNa) (R3AL) (R2Zn)

Metal Carbonyls:

Nickel tetracarbinyl (Ni(CO)4) Iron pentacarbonyl (Fe(CO)5) Cobalt carbonyl (Co3(CO)8)

Alkali Metals:

Potassium (K) Sodium (Na) White phosphorus Metal Hydrides: Sodium hudride (HaH)

Non-Metal hydrides:

Diborane (B2H6) Phosphine (PH3) Arsine (AsH3) Other boranes

Non-Metal Alklys: (R3B)

(R3P) (R3As)

Metal Powders (especially when finely divided):

Aluminum (Al) Cobalt (Co) Iron (Fe) Magnesium (Mg) Palladium (Pd) Platinum (Pt) Tin (Sn) Zinc (Zn) Zirconium (Zr)

PRECAUTIONS:

- 1. Appropriate personal protective apparel should be worn at all times.
- 2. Reactive chemicals are sensitive to shock, pressure, temperature, light, and friction.
- 3. Know the incompatibility of other materials and monitor the laboratory environment change.
- 4. Explosives should be stored in a cool, dry protective area.
- 5. Unopened organic peroxides should be discarded within 1 year and opened material within 6 months.
- 6. Metal spatulas should not be used with peroxide formers.
- 7. Never use glass containers with a screw cap lids or glass stoppers.
- 8. Water reactives should be stored under mineral oil- isolated from chemicals.
- 9. Pryophoric should be stored in inert environments.
- 10. Clean up all spills immediately and properly dispose of the residue.

ACUTELY HAZARDOUS CHEMICALS

1. **PURPOSE**

All new employees and students should receive a safety training designed to enable their active participation in the Laboratory hygiene plan. The information provided to new employees will promote their awareness and understanding of the possible hazards at work, as well as the methods to be used to control such hazards from occurring.

2. ACUTELY HAZARDOUS CHEMICALS

The following is a listing of the types of materials that should be considered acutely hazard and would therefore warrant the approval before use. The Chemical Hygiene Officer should review the Department's chemical inventory listing and designate the acutely hazardous material actually present. The listing should be reviewed periodically to keep it up-to-date.

Chemical listed in OSHA Standard 1910-parts of Z-1 plus Z-2 and Z-3.

These constitute the original twelve know carcinogens, plus additional ones, blood borne pathogens, plus some highly toxic compounds.

Known Carcinogens

2-Acetylaminofluorene Acrylonitrile 4-Aminobiphenyl Asbestos 4,4'methylene-bis(2-chloroaniline) Benzidine Bis(chloromethyl) ether 3,3'-Dichlorobenzidine 4-Dimethylaminoazobenzene

Toxic Gas

Arsine Fluorine Hydrogen cyanide Hydrogen selenide Phosphine

Extremely Flammable Compounds

Carbon disulfide Ethylene oxide Arsine Methyl chloromethyl ether a-Naphthylamine b-Naphthyamine 4-Nitrobiphenyl N-Nitosodimethylamine b-propiolactone Vinyl chloride 1,2-Dibromo-3-chloropropane Ethyleneimine

Shock Sensitive Compounds

Picramide Picric Acid Nitrate ester, such as nitroglycerin Benzoyl Peroxide Acetyl peroxide

Blood Borne Pathogens

PROCEDURE FOR CHEMICAL FUME HOOD USAGE

Fume Hoods must be used to prevent toxic or flammable vapors from entering the laboratory atmosphere. In addition, fume hoods should provide a barrier between the lab workers and chemical reactions and, contains accidental spills and splashes.

- 3.1 The hood sash opening should be kept at a minimum of 80-120 linear feet per minute while the hood is in use.
- 3.2 Hoods should be monitored daily by the user to ensure that air is moving into the hood. The airflow should be check by taping the Kimwipe to the hood sash to ensure that the hood is pulling air. Notify the safety Officer immediately if a Fume Hood is not functional.
- 3.3 Hoods not in use must be closed, in accordance with NFPA guidelines, to one inch opening.

4 CHEMICAL HANDLING AND STORAGE

While working with chemicals, proper safety guidelines must be followed to ensure a hazard-free work environment.

5 CORROSIVE CHEMICALS

Corrosive (solids, liquids, and gases) are chemicals that destroy living tissue at the site of contact. Corrosive can also be damaging to the respiratory and gastrointestinal tracts through inhalation and injection. The following procedures must be followed when handling corrosive chemicals.

- 5.1 Protective apparel must be worn at all times.
- 5.2 Appropriate gloves, which are resistant to penetration, should be worn.
- 5.3 Corrosive chemicals should be handled in a fume hood to ensure that fumes do not enter the laboratory atmosphere.
- 5.4 When mixing concentrated acids with water, the acid should be slowly by allowing the acid to run down the inside of the container into the water. This method is used to prevent violent reactions.
- 5.5 NEVER ADD WATER TO ACID.
- 5.6 Storage containers should be corrosive resistant.
- 5.7 Corrosive chemicals should be stored below eye level, to minimize accidents.
- 5.8 Acids and caustics (bases) should be stored separately from each other.
- 5.9 Inorganic should be separated from organics and flammable/combustible.

6. FLAMMABLE AND COMBUSTIBLES LIQUIDS

Chemicals which exist in liquid form at ambient temperatures will sufficient vapor pressure to ignite, are called flammable or combustible.

- 6.1 All flammable liquids should be stored in an approved safety cans or flammable liquids storage cabinets. The storage cabinets should be located far away from sources of ignition and exit pathways.
- 6.2 Areas where flammable liquids are being stored and used should be provided with adequate ventilation to control vapor concentration.
- 6.3 Spills of flammable liquids must be cleaned up immediately by absorption with a vapor generation retardant absorbent such as "Oil Dry". Oil Dry is the type of absorbent used to control oil spills in automobile garages. Spills should not be moped up due to possible

generation of static electricity and ignition.

- 6.4 Appropriate personal protective apparel should be worn.
- 6.5 Flammable/combustibles should not be heated up using an open flame.
- 6.6 Flammable/combustible must be dispensed from under a fume hood.
- 6.7 Fore extinguisher/blankets must be available where flammables are being used. Quantities exceeding a total of 10 gallons should be stored in safety cans or flammable storage cabinets.
- 6.8 Flammable/combustibles should not be stored near oxidizers, and combustible materials or hest sources.

7. OXIDIZING AGENTS

Oxidizing agents are chemicals that form an oxidation reaction. Fire or explosion may occur when strong oxidizing agents come into contact with metals, metal hydrides, or organics. Because of their instability, oxidizing agents can be explosive.

Examples of Oxidizing Agents:

| Gases: | fluorine, chlorine, ozone, nitrous oxide, and oxygen |
|----------|---|
| Liquids: | hydrogen peroxide, nitric acid, perchloric acid, bromine, and sulfuric acid |
| Solids: | nitrites, nitrates, perclorates, peroxides, chromates, dichromates, picrates, permanganates, hypochlorites, bromates, iodates, Chlorites, chlorates and persulfates |
| | emontes, emorates and persunates |

- 7.1 Appropriate personal protective apparel must be worn when working with oxidizers.
- 7.2 The use of a fume hood is necessary if the reaction under investigation is unknown.
- 7.3 Oxidizers can react violently with compatible materials; caution should be taken to ensure that no extraneous material is in the area of the oxidizers.
- 7.4 There should be a minimum amount of oxidizers for the procedure.
- 7.5 Oxidizers should be stored separately from organic materials, flammables, combustibles, and strong reducing agents.
- 7.6 Oxidizing acids, (perchloric and nitric), should be stored separately away from other containers.

EXPLOSIVES/REACTIVE CHEMICALS

Explosive/Reactive chemicals are substance that release energy in quantities too great to be dissipated by the immediate environment producing destructive results.

EXAMPLES OF EXPLOSIVE/REACTIVE CHEMICALS

8.1. Organic Peroxides:

Organic peroxides are a class of compounds that have stability characteristics that make them among the most hazardous substances handled in laboratories. These are low-powered explosives and are hazardous due to their extreme sensitivity to shock, sparks, or other forms of accidental ignition. In addition, organic peroxides are sensitive to heat, friction, impact and light s well as strong oxidizing and reducing agents. All organic peroxides are flammable and fires involving peroxides should be approached with extreme caution.

The following types of compounds are known to form peroxides:

- i. Aldehydes
- ii. Ether, especially cyclic ether and those with alpha-hydrogen, form dangerously explosive peroxide on exposure to air and light. Ether must never be distilled unless known to be free of peroxides.
- iii. Secondary alcohols are just as bad as ether in terms of explosive peroxides being formed.
- iv. Compounds containing benezylic hydrogen atoms, especially if the hydrogen atoms are on tertiary carbons atoms such as isopropylbenzene.
- v Compounds containing an allylic (CH2=CHCH2R) structure, which includes most alkenes.
- vi Vinyl and vinylidene compounds.

EXAMPLES OS PEROXIDIZABLE COMPOUNDS:

A. Peroxide hazards on Storage- Discard after 3 Months

Isopropyl ether Divinyl acetylene Vinylidene chloride Potassium metal Sodium amide

B. Some Chemicals Which Form Peroxide Hazard on concentration- Discard after One (1) Year or Test Routinely

| Diethyl ether | Dicyclopentadiene |
|--------------------------------|----------------------------------|
| Tetrahydrofuran | Diacetylene |
| Dioxane | Methyl acetylene |
| Decahydronaphthalene | Tetrahydronaphthalene (Tetralin) |
| (Decalin) | |
| Ethylene glycol dimethyl ether | Cyclohexene |

C. Hazardous to Peroxide Initiation of Polymerization Note: Polymerizable compounds should be stored cold (<5 degrees C)

| Methyl methacrylate | Chlorotrifluorethylene |
|---------------------|------------------------|
| Styrene | Vinyl acetylene |
| Acrylic acid | Vinyl acetate |
| Acrylonitrile | Vinyl chloride |
| Butadiene | Vinyl Pyridine |
| Tetrafluorethylene | Chloroprene |

PRECAUTIONS OF PEROXIDES

- 8.1.1 The handling of peroxide forming compounds should be limited to the minimum amount possible. All chemicals should be **dated when received** and disposed of in accordance with good recommended practices.
- 8.1.2 All spills should be cleaned up immediately. Solutions of peroxide can be absorbed onto

vermiculite.

- 8.1.3 The sensitivity of most peroxides to heat and shock can be reduced by dilution with inert solvent such as aliphatic hydrocarbons.
- 8.1.4 Smoking, open flames and other sources of heat should not be permitted near peroxides.
- 8.1.5 Laboratory experiments employing peroxides should always be carried out behind shields and with other recommended precautions.

8.2 Picric Acid

Picric acid (C6H3N3O7, Ammoniun picrate, 2,4,6,- trinitrophenol, picronitric acid, carbazotic acid, nitroxanthic acid, and phenoltrinitrate) normally contains 10-20% water for stabilizing. Over the passage of time, the acid may become dry (<10% water) to present a potential explosive hazard. NOTE: Dry picric acid is yellow; Damp picric acid is white. If the bottle is yellow, handle with extreme care. Supplies of picric acid should be checked monthly for color, and water added as necessary.

The following procedures are recommended for handling picric acid :

- 8.2.1 Keep the amount of acid to as small as possible. A record of the date of receipt should be maintained, and unused acid should be disposed of before time can degrade it to an unsafe condition.
- 8.2.2 all storage areas and containers should be properly labeled to indicate the contect and cautioning against disturbing.
- 8.2.3 Store containers in a well- secured area equipped with adequate ventilation.
- 8.2.4 Do not open a container if the acid appears dry. If crystals role over or appear yellow, this may indicate sufficient dryness to be hazardous.
- 8.2.5 Do not attempt dilution of acid unless properly trained to do so.
- 8.2.6 Avoid excessive movement of picric containers.
- 8.2.7 Spills of picric acid must be properly cleaned up as soon as possible and the residue properly disposed. If a spill occurs in a sink, flush with copious amount of water. If a spill is on the counter or floor, cover with sand/soda ash mixture.
- 8.2.8 All unwanted and old picric should be properly disposed. The safest method of disposal is detonation be explosive experts.
- 8.2.9 Remember that picric acid is a corrosive material, which requires the application of the standard acid handling safety precautions. Adequate personal protective equipment should be worn when handling the acid.
- 8.3 <u>Perchloric Acid:</u>

Perchloric acid presents a potential fire and explosive hazard. Persons using this acid should be familiar with its hazards. The following safety precautions must be followed:

- 8.3.1 Only the amount of acid needed for an experiment should be used/allowed in the immediate working area.
- 8.3.2 All laboratory reactions should be performed in a fume hood.
- 8.3.3 All glassware contaminated with perchloric acid should be rinsed thoroughly.
- 8.3.4 Avoid mixing perchloric acid with dehydrating agents such as concentrated sulfuric acid (explosive anhydrous perchloric acid may be formed).
- 8.3.5 In the event of an acid spill wash up immediately with copious amounts of water. The acid residue should be neutralized before final disposal.

SOME COMMONLY FOUND POTENTIALLY EXPLOSIVE AND SHOCK SENSTIVE CHEMICALS

Acetylides of heavy metals aluminum arphorite amatol ammonal Ammonium nitrate Ammonium perchlorate Ammonium picrate Ammonium salt lattice Butyl tetyl Calcium nitrate Copper acetylide Cyanuric triazide Cyclotrimethylenetranitramine Cyclotetramethylenetetranitramine Dinitroethyleneurea Dinitroglycerine Dinitrophenol Dinitrophenolates Dinitrophenyl hydrazine Dinitroesorcinol Dinitrotoluene Dipicryl sulfone Dipicrylamine Erythritol nitrate Fulminate of mercury Fulminate of silver Fulminate of gold Gelatinized nitrocellulose Guanyl nitrosamino guanyl tetrazene Guanyl nitrosamino guanyllidene hvdrazine Heavy metal azides Hexanite Silver azide Silver tetranzene Sodatol Sodium amatol Sodium nitrate Sodium Picramide Tetrazene Hexanitrostilbene hexanitrodiphenylamine Hexogen Hydraziniumnitrate Hydrazoic zcid

Lead azide Lead mannite Lead monoitroresorcinate Lead picrate Lead salt Lead styphnate Mercury tartate Mononitrotoluene Nitrated carbohydrate Nitrated glucoside nitrogen trichloride Nitrogen tri-iodide Nitroglycerin Nitroglycide Nitroglycol Nitroguanidine Nitroparaffins Nitronium perchlorate Nitrourea Organic amine nitrates Organic nitramines Organic peroides Picramic acid Picramide Picratol Pocroc acid picryl chloride Picryl fluoride Silver acetylide Silver azide Silver tetranzene Sodatol Sodium amatol Sodium nitrate Sodium Picramide Tetrazene Trinitroanisole Trinitrobenzene Trinitrocresol Trinitronaphthalene Trinitrophenenetol Trinitroresorcinol Urea nitrate

Substance that Present a Hazard Due to their Corrosive or Irritant Characteristics

This category of irritants is generally considered the most hazardous in causing external injury due to the fact that the liquid formed is most amenable to tissue-chemical contact. The more concentrated the irritant and the longer the exposure, the more rapid and intense will be the damaging process.

A. EXAMPLES OF LIQUID IRRITANTS:

Mineral Acids:

Nitric acid Sulfuric acid Hydrochloric acid Hydrofluoric acid Phosphoric acid

Organic Acids:

Formic acid Chloroacetic acid Polyhalogenated acetic acid Cresylic acid Acetic acid

Organic Solvents:

Petroleum ether Most alcohols Cool tar solvents Carbon disulfide Chlorinated hydrocarbon solvents Most liquid ether and ketones Teupentine and terpenes

9.1 PRECAUTIONS FOR LIQUID IRRITANTS:

- 9.1.1 When handling liquid irritants, adequate personal protective equipment should be used; these include rubber gloves, chemical safety goggles, face shield as warranted, and rubber aprons.
- 9.1.2 Containers containing liquid irritant should be stored above eye level. Storage shelves should have rim or lip to prevent accidental slippage.
- 9.1.3 Care should be taken to keep irritants/corrosives separated from other incompatible chemicals.
- 9.1.4 Emergency response procedures should be well understood by all individuals involved in the use of corrosives.

B. EXAMPLES OF SOLID IRRITANTS

Caustic Alkalis:

Alkaline sulfides Sodium hydroxide Sodium carbon Sodium silicate Potassium carbonate Ammonium carbonate Barium hydroxide Barium carbonate Trisodium phosphate Lime (both hydrated and dehydrated) Calcium cyanamide Phenol

Elements and Salt: Elemental sodium Elemental potassium Elemental phosphorus Antimony and its salt Arsenic and its salt Chromium/alkaline chromates Copper sulfate Copper cyanide Mercuric salts Zinc chloride Silver nitrate

9.2 PRECAUTIONS FOR SOLID IRRITANTS:

The precautions outline above for liquid irritants should be followed.

C Gaseous Irritants:

Gaseous irritants are more hazardous that liquid or solid irritants. The symptoms resulting from exposure to gaseous irritants doffer widely and depend upon the specific structures on which the irritants act. The site of action of gaseous irritants is influenced primarily by the solubility of the act. Ammonia gas, for example, in high concentrations will cause intense congestion and swelling of the upper respiratory passages and possible rapid death from spasm or edema of the larynx. If the immediate effects are survived, there may be little serious aftereffects since the deeper the structures of the respiratory tract may not be seriously injured.

Phosgene on the other hand, even in concentrations that cause little immediate irritation, may later be fatal owing to the chemical pneumonitis or pulmonary edema (filling of the lungs with fluid) through its action on the air cells (alveoli) of the lungs. Chlorine is intermediate in its action.

EXAMPLES OF GASEOUS IRRITANT:

Acetic acid Acetic anhydride

I. Highly soluble-affecting mainly the upper respiratory tract: Ammonia Hydrogen chloride Sulfur trioxide Hydrogen fluoride Formaldehyde Sulfur monochloride Thionyl chloride Sulfuryl chloride

- II. Intermediately soluble- affecting the upper respiratory tract and deeper structures as the bronchi:
 - Sulfur dioxide Chloride Bromine Iodine Arsenic trichloride Phosphorus trichloride Phosphorus pentachloride

III. Least soluble- minimal primarily irritants; causes delayed pneumonitis: Ozone Nitrogen dioxide Phosgene

IV. No general rule as to the local of action: Acrolein Dimethy sulfate Dichloroethyl sulfide (mustard gas) Chlorpicrin Ethyl chlorosulfonate Dichloromethyl ether Xylyl bromide

9.3 PRECAUTIONS FOR GAS IRRITANTS:

The precautions outline above for liquid and solid irritants should be followed. should be followed.

10. WATER- REACTIVE AND PYROPHORIC:

A number of chemicals react with water or moisture in the air producing heat or toxic gases (alkali metals, hydrides, peroxides, phosphides and aluminum halides).

Pyrophorics: Chemicals that react spontaneously and violently on exposure to air leading to spontaneous ignition

A. **EXAMPLES OF WATER REACTIVE CHEMICALS:**

I Alkali Metals:

Potassium metal (K) Sodium (Na) Lithium (Li)

II. Alkali Metal Amides:

Silver amides (Ag2NH) Cuprous nitride (Cu3N) Cadmium amide (Cd(NH2)2) Sodium amide (NaNH2) Potassium amide (KNH2) (NOTE: the latter two chemicals under certain conditions).

III. Halides of Non-Metals:

Boron trichloride (BCI3) Boron trifluroide (BF3) Phosphorus trichloride (PCI3) Silicon tetrachloride (SiCl4) Sulfur monochloride (S2Cl2) Phosphorus oxychloride (OPCl3

- IV Alkali Metal Hydrides: Lithium aluminum hydrides (LAH) Sodium borohydride (NaBH4) Sodium hydride (NaH) Potassium hydride (KH) Calcium hydride (CaH)
- V. Metal Alkyls: Alkylithiums Aryllithiums Trialkylaluminums
- VI. Anhydrous Metal Halide: Aluminum chloride (AlCl3) Titanium tetrachloride (TiCl4) Zirconium tetrachloride (ZrCl4) Stannic chloride (SnCl4)
- VII. Others: Phosphorus pentaoxide (P2O5) Calcium carbide (CaC2) Organic acid halides and hydrides of low molecular weight.

B. **EXAMPLES OF PYROHORIC CHEMICALS:**

- I. Grignard Reagents: (RMgX)
- II. Metal Alkyls and Aryls: (RLi) (RNa) (R3AL) (R2Zn)

- III. Metal Carbonyls: Nickel tetracarbinyl (Ni(CO)4) Iron pentacarbonyl (Fe(CO)5) Cobalt carbonyl (Co3(CO)8)
- IV. Alkali Metals: Potassium (K) Sodium (Na)
- V. Metal Hydrides: Sodium hudride (HaH)
- VI Non-Metal hydrides: Diborane (B2H6) Phosphine (PH3) Arsine (AsH3) Other boranes
- VII. Non-Metal Alklys: (R3B) (R3P) (R3As)
- VIII. Non-Metal : White phosphorus
- IX. Metal Powders (especially when finely divided): Aluminum (Al) Cobalt (Co) Iron (Fe) Magnesium (Mg) Palladium (Pd) Platinum (Pt) Tin (Sn) Zinc (Zn) Zirconium (Zr)

10.1 PRECAUTIONS FOR REACTIVE AND PYROPHORICS:

- 10.1.1 Appropriate personal protective apparel should be worn at all times.
- 10.1.2 Reactive chemicals are sensitive to shock, pressure, temperature, light, and friction.
- 10.1.3 Know the incompatibility of other materials and monitor the laboratory environment change.
- 10.1.4 Explosives should be stored in a cool, dry protective area.
- 10.1.5 Unopened organic peroxides should be discarded within 1 year and opened material within 6 months.
- 10.1.6 Metal spatulas should not be used with peroxide formers.
- 10.1.7 Never use glass containers with a screw cap lids or glass stoppers.
- 10.1.8 Water reactives should be stored under mineral oil- isolated from chemicals.
- 10.1.9 Pryophoric should be stored in inert environments.

10.1.10 Clean up all spills immediately and properly dispose of the residue.

Alkali Metals:

Potassium metal (K) Sodium (Na) Lithium (Li)

Alkali Metal Amides:

Silver amides (Ag2NH) Cuprous nitride (Cu3N) Cadmium amide (Cd(NH2)2) Sodium amide (NaNH2) Potassium amide (KNH2) (NOTE: the latter two chemicals under certain conditions).

Halides of Non-Metals:

Boron trichloride (BCI3) Boron trifluroide (BF3) Phosphorus trichloride (PCI3) Silicon tetrachloride (SiCl4) Sulfur monochloride (S2Cl2) Phosphorus oxychloride (OPCl3)

Others:

Phosphorus pentaoxide (P2O5) Calcium carbide (CaC2) Organic acid halides and hydrides of low molecular weight.

Alkali Metal Hydrides:

Lithium aluminum hydrides (LAH) Sodium borohydride (NaBH4) Sodium hydride (NaH) Potassium hydride (KH) Calcium hydride (CaH)

Metal Alkyls:

Alkylithiums Aryllithiums Trialkylaluminums

Anhydrous Metal Halide:

Aluminum chloride (AlCl3) Titanium tetrachloride (TiCl4) Zirconium tetrachloride (ZrCl4) Stannic chloride (SnCl4)

EXAMPLES OF PYROHORIC CHEMICALS:

Grignard Reagents: (RMgX)

Metal Alkyls and Aryls: (RLi) (RNa) (R3AL) (R2Zn)

Metal Carbonyls: Nickel tetracarbinyl (Ni(CO)4) Iron pentacarbonyl (Fe(CO)5) Cobalt carbonyl (Co3(CO)8)

Alkali Metals:

Metal Hydrides: Sodium hudride (HaH)

Non-Metal hydrides:

TENNESSEE STATE UNIVERSITY POLICE DEPARTMENT INCIDENT/ACCIDENT FORM (PLEASE DOCUMENT)

| <u>INJURED</u> NAME | STUDENT | | VISITOR | EMPLOYEE SSN# | | | | |
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| OFFICE USE | |
|-----------------|------------------|
| INCIDENT NUMBER | COMPLAINT NUMBER |
| | |

PERMISSION FOR CHEMICAL USE

(PLEASE DOCUMENT)

| DATE | |
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| NAME | - PO | DSITION | | | Work Home | PHONE # | |
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| 2. ALL NECESSARY SAFETY | EQUIPMENT PRES | SENT | | YES | | NO | |
| 3. MSDS PRESENT 4. ALL PERSONNEL TO RECE TRAINING ON | IVE | | | YES | | NO | |
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PLEASE ATTACH MSDS ALONG WITH THIS REPORT

TENNESSEE STATE UNIVERSITY DEPARTMENT OF CHEMISTRY

REPRODUCTIVE HAZARD EVALUATION FORM (PLEASE DOCUMENT)

| DATE | |
|------|--|
| | |

| Do you want this mate confidential? | ter to be | | YES | NO NO | | |
|---|---------------|--------|-----|---|---|-------------|
| NAME | | ID/SSN | | PHONE # | DEPARTMENT/MAJOF | R |
| (PRIN ADDRESS: | Γ) | | | I have requested list of chemicals to discuss my physician regarding the effect of the che on my fetus and completion of this course a SIGNATURE | | ne. DATE |
| LAB CO-COORDINATOR or COURSE/WORK ASSIGN | SUPERVISORNar | ne | | Signature | <u>, </u> | Date |
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| PHYSICIAN'S RECOMMENDATION | | | | - - - - |
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| THE PREGNANT WOMAN CAN WORK IN | N THE LAB | YES | NO | - |
| SAFETY OFFICER | Name | | Signature | Date |
| | | | | - - - |

If requested, MSDS can be provided

TENNESSEE STATE UNIVERSITY DEPARTMENT OF CHEMISTRY

SAFETY COMPLAINTS REPORT (PLEASE DOCUMENT)

DATE _____

| NAME | | POSITION | | PHONE # | DEPA | ARTMENT |
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