FITCHBURG STATE UNIVERSITY

CHEMICAL HYGIENE PLAN

Fitchburg State University

160 Pearl Street,

Fitchburg, MA 01420

May 2017

EMERGENCY TELEPHONE NUMBERS

CAMPUS POLICE:.....978-665-3111

HEALTH SERVICES:.....978-665-3216

ENVIRONMENTAL HEALTH AND SAFETY OFFICE:.....978-665-3756

CHEMICAL HYGIENE OFFICER (CELL PHONE):.....978-833-7308
(Environmental Health and Safety Officer)

EMERGENCY COORDINATOR/FACILITIES:.....978-665-3115

FITCHBURG POLICE:..... 911

OUTSIDE EMERGENCY RESPONDERS:..... 911

POISON CENTER:.....800-682-9211

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LIST OF ABBREVIATIONS AND ACRONYMS

AFSCME	American Federation of State, County and Municipal Employees
APA	Administrative Professionals Association
CFR	Code of Federal Regulations
CHO	Chemical Hygiene Officer
CHP	Chemical Hygiene Plan
EH&S	Environmental Health and Safety
Faculty	Responsible Faculty Members
Fitchburg State	Fitchburg State University
LC_{50}	lethal concentration, 50%
LD_{50}	lethal dose, 50%
MSCA	Massachusetts State College Association
MTA/NEA	Massachusetts Teachers Association/National Education Association
NFPA	National Fire Protection Association
OSHA	U.S. Occupational Safety and Health Administration
PEL	permissible exposure limit
PPE	personal protective equipment
ppm	parts per million
SAA	Satellite Accumulation Area
SDS	safety data sheet
SOP	standard operating procedure
STEL	short-term exposure limit
TLV	threshold limit value
°F	degrees Fahrenheit

1.0 POLICY AND PURPOSE

1.1 POLICY

It is the policy of Fitchburg State University (Fitchburg State) to provide a safe and healthy workplace in compliance with the Occupational Safety and Health Act of 1970 and with regulations of the U.S. Department of Labor, including Title 29 Code of Federal Regulations (CFR) Section 1910.1450, *Occupational Exposure to Hazardous Chemicals in Laboratories*. The full U.S. Occupational Safety and Health Administration (OSHA) standard can be found at the following link: OSHA 29 CFR 1910.1450.

1.2 PURPOSE

The purpose of this Chemical Hygiene Plan (CHP) is to describe proper practices, procedures, equipment, and facilities for all personnel (employees, students, visitors or other persons) working in laboratories at Fitchburg State, to protect them from potential health hazards presented by chemicals used in the workplace and to keep exposures below specified limits. It is the responsibility of all affected personnel to know and to follow the provisions of this CHP.

The CHP shall be followed by all chemical users on campus, regardless of department. As such, the term "laboratory" refers to any room where chemicals are used.

Fitchburg State will appoint a Chemical Hygiene Officer (CHO) who is responsible for developing, implementing, monitoring, and updating the plan annually. Affected departments are all those maintaining laboratories that contain and use hazardous chemicals, as defined by the regulations, and include the Departments of Biology and Chemistry, Industrial Technologies, Communications Media, Humanities, Earth and Geographic Sciences, Psychological Science, and Exercise Science. Leah Fernandes is the Environmental Health and Safety (EH&S) Officer and the current CHO.

2.0 RESPONSIBILITY, AUTHORITY, AND RESOURCES

2.1 UNIVERSITY PRESIDENT AND THE BOARD OF TRUSTEES

The University President and the Board of Trustees have responsibility for compliance with all applicable federal, state and local regulations and to provide for the safety of its employees, students, and the Fitchburg State community. The University may set forth and enforce rules and regulations to implement this CHP as needed. In accordance with Article III C of the collective bargaining agreement between the Board of Higher Education and the Massachusetts Teachers Association/National Education Association/Massachusetts State College Association (MTA/NEA/MSCA), prior to the promulgation of any such rules or regulations by the University, the University President shall first consult with the MSCA Chapter President regarding such rules and regulations and their enforcement.

2.2 VICE PRESIDENT OF ACADEMIC AFFAIRS

The Vice President of Academic Affairs shall:

- Ensure that the Academic Curriculum complies with all applicable laws and regulations.
- Enforce disciplinary procedures to ensure compliance with all applicable local, state and federal regulations, and with Fitchburg State policy in academic departments.

2.3 VICE PRESIDENT OF ADMINISTRATION AND FINANCE

The Vice President of Administration and Finance has the direct responsibility for chemical hygiene within the University, and provides continuing support for efforts to improve campus health and safety.

2.4 CHEMICAL HYGIENE OFFICER

The CHO shall identify and minimize risks to persons working with chemicals in laboratories, photographic darkrooms and studios, to the community, and to the environment. The CHO has the authority to suspend operations that do not conform to health and safety practices required by the CHP. The CHO shall:

- Review and approve the operation, acquisition, and maintenance of fume hoods, emergency safety (drench) showers, eyewashes, and fire extinguishers in all laboratories where chemicals are used and handled.
- Provide technical expertise to the university community with regard to chemical and laboratory safety and health issues, and also direct inquiries to appropriate resources.

- Work with departments to develop and implement the standard operating procedures (SOPs) for the handling and storage of hazardous materials and hazardous chemical waste as required in the CHP.
- Work with departments to appropriately label, store and dispose of hazardous chemicals and waste as required in the CHP.
- Work with departments and employees engaged in the use of hazardous materials to provide training in the use of Hazardous Chemicals as required in the CHP.
- Conduct regular inspections of laboratories and chemical storage areas.
- Write up and distribute inspection results to the appropriate Deans, to relevant Department Chairs and to relevant Designated Laboratory Users and Faculty, along with recommendations and follow-up actions.
- Coordinate and conduct department health and safety training sessions. These shall include hazardous chemicals, hazardous waste and laboratory safety topics.
- Maintain documentation of health and safety training for Fitchburg State employees and students. The CHO will maintain the master file of Safety Data Sheets (SDSs) for all hazardous substances used or stored on campus.
- Review and approve department procedures for the use, disposal, spill prevention, cleanup, and decontamination of extremely hazardous chemicals and substances.
- Investigate all reports of laboratory hazard incidents and chemical spills to prevent reoccurrence, and report results of investigations to the appropriate Deans.
- Coordinate handling and disposal of hazardous waste generated on campus in accordance with the U.S. Department of Transportation (DOT), OSHA, Massachusetts Department of Environmental Protection and U.S. Environmental Protection Agency (EPA) Resource Conservation and Recovery Act (RCRA) requirements.
- Maintain a master chemical inventory for all chemicals used at Fitchburg State.
- Review and evaluate the effectiveness of the CHP at least annually and update it as necessary.

2.5 ALL UNIVERSITY SAFETY COMMITTEE

The All University Safety Committee will be established as a Special Committee according to Article VII.D.2.d, page 85, of the 2004-2007 collective bargaining agreement between the Board of Higher Education and the MTA/NEA/MSCA.

- The Committee shall:
  - Review at least annually, the CHP and revise as needed.

  - Participate with the CHO in inspections including records required to be kept of laboratories prior to the beginning of each semester.
  - Participate with the CHO to perform follow-up visits to laboratories not meeting initial compliance.
  - Report to the Deans all unresolved chemical safety issues.

- The Committee shall consist of at least fourteen members, including:
  - Two technicians appointed by their union representatives.
  - Two Fitchburg State employees, APA or AFSCME members, appointed by their union representatives.
  - Three faculty members appointed by the MSCA Fitchburg Chapter, including, if possible, a Department chair from a relevant Department.
  - The Director of the Facilities Division.
  - One member of the Senior Staff appointed by the President.
  - The CHO.
  - The Administrator responsible for the Institutional Animal Care and Use Committee (IACUC) and Institutional Biosafety Committee (IBC).
  - One member of the Campus Police.
  - One student representative appointed by the Student Government Association (SGA).

- The Chair of the All University Safety Committee will be appointed by the President.

2.6 CHAIRPERSONS OF DEPARTMENTS THAT OPERATE LABORATORIES

The Department Chair is responsible for chemical safety in his/her department, and shall understand the CHP. The Department Chair or designee (hereinafter, the "Department") shall:

- Notify the CHO when a laboratory will be opened for operation or taken out of operation, or when procedures or Designated Users are changed.
- Submit a Clearance Form for Departing Personnel (in Appendix I) when personnel who work in laboratories end their employment at the University.
- Work with the CHO to develop and implement the SOP for the handling and storage of hazardous chemicals and hazardous waste.
- Ensure that all laboratory users in his/her department attend the hazardous chemical training as required in the CHP.
- Ensure that all students enrolled in science laboratory courses and/or in courses using any rooms containing hazardous chemicals receive appropriate training in chemical and laboratory safety. The Chair will establish a record-keeping system that will consist of a Student Laboratory Safety Agreement signed by students in acknowledgement that they have

received training and agree to abide by all applicable policies and procedures. Students shall keep a copy of the signed Student Laboratory Safety Agreement. The Department Chair will retain a copy of the Student Laboratory Safety Agreement and will forward a copy of the Student Laboratory Safety Agreement to the CHO.

- Work with the CHO to make recommendations to the Vice President of Academic Affairs for the purchase of safety equipment required by the CHP.
- Supervise department employees to ensure that they use the required safety equipment in his/her department.
- Be responsible for the oversight of a current chemical inventory at the point of use.
- Be responsible for the routine identification of expired and unusable chemicals and their proper disposal.
- Be responsible for the maintenance of SDS files at the chemical's point of use. Point of use is the laboratory in which the chemical is put to use.
- Ensure that the routine inspections of all laboratories in his/her department occur, and maintain records of routine inspections.
- Work with faculty and the CHO to identify Responsible Faculty Members and Designated Users with responsibility for specific laboratory.

2.7 RESPONSIBLE FACULTY MEMBERS

Responsible Faculty Members (Faculty Members) will be assigned designated laboratory space in which to conduct research or otherwise utilize for professional purposes, and will be responsible for chemical safety in his/her designated laboratory space. Faculty Members shall:

- Notify the CHO when the designated laboratory space will be opened for operation or taken out of operation, or when procedures or Designated Users are changed.
- Submit a Clearance Form for Departing Personnel (in Appendix I) when personnel who work in the designated laboratory end their employment at the university.
- Work with the CHO to develop and implement the SOPs for the handling and storage of hazardous chemicals and hazardous waste in the designated laboratory space.
- Ensure that all personnel, including students, working in designated laboratory space attend hazardous chemical training as required in this CHP.
- Maintain training records of employees (including students) working in the designated laboratory space, and forward documentation of training to the CHO and Department Chair.
- Work with the CHO to make recommendations to the Department Chair for the purchase of safety equipment required by the CHP.

- Supervise workers to ensure they use the required safety equipment in the designated laboratory space.
- Be responsible for the maintenance of a current chemical inventory at the point of use.
- Be responsible for the routine identification of expired and unusable chemicals and their proper disposal.
- Be responsible for accessing of SDS files at the chemical's point of use.
- Ensure that the routine inspections in the designated laboratory space occur, and submit completed inspection forms to the CHO, and a copy of the completed inspection forms to the Department Chair
- Comply with the procedures and requirements of the CHP.
- Report any possibly unsafe or noncompliant conditions in the designated laboratory space to the CHO.
- Work with the Department Chair and the CHO to develop and implement the standard operating procedures for the handling and storage of hazardous materials and hazardous waste.
- Include compliance with the CHP in grant proposals.

2.8 DESIGNATED LABORATORY USERS

Faculty members who are designated laboratory users (hereinafter "Designated Users") have the primary responsibility for chemical hygiene in laboratories used for teaching. A Designated User is responsible for a space for a specified period of time (time of day, by semester, for Academic Year, etc.) during which his/her classes are in session or he/she is otherwise providing instruction within the designated space. The Designated User for a space as identified on the laboratory ID card will also be a contact for the designated space. Designated Users shall:

- Follow the procedures and requirements of the CHP.
- Ensure that all Fitchburg State employees and students under their direction or instruction have completed the required training prior to performing duties or attending laboratory classes.
- Forward copies of signed Student Laboratory Safety Agreements or equivalent as approved by the CHO to the Department Chair.
- Report any possibly unsafe or noncompliant laboratory conditions to the CHO.
- Complete and maintain accurate chemical inventories at the point of use in Designated Users' courses as specified in the CHP and forward copies of the chemical inventories to the CHO and Department Chair.

- Work with their Department Chair and the CHO to develop and implement the standard operating procedures for the handling and storage of hazardous materials and hazardous waste.

2.9 LABORATORY EMPLOYEES (TECHNICIANS AND POST DOCTORALS)

All laboratory workers and students shall:

- Follow procedures and guidelines of the CHP and any applicable department or Fitchburg State SOP or policy.
- Use direct observation, checklists and incident reports, to identify and report any unsafe working conditions, faulty fume hoods or defective emergency or safety equipment to the Designated User or Responsible Faculty Member and the CHO.
- Prepare and provide to Designated Users, Responsible Faculty Members, Department Chairs, and CHO documentation for chemicals used, and the hazardous waste the chemicals produce, by keeping an accurate and current chemical storage area and Satellite Accumulation Area (SAA) inventory. This documentation will be submitted as requested/needed.
- Discharge such other duties as are assigned from time to time by the CHO.

2.10 STUDENTS, STUDENT WORKERS, VISITORS AND OUTSIDE CONTRACTORS

Students, Visitors and Outside Contractors shall:

- Follow procedures and guidelines of the CHP and any applicable department or Fitchburg State SOP or policy.
- Attend, understand, and sign off on the Student Laboratory Safety Agreement (Students) or Hazard Communications/Safety Training (Student Workers, Visitors and Outside Contractors) before beginning work or study at Fitchburg State.
- Report any unsafe or noncompliant conditions in laboratories to the Designated Users or Fitchburg State employee directing his/her work or study.

3.0 CHEMICAL HYGIENE PLAN

3.1 DEVELOPMENT, IMPLEMENTATION, AND UPDATE

The CHO coordinates the preparation of the CHP and specific SOPs, if required, for the laboratories. The CHO is responsible (per OSHA regulation) for ensuring that the plan meets the requirements set forth in 29 CFR 1910.1450 and is fully implemented.

The CHO is responsible for ensuring that the CHP is reviewed on an annual basis and updated as necessary to accommodate changes in the OSHA standard 29 CFR 1910.1450, departmental procedures, and personnel policy. In addition, the CHO will ensure that the CHP update includes procedures regarding new chemical hazards and new processes as they are introduced. The CHO will ensure that the CHP and updates are distributed or made available to those affected by the changes.

3.2 INVENTORY, IDENTIFICATION AND CLASSIFICATION OF HAZARDOUS CHEMICALS

3.2.1 Chemical Inventory

- Each Department shall be responsible for developing and maintaining an accurate and current inventory of all chemicals used and stored within the department or, in the case of a Faculty Member, in his or her laboratory. The Department shall maintain the inventory on a computerized database that has been approved by the CHO. Chemicals shall be entered into the inventory immediately upon their arrival at their point of use.

- The CHO shall maintain a master inventory of all the chemicals and their storage locations on campus. Each chemical shall be entered into the master inventory upon the chemical's arrival at Fitchburg State and when the chemical is delivered to its point(s) of use the inventory will be modified to reflect the distribution of the chemical. The CHO shall reconcile the inventories and shall investigate any discrepancies.

3.2.2 Identification and Classification

Hazardous chemicals can be classified into several generic categories based on their hazardous characteristics (e.g., corrosive, reactive, flammable, toxic, etc.) and are labeled on the primary container as such. Definitions and other hazardous properties/health effects of chemicals can be found in Appendix A or online at the following link: http://www.osha.gov/SLTC/laboratories/

Alternate means of classifying and identifying hazardous chemicals include the following:

- Lists of known or suspect human carcinogens, prepared by the International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP) are available online at the following link: Known and Probable Human Carcinogens.

- The National Fire Protection Association (NFPA) has categorized a wide variety of chemicals found in industrial settings. This list is available online at https://www.newenv.com/resources/nfpa_chemicals/ or in the EH&S Office.

- Safety data sheets (SDSs) can be obtained online from the chemical vendor's website or Velocity EHS (https://www.msdsonline.com/). For instructions on how to access SDSs, contact the EH&S Office. All researchers should be aware of how to find a SDS, and should have access to the SDS for each chemical used in the laboratory. SDSs should be reviewed prior to beginning work with a chemical. Note that prior to 2013, SDSs were known as Material Safety Data Sheets (MSDSs).

3.2.3 Safety Data Sheets

The CHO will be responsible for ensuring that a proper SDS is filed for each chemical shipped to the campus and that a copy of that SDS is made available at its point of use and/or to the end user. SDSs shall be accessible 24 hours a day in case of emergency.

The Department or the Faculty Member responsible for the point of use shall maintain a copy of the SDS at the point of use.

All Designated Users, Faculty Members, technicians and student workers shall review the SDS prior to use of a chemical.

3.2.4 Chemical Labeling

Chemical labels on original containers shall display the information listed below upon their delivery to Fitchburg State. Any chemicals delivered to Fitchburg State shall be inspected for correct labeling upon receipt by the Materials Management Department under the guidance of the CHO. Containers shall be rejected and sent back to the supplier if the labeling is insufficient.

- The common name of the chemical.
- The name of the company supplying the chemical.
- A hazard warning indicating any health or safety hazards that the chemical may present, including: corrosiveness, carcinogenicity, water reactivity, flammability, mutagenicity and toxicity. If a chemical presents a health hazard, the label shall indicate the precautions required (gloves, respirator, etc.) for its safe handling.

Upon the delivery of an original container to its point of use, the Laboratory Technician, together with the Designated User or Faculty Member in control of the point of use shall be responsible for maintaining the proper labeling of the containers in which the chemical is stored or transported. A chemical may be dispensed from its original container only if it is dispensed into a container that has been (i) approved by the CHO as safe and compatible; and (ii) labeled with the common and scientific name of the chemical and hazards, if any.

Container labeling requirements also apply to chemical substances developed in the laboratory. If the composition of the chemical substance is known it should be labeled accordingly. If the chemical produced is a byproduct whose composition is not known it should be labeled and managed as a hazardous waste.

Chemical container labeling will be assessed in the routine inspections of laboratories, studios, darkrooms and storage areas. Questions on the use and type of containers shall be referred to the CHO.

Anyone who discovers an unlabeled or mislabeled chemical shall promptly contact the CHO.

3.3 SELECTION OF REQUIRED CONTROL METHODS AND AUTHORITY FOR CHEMICAL USE

- SDSs for many chemicals used in the laboratories indicate recommended limits (e.g., threshold limit value or TLV) or OSHA-mandated limits (e.g., permissible exposure limit or PEL, short-term exposure limit or STEL, and action limit or AL), or both, as exposure guidelines.

- When such limits are stated, they will be used in the laboratories by the CHO to assist in determining the safety precautions and control measures necessary when handling toxic materials. A chemical fume hood must be used when the following occurs:
  - When working with a compound that has a reported TLV or PEL less than 50 parts per million (ppm).
  - If the LD_{50} is less than 500 milligrams per kilogram (mg/kg) or the median inhalation dose, LC_{50}, is less than 200 ppm.
  - When working with or handling toxic or malodorous materials (e.g., 2-mercaptoethanol) with moderate or high vapor pressure.
  - When the SDS recommends use.

- Personal Protective Equipment
  - Whenever any hazardous chemical is used in the laboratory, the Faculty Member or Designated User for that laboratory must ensure the appropriate types and sizes of gloves

are readily available and worn by all laboratory staff. Glove compatibility charts are available as a reference in the EH&S Office.

  - Safety glasses must be worn in the laboratory when pouring or handling hazardous chemicals or when there is potential for splash hazards. Safety glasses must meet the specifications of the American National Standards Institute (ANSI) Z87.1. Information on types and sizes of safety glasses is also available in the EH&S Office.

  - Long-sleeved laboratory coats or chemical-resistant aprons must be worn in the laboratory whenever chemical hazards exist.

  - Sandals or open-toed shoes and other clothing which do not protect the laboratory worker from accidental spills of hazardous materials are prohibited in the laboratory.

- Respirators are not to be used in any area at Fitchburg State without prior approval from the EH&S Officer. Respirators require medical clearance, fit testing, and training prior to use.

- Staff members must obtain prior approval from the CHO whenever a new use of extremely toxic (refer to Section 3.4), carcinogenic, or physically hazardous chemical is being considered.

3.4 SPECIAL PROVISIONS FOR PARTICULARLY HAZARDOUS SUBSTANCES (CARCINOGENS, REPRODUCTIVE TOXINS, AND ACUTELY AND EXTREMELY TOXIC CHEMICALS)

The procedures described in this section must be followed when performing laboratory work with any carcinogen, reproductive toxin, substances with a high degree of acute toxicity, or chemical whose toxic properties are unknown.

These substances must be handled, used, and stored only in areas designated areas of restricted access. Appropriate areas include chemical fume hoods, designated portions of a laboratory, or an entire laboratory if it is specifically dedicated for that purpose. A designated area must be clearly posted with signs warning that a specific, extremely hazardous material is in use and that only those trained to work with it are allowed to enter the area while procedures using it are ongoing. The boundaries of the designated area must be clearly defined.

Please note: A designated area may be posted with a removable sign if work with extremely hazardous agents is not continuous in the laboratory.

The smallest amount of a chemical that is required by a procedure should be purchased, used and stored. Whenever possible, material should be ordered in amounts equal to that required in a given procedure to avoid unnecessary weighing out of the material.

Spill procedures must be developed and posted in the designated area. Staff should be familiar with and have available materials that will inactivate the chemical.

The designated area must be decontaminated when work is completed.

Liquid wastes must be put into screw-top containers that are compatible with the chemical. Hazardous waste containers must be labeled with the words, *Hazardous Waste*, the chemical name, the type of hazard (toxic, ignitable, corrosive, or reactive), and dated only when full. Hazardous waste tags are available from EH&S. Hazardous waste must be removed from the laboratory within three business days after dating the container. Please contact EH&S for hazardous waste removal.

3.5 ELIMINATION OR SUBSTITUTION

The first step in evaluating the safety of a new experiment, process or operation is to investigate the possibility of eliminating hazardous materials or substituting with a less hazardous material. When selecting alternate products, care must be taken that one hazard is not being substituted for another.

The particular process, experiment, or operation may also be modified to reduce the quantity of the hazardous chemical(s) necessary or limit the potential emission release rate or exposure time. The use of a secondary containment device, such as a pan, can also be helpful in preventing or minimizing the effects of chemical spills.

3.6 ENCLOSURE, ISOLATION AND DESIGNATED AREAS

Reducing the potential for exposure to particularly hazardous chemicals is achieved by restricting the use of the material to a designated area equipped with the proper control devices. This designated area can be a chemical fume hood, bench, or an entire laboratory depending on the manipulations required. Hazardous substances are stored, used, and prepared for disposal only in designated areas. The designated area is identified by signs to alert others of the presence of a particularly hazardous material. For example:

"ACRYLAMIDE BALANCE" over balance area

In addition to establishing the physical boundaries that define the designated area, procedures used in a designated area have special provisions. These include storage, use of protective equipment, containment, equipment disposal, and decontamination procedures.

3.7 EDUCATION AND TRAINING

The CHO or appointed individual(s) shall provide information and training concerning the handling of hazardous chemicals in the laboratory.

Employees shall be informed of the presence of hazardous chemicals when assigned to a work area and prior to new exposure situations. This information must include the following:

1. Contents of the OSHA Laboratory Standard.
2. Applicable details and location of the CHP.
3. Emergency and personal protective equipment training.
4. Physical and chemical properties of hazardous substances used in the work place.
5. Proper handling of hazardous chemicals to minimize exposure.
6. Signs and symptoms of exposure associated with hazardous chemicals used in the work place.
7. Availability of reference material, including SDSs.

Training shall be provided immediately for new employees in the affected work area and annually thereafter for all personnel. The name of each person trained shall be recorded together with the training contents, date, time, and the trainer.

It is the responsibility of the Responsible Faculty Member to assure that all staff members attend the required training sessions. Further, if English is not the primary language spoken by a staff member, the Responsible Faculty Member should ensure that an interpreter accompanies the non-English speaking staff.

Fitchburg State laboratory staff must complete all required laboratory safety and chemical hygiene training before working in the laboratory.

3.8 GENERAL WORK PRACTICES AND STANDARD OPERATING PROCEDURES FOR CHEMICALS OR CLASSES OF CHEMICALS

General work practices and SOPs are designed to protect the user and surrounding areas from chemical hazards. When developing these procedures, it is important to consult the SDS for the chemical to ensure that the hazards are understood and have been addressed.

3.8.1 Avoidance of Routine Exposure

- Work should be conducted in a chemical fume hood whenever possible.
- Smelling chemicals to determine their identity should be avoided.
- **Never** place your head inside of a chemical fume hood to check on an experiment.

- Select gloves that will protect against the chemical(s) to be handled. Inspect gloves before use.
- Release of toxic chemicals (including dry ice) in cold or warm rooms must be avoided, as these rooms contain recirculated atmospheres.
- Exhaust of an apparatus (e.g., vacuum pumps) that may discharge toxic chemicals should be vented into a chemical fume hood or filter.
- When transporting hazardous chemicals, carriers or carts designed to prevent bottles from breaking and spilling must be used.

3.8.2 Choice of Chemicals

- Less toxic substances should be substituted in place of more toxic ones wherever possible.
- Only those amounts necessary for immediate work should be ordered.

3.8.3 Personal Hygiene

- No eating, drinking, smoking, handling of contact lenses, or applying eye drops or cosmetics is allowed. Mouth pipetting of **any** substance is prohibited.
- Hands must be washed after removing gloves and before leaving the laboratory. Solvents must never be used to wash hands.
- Laboratory coats and safety glasses should be worn in the laboratory whenever there is a potential for exposure to infectious, chemical, or radioactive hazards. Appropriate gloves must be worn when handling chemicals. Refer to Appendix E, Effective Use of Gloves.

3.8.4 Appropriate Storage of Chemicals

- Incompatible chemicals must be segregated (see Appendix F for lists of incompatible materials and Appendix H for Chemical Storage Guidelines).
- Glass bottles must not be stored on high shelves or on the floor.
- Chemicals should be stored in containers with which they are compatible.
- All bottles must be labeled with the correct chemical name. No abbreviations! Bottles should be dated upon receipt and again upon opening.

3.8.5 Horseplay

Avoid practical jokes or other behavior that might confuse, startle or distract another worker.

3.8.6 Unattended Operations

- All chemical containers, including reaction vessels and process equipment, must be labeled.

- A sign stating “Let Run” (or equivalent) must be posted near the process and on the laboratory door. This sign will include a contact name for person responsible for operation and an end date for the experiment.
- Provide for the containment of hazard substances in the event of failure of a utility service, such as cooling water. Additional controls are needed for particularly hazardous chemicals.

3.8.7 Working Alone

Workers should avoid working alone when conducting research and experiments involving hazardous substances and procedures.

Undergraduate Teaching Laboratories:

A university representative trained in chemical safety (faculty member or other person chosen by the Department Chairperson) must be present in the laboratory at all times when undergraduate students are conducting experiments.

Independent Study and Graduate Students:

Students who need to work alone must receive permission from their advisor prior to working alone. If students have approval from their advisor to work alone after normal working hours, they shall contact Fitchburg State Campus Police to make them aware of their presence in the facility. Fitchburg State Campus Police shall make periodic checks of any laboratory having lone workers. Students working alone should plan a route of escape in case of an emergency. Students working alone should always notify a responsible person about their location and anticipated time of arrival at home or elsewhere. Those persons should be asked to contact the Fitchburg State Campus Police within a reasonable time after which the person does not return.

Research Laboratories:

Personnel with special need to work alone after hours shall contact Fitchburg State Campus Police to make them aware of their presence in the facility. Fitchburg State Campus Police shall make periodic checks of any laboratory having lone workers. Laboratory personnel should plan a route of escape in case of emergency. Personnel working alone shall also notify a responsible person about their location and anticipated time of arrival at home or elsewhere. Those persons should be asked to contact the Fitchburg State Campus Police within a reasonable time after which the person did not return.

3.8.8 Chemical Procurement, Distribution, and Storage

3.8.8.1 Procurement

Before the approval of any chemical purchases, the current chemical inventory must be checked and the Purchase Order signed-off by the EH&S Officer or his/her designee. This measure prevents the duplicate or unnecessary purchase of chemicals already in inventory, see Section 3.2.

3.8.8.2 Transport of Hazardous Chemicals

The following guidelines will be used when transporting hazardous chemicals within facilities or from building to building. Transportation of all chemicals on public ways (streets and roads) is not permitted without proper licensing and proper vehicles.

- Hazardous chemicals that are hand-carried shall be placed in a secondary container or acid carrying bucket with tight fitting covers and shock absorbing material to protect against breakage. Bottles shall be protected from falling or tipping with a Speedi-Dry or similar means.
- Wheeled carts used to transport chemicals shall be stable and move smoothly over uneven surfaces without tipping or stopping suddenly, and shall have lipped surfaces that would contain the chemicals if the containers break.
- Laboratory employees transporting hazardous chemicals must wear splash goggles and a lab coat or apron in case containers break or chemicals are splashed.
- Passenger elevators shall be used only during low-use time periods and then shall be occupied only by those who are handling the chemicals. All hazardous chemicals shall be placed in a secondary container or acid carrying bucket with tight fitting covers and shock absorbing material to protect against breakage.
- Compressed gas cylinders shall be transported with hand trucks only with the cylinder strapped in place. Cylinders shall NEVER be dragged. Keep the cylinder capped until use.

3.8.8.3 Stockrooms/Prep Rooms

Stockrooms and prep rooms are areas in facilities in which relatively large quantities of chemicals are stored for laboratory use. The following rules will be followed for all stockrooms and prep rooms:

- Access must be strictly limited to authorized Laboratory Employees. All prep rooms, and storeroom/stockrooms must be locked and secured when designated Laboratory Employees are not present.

- The CHO shall ensure that all stockrooms, prep rooms and other chemical storage areas are supplied with a mechanical ventilation system that provides at least six air changes per hour.

- Each chemical stockroom and prep room must have access, in or adjacent to the room, to at least one large sink, safety shower, eyewash station, and appropriate fire extinguisher with adequate extinguishing capacity. The fire extinguisher shall be located next to the exit door and also within 25 feet of a hazardous area. Fire extinguishers, safety showers and eyewash stations cannot be obstructed.

- For new facilities constructed subsequent to the implementation of this CHP, each stockroom and prep room and chemical storage area must have a master control shutoff valve for water, electricity, and gas.

- Shelving must be secure and well balanced. Shelving characteristics shall include:
  - Anti-roll lips on all shelves to prevent containers from falling off shelves. Existing shelving otherwise suitable for storage shall not be replaced. New shelving shall have anti-roll lips.
  - Metal shelves shall be corrosion-resistant.
  - Aisles at least 3 feet between standing shelves.
  - Chemicals shall be stored according to the storage patterns described in Appendix H.

- All stockroom and prep room exits must be clearly marked and unobstructed.

- Stockrooms and prep rooms must be well lit so that labels can be easily read.

- No aisle is permitted to dead end. Aisles must be kept clear of clutter. Material cannot be stored in a means of egress.

- The environment in stockrooms must be controlled and avoid extremes of temperature and high humidity.

- Floors must be kept clean and dry. If being cleaned or when a spill has occurred, signs shall be posted to warn of hazard.

3.8.9 Procedures for Flammable Chemicals

3.8.9.1 General Use and Handling

- Flammable liquids are defined as those liquids with a flash point of 140 degrees Fahrenheit (°F) or less and having an absolute vapor pressure of not more than 40 pounds per square inch at 100 °F. Some examples commonly found at Fitchburg State are acetone, ethanol, ether, and xylene. All flammable liquids should be handled carefully.

- Flammable substances should be handled only in areas free of ignition sources (e.g., away from electric ovens, burner flames, and hot surfaces).

- Flammable substances should never be heated using an open flame. Heating mantles, oil baths, safety hot plates, and steam baths should be used. When heating either by steam bath or hot plate, use a filter or distilling flask as a receiver. Such distillations must be carried out in a chemical fume hood.

- Smoking is not permitted where flammable liquids are used. Fitchburg State is a smoke-free environment.

- Boiling chips or glass beads are helpful in distilling or evaporating flammable substances to prevent superheating and bumping.

- Ground cylinders or equipment when transferring flammables from one container to another. Contact the EH&S Office if there are questions about proper grounding.

3.8.9.2 Storage

- Bottles of flammable liquids should not be stored near heat sources or in direct sunlight.

- Quantities of flammable solvents stored in the laboratory should be kept to a minimum.

- Whenever possible, flammable liquids should be stored in approved storage cabinets. Flammable liquids must never be stored on the floor.

- Adequate ventilation must be provided where flammable liquids are used.

- When flammable liquids are stored in a refrigerator, it must be a *Laboratory-Safe* Refrigerator (as defined in NFPA 45). These are approved for storing flammable liquids and have all electrical equipment mounted on the outside surface of the refrigerator.

- Flammable liquids must not be stored with chemicals that are considered to be incompatible with them (e.g., oxidizers, oxidizing acids, etc.).

3.8.10 Procedures for Reactive Chemicals

- Reactive materials include oxidizers, organic peroxides, explosives, and those ranked 3 or 4 for reactivity by the NFPA.
- For peroxide-forming chemicals (e.g., ethyl and isopropyl alcohol, ethers, and tetrahydrofuran), containers should be dated upon opening and disposed of as hazardous waste by the expiration date or within six months, whichever is sooner.
- All reactive materials must be handled with caution, personal protective equipment must be used, and, where possible, work should be done in a chemical fume hood.

3.8.11 Procedures for Corrosive Chemicals

- Extreme care must be exercised in handling and pouring corrosive materials. This includes approved gloves, a laboratory coat, and safety glasses. The use of a faceshield is recommended.
- Acids and similar chemicals should not be stored above laboratory bench level.
- Corrosive materials should not be heated or handled in large, fragile containers (e.g., four-liter beakers) without providing a secondary containment to catch the contents in case of breakage.
- Porcelain dishes should not be used as cleaning baths.
- Strong alkalis should not be stored next to strong acids.
- If strong acids or alkalis come in contact with skin or clothing, affected parts should be washed quickly and thoroughly with large quantities of water. If such materials are splashed in the eyes, they should be flushed thoroughly with a continuous stream of cold water for at least 15 minutes. In either case, medical attention should be sought immediately.

3.8.12 Special Procedures: Work with Formaldehyde

The OSHA formaldehyde standard, Occupational Exposure to Formaldehyde, 29 CFR 1910.1048, states that the exposure limit (eight-hour PEL) for exposure to formaldehyde is 0.75 ppm. The 15-minute average STEL is 2 ppm.

The Hazard Warning, including labeling requirements, falls under the OSHA Hazard Communication Standard, 29 CFR 1910.1200, and the formaldehyde standard, 29 CFR 1910.1048. If formaldehyde is to be used, all staff should be informed of the health hazards of formaldehyde upon initial orientation to the work site. Notify EH&S if you work with

formaldehyde containing chemicals so a review can be conducted to ensure compliance with 29 CFR 1901.1048.

3.9 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) is designed to serve as a barrier between laboratory workers and hazardous materials to prevent personal injury and illness. Examples of PPE include safety glasses or goggles; face shields; safety shields; gloves; rubber aprons; laboratory coats; and respirators. It is the responsibility of the Faculty Member to ensure that laboratory staff uses necessary PPE.

The use of PPE shall be included in all SOPs. The type and level of equipment can be determined with the aid of the CHO. The use of PPE should only be considered after exercising all options for reducing the hazards. If in doubt about the potential danger of an experiment or activity, all available safety devices should be employed. Information on such devices can be obtained from EH&S upon request.

PPE must remain within the laboratory area and is not to be worn outside of laboratory areas or taken offsite for any reason.

3.9.1 Respirators

The Fitchburg State Respiratory Protection Program must be followed when respiratory protection is required. All staff must follow these elements.

- Selection of a respirator type must be performed in consultation with EH&S.
- A medical clearance is required for each employee before a respirator is worn.
- Fit testing and training shall be performed under the direction of EH&S for all negative pressure respirators before use.

3.9.2 Eye Protection

Eye protection must be worn in the laboratory whenever there is a potential for eye contact with liquids and/or particulates. Safety glasses with side shields must be worn when handling chemicals with the potential for splash or splatter. It is recommended that safety glasses be worn at all times when working in the laboratory. Safety glasses are available through the Department.

Goggles are recommended when working with volatile substances that irritate the eyes (e.g., chlorine, strong ammonia, irritating dusts) as well as for protection against spattering or splashing of hazardous materials. It is also advisable to wear a faceshield when distilling at high temperatures, under reduced pressures, or when distilling corrosive liquids. Safety glasses and

goggles have only a limited application and do not offer full protection against all hazards. For particularly dangerous operations, full faceshields of an approved type are to be worn. Contact EH&S if you need assistance with selecting eye protection.

3.9.3 Protective Clothing

The use of protective clothing, including chemical aprons or laboratory coats, is required when working with hazardous chemicals. Contact a Laboratory Manager for more information.

- Protective clothing is chosen, with the aid of EH&S, on the basis of the potential for chemical exposure.
- Contaminated protective clothing must be disposed of properly.
- Open-toed shoes or sandals must not be worn in the laboratory.
- Skin must not be exposed when working with hazardous materials.

3.9.4 Protective Gloves

When handling toxic or hazardous chemicals, protective gloves are required. To protect against accidental spills or contamination, workers should refer to glove manufacturers' glove charts to select a glove appropriate for use with the reagent in question (see Appendix E for glove selection). There is no glove currently available that will protect against all chemicals for all types of tasks. If the gloves become contaminated, they should be removed and discarded as hazardous waste as soon as possible. Remove at least one glove before leaving the immediate work site to prevent contamination of public areas (e.g., doorknobs, light switches, telephones, etc.).

Latex Alert: Latex (i.e., several protein antigens) has been shown to be a sensitizer. In order to best protect workers from becoming sensitized, latex gloves are discouraged in laboratories.

3.9.5 Other Personal Protective Equipment

Other PPE shall be used as needed.

3.10 VENTILATION, CHEMICAL FUME HOODS, AND PROPER OPERATIONS

Local exhaust ventilation through the use of a chemical fume hood is the primary method used to control inhalation exposures to hazardous substances in the laboratory. Other types of local exhaust include vented enclosures for large pieces of equipment or chemical storage and snorkel types of exhaust for capturing contaminants near the point of release.

A chemical fume hood should be used when working with hazardous substances. A properly operating and correctly used chemical fume hood will control the vapors released from volatile liquids, as well as unpropelled dusts and mists.

Do not make any modifications to chemical fume hoods or ductwork without first contacting EH&S. A chemical fume hood should not be used for large pieces of equipment unless the chemical fume hood will be dedicated for this use since it may change airflow patterns and render it potentially unsafe for other uses. It is generally more effective to install a specially designed enclosure for large equipment so that the chemical fume hood can be used for its intended purpose.

A chemical fume hood should not be used for chemical or other miscellaneous storage, as this may also restrict airflow. Chemicals should be stored in an appropriate (following NFPA 45 requirements) chemical storage cabinet. All freestanding cabinets should have bungs in place and the doors should close properly.

EH&S oversees the chemical fume hood program. Before you begin using a chemical fume hood, check to see that the hood is labeled appropriately for use with toxic chemicals and has been certified within the last 12 months. If a chemical fume hood requires certification or if you have questions regarding safe operation, contact EH&S.

Some of the basic guidelines for working safely in a chemical fume hood include the following:

- Work at least six inches behind the sash.
- If it is necessary to store materials in a chemical fume hood, they should be elevated so air can pass under them.
- **Never** put your head (or face) inside an operating chemical fume hood!
- Work with the sash in the lowest position possible. The sash will act as a barrier and provide containment should a problem arise with the reaction.
- Do not clutter the chemical fume hood with bottles or equipment. Only materials actively in use should be in the chemical fume hood.
- Clean the grille along the bottom slot of the chemical fume hood regularly so it does not become clogged with paper and dirt.
- Do not dismantle or modify the physical structure of the chemical fume hood or exhaust system in any way.
- Report any suspected chemical fume hood malfunctions to EH&S.

3.11 HOUSEKEEPING

It is essential for both safety and efficiency that the laboratory facilities be kept neat and orderly. Floors, shelves, and benches should be free from dirt and unnecessary apparatus and tools. Equipment should never obstruct exits, passages, or fire extinguishers, etc.

Care should be exercised when disposing of materials. Flammable or toxic materials should be collected for disposal as hazardous waste and, therefore, should not be placed in the regular waste stream. Refer to Section 3.14 for information regarding waste disposal at Fitchburg State.

General guidelines for good housekeeping include the following:

- Never block access to emergency equipment, showers, eyewashes, and exits.
- Label all chemical containers with the identity of the contents and the hazards at the very least.
- All work areas should be kept clear of clutter.
- All aisles, hallways, and stairs must be kept clear.
- All chemicals should be returned to their proper storage area at the end of the day.
- Liquid wastes should be kept in spill-proof containers, and stored off the floor in an appropriate storage area.

BE PREPARED FOR SPILLS. Small spills should be cleaned up promptly using the spill kit located in the laboratory. All clean up materials must be collected for disposal as hazardous waste. Refer to Appendix C, Chemical Spill Response/Release of other Hazardous Materials.

Formal housekeeping and chemical hygiene inspections shall be held at least quarterly for units that have frequent personnel changes and semiannually for others; informal inspections shall be continual. The CHO and Department Chairs shall conduct regular inspections of laboratories.

The CHO shall conduct an annual hazard review to identify the hazards presented by its laboratories, classrooms, studios, darkrooms, and storage rooms, the chemicals contained therein and the processes and operations conducted in these areas. Based on the hazard review, the Department or Faculty Member, as appropriate, shall determine and, upon receipt of the approval of the CHO, initiate the control measures needed to protect the occupants and users of its facilities. Designated Users shall be responsible for ensuring that these control measures are in effect and followed in the areas for which they have responsibility.

The EH&S Office should be contacted to determine the hazard potential of any new laboratory darkroom or studio procedure and the level of precautions required. No matter the hazard level, general laboratory practices shall be followed. In addition, the Department or Faculty Member shall institute such other specific measures (engineering, administrative, etc.) as are necessary to

reduce the hazard risks to an acceptable minimum. Specific control measures relating to engineering controls (such as local exhaust ventilation), administrative controls (such as job rotations), personal protective equipment, the storage of hazardous materials and hazardous waste disposal are treated in separate sections later in this document.

3.12 SIGNS AND LABELS AND SAFETY DATA SHEETS

3.12.1 Signage

- *Eye Protection Required* signs are recommended at entrances to laboratories using acids and corrosive chemicals. Safety glasses for visitors must be provided.
- Signs indicating the location of fire blankets, eyewash units, safety showers, fire extinguishers, and other safety devices are required.
- Entrances to laboratories, storage areas, and associated facilities must have signs as necessary to warn emergency personnel and custodians of unusual or severe hazards.

3.12.2 Chemical Container Labeling

All containers must be labeled with the chemical contents. Chemicals received from outside vendors must have labels indicating the name, along with other physical and chemical data. Toxicity warning signs or symbols should be prominently visible on the labels.

All chemical containers that have been decanted from an original container must be labeled with the full chemical name (no abbreviations!), the primary hazard(s), the name of the responsible person, and the date. EH&S can be contacted for further information regarding labels for this purpose.

All chemical waste containers must be labeled with the words *Hazardous Waste*, the full chemical name(s) with no abbreviations, the type of hazard (i.e., toxic, ignitable, corrosive, or reactive), the responsible person and the date the container became full. Labels are available from EH&S. Labeling must be provided for chemicals synthesized in the laboratory or prepared by other processes, such as distillation or extraction. For information about obtaining hazard labels, please contact EH&S.

Chemicals developed in the laboratory must be assumed to be toxic if no data on toxicity are available. Suitable handling procedures must be prepared and implemented, including training of users in controls necessary to handle a material safely. If the substance is produced for another user outside of the laboratory, an SDS and labels must be prepared and provided to such users (in accordance with OSHA 29 CFR 1920.1200).

3.13 MONITORING AND EMPLOYEE ASSESSMENT

EH&S will perform exposure monitoring, when appropriate, in accordance with paragraph (d) of OSHA 29 CFR 1910.1450. Other qualified consulting service providers may be employed by EH&S to conduct such monitoring. All monitoring results will be kept on file with EH&S and communicated to employees.

3.13.1 Employee Exposure Determination

- **Initial monitoring** will be performed if there is reason to believe that exposure levels for a substance could routinely exceed the action level (or PEL in the absence of an action level).
- **Periodic monitoring** will be performed **if** the initial monitoring performed discloses employee exposure over the action level (or PEL in the absence of an action level).
- Monitoring may be terminated in accordance with the relevant standard.
- Within 15 working days after the receipt of any monitoring results, the employees will be notified in writing of these results. Notification will either be given individually or by posting the results in an appropriate location that is accessible to employees.

Anyone with a reason to believe that exposure levels for a substance routinely exceed the action level, or PEL in the absence of an action level, may request that EH&S initiate the monitoring process. It will be the responsibility of the EH&S to ensure that periodic monitoring requirements are satisfied, when necessary. EH&S will maintain records in accordance with the record-keeping requirements of OSHA 29 CFR 1910.1450.

3.14 WASTE DISPOSAL

3.14.1 Policy

Every effort shall be made to dispose of hazardous waste in a proper, safe and efficient manner. It is the responsibility of the individual creating the waste to properly identify and handle waste chemicals.

3.14.2 Main Accumulation/Storage Area

EH&S maintains a Main Accumulation Area (MAA) for the storage of chemical hazardous wastes removed from the laboratories. Once the waste container has been filled and dated in the laboratory, it must be transported to the waste room within three business days (as per Massachusetts Department of Environmental Protection requirements).

3.14.3 Satellite Accumulation Areas

EH&S maintains SAAs in the laboratories for the storage of chemical hazardous waste. The following guidelines must be followed at all SAAs.

- Once a waste container has been filled and dated in the laboratory, it must be transported to the main accumulation area within three business days.
- Waste chemicals stored in containers of one gallon or larger sizes shall be *break resistant* whenever possible.
- Waste chemicals stored in breakable containers of one gallon or larger sizes shall be kept in *approved secondary containers.*
  - Break resistant shall mean a container made of metal, plastic, plastic-coated glass or metal overpack of glass.
  - An approved secondary container is a bottle carrier made of rubber, metal, or plastic with carrying handle(s) which is of large enough volume to hold the contents of the chemical container. Rubber or plastic should be used for acids/alkalines; and metal, rubber, or plastic for organic solvents.
- Wastes must be packaged and placed in containers in a manner that will allow them to be transported without the danger of spillage, explosion, or hazardous vapors escaping. Wastes that have not been properly packaged and identified will not be accepted for disposal.

3.14.4 Chemical Identification and Unknown Waste Chemicals

All waste chemicals must be identified by full chemical name, including the proportions of a mixture. Do not use symbols or abbreviations. All containers must be labeled prominently because the safe transportation of chemicals is possible only when everyone who handles the containers knows the identity of the contents.

Every effort should be made by the Faculty Member or his/her designee to identify unknown waste. It is the responsibility of the department to identify all chemicals. The Faculty Member may need to question laboratory personnel, students, and volunteers, or send a sample to an analytical laboratory with the assistance of EH&S, to ascertain the contents of unknown wastes. Laboratory personnel must be constantly reminded to identify and label all wastes and project products. If unknown waste has been discovered and cannot be identified, immediately contact EH&S. Everyone must do their part to identify chemicals.

NOTE: Never Mark a container "UNKNOWN".
Label unknown waste streams with the words "Pending Analysis" and contact EH&S.

3.14.5 Guidelines for Waste Reduction/Management

Procedures for waste disposal should be prepared *before* beginning a project. Waste must be labeled properly. Each department, group, or researcher must properly identify waste materials prior to disposal; inadvertent mixing of incompatible materials could have serious consequences.

Waste minimization is very important to protect the environment and also to reduce the disposal costs charged to the laboratory. The following suggestions should be considered in an effort to minimize the amount of waste generated by the laboratory.

- Only order and store the amount of material needed for the project or experiment.
- Use only the amount of material that is needed for conclusive results.
- Date containers upon receipt and again upon initial opening.
- Before disposing of unwanted, unopened, or uncontaminated chemicals, check with others at Fitchburg State who may be able to use them.
- On termination of a research project, all unused chemicals to be kept by the laboratory shall be labeled and dated. All chemicals for disposal must be in proper containers and labeled with the words *Hazardous Waste*, the chemical name, type of hazard (toxic, ignitable, corrosive, or reactive), and the date when the container is full and/or ready for removal and disposal.

3.14.6 Types of Chemicals and Their Disposal

Regulations prohibit the discharge of most organic solvents into the sewer system. Small amounts of water-soluble, non-flammable materials may be discharged down the drain. Table 3.1 provides a summary of disposal procedures for many chemical types. Consult with EH&S to determine which chemicals can be disposed in this manner.

Table 3.1 Types of Chemicals and Their Disposal	
Chemical Class	Disposal
Organic solvents	• Placed in suitable containers that prevent vapors or liquids from escaping. • Cap tightly. • Prominently label containers. • Disposed as hazardous waste.
Mixtures of organic solvents	• If compatible they can be combined in one container. • Container must have estimated percentages of each solvent in the mixture.
Ether (di-ethyl) in cans	• Do not move it over a year beyond the expiration date or beyond six months from the date of opening. • EH&S must be contacted immediately.
Acids and alkaline solutions	• These may be neutralized and disposed in the drain if they do not contain heavy metals or toxic contaminants. • Concentrated acids and caustics must be treated as hazardous waste. • Store in tightly capped and labeled containers.
Inorganic and organic solids	• If in original containers may be placed in the SAA.
Mercury	• Put broken mercury thermometers into a jar or secondary container. • Clean-up materials from a mercury spill may be placed in a container, labeled, and placed in the SAA. • Mercury-containing compounds must be placed in the SAA.
Cyanide compounds, arsenic, lead, and heavy metal wastes	• Place in bottles or containers. • Seal tightly. • Label and place in the SAA.
Alkali metals (e.g., sodium and potassium)	• Place in a suitable container. • Cover with Nujol® (mineral oil). • Label properly, seal and dispose as hazardous waste and place in the SAA.
Pyrophoric metals (e.g., magnesium, strontium, thorium, zirconium, and other pyrophoric chips and fine powders)	• Place in a metal container. • Seal tightly. • Label properly, seal, and dispose as hazardous waste and place in the SAA.
Waste Oil (e.g., vacuum pump oil or lubricating oils)	• Collect in one-gallon containers or less. • Dispose of as hazardous waste and place in the SAA.

EH&S may be consulted if there is any question concerning the toxicity or packaging of any wastes. EH&S must also be contacted *before* any laboratories are moved, either within Fitchburg State or to another facility.

3.14.7 Universal Waste

A comprehensive universal waste management program is in place at Fitchburg State that includes designated collection and accumulation areas in each of our buildings, annual universal waste management training for our building services staff and an inspection/audit program to ensure we are managing our universal waste in compliance with federal and state regulations.

Fitchburg State operations generate mercury-containing lamps, various types of batteries, and any mercury-containing devices that we replace as part of our mercury-free device initiative. These wastes are classified as universal waste by federal regulations, EPA 40 CFR 273, and

Massachusetts regulations, 310 CMR 30.1000-1082. We partner with a vendor to recycle our universal waste.

3.14.8 Other Types of Wastes—Special Procedures Required

- **Gas cylinders** are to be returned to the proper vendor. Some small lecture bottles are of the non-returnable type and become a disposal problem when empty or near empty with a residual amount of gas. When ordering gases in lecture bottle size, be sure to order the gases in a returnable cylinder. Contact EH&S for assistance.

- **Controlled drugs** to be disposed of as waste must **not** be sent to the waste accumulation area. The handling, records, and disposal of controlled drugs are the responsibility of the department and must be conducted within U.S. Drug Enforcement Agency (DEA) regulations. Contact EH&S for assistance.

- **Biological waste and physically dangerous waste (sharps)** must be placed in proper containers. Contact EH&S for proper disposal procedures.

- **Polychlorinated biphenyls (PCBs)** found in capacitors, transformers, equipment, and oil are the responsibility of the department. Information on possible disposal contractors can be obtained by contacting EH&S.

3.15 MEDICAL SURVEILLANCE

Medical consultations/examinations are coordinated for Fitchburg State employees under the following circumstances:

- Whenever an employee develops signs or symptoms potentially associated with a hazardous chemical to which the employee may have been exposed in the laboratory.

- Where exposure monitoring reveals an exposure level routinely above the OSHA action level or permissible exposure limit for an OSHA-regulated substance requiring such medical monitoring and medical surveillance.

- Whenever an event occurs, such as a chemical spill, leak, or explosion that results in the likelihood of a hazardous exposure.

- Whenever an employee is exposed to human materials such as blood or visibly bloody fluids by a needlestick, cut or splash to exposed skin.

3.16 EXPOSURE REPORTING

Employees who believe they have had an exposure should contact the CHO for evaluation. An Incident Report (Appendix D) should be completed and submitted as soon as possible.

If any employee exhibits adverse health effects, they should contact EH&S immediately or the Emergency Coordinator during off hours. EH&S will evaluate the situation and conduct air sampling, if necessary, to determine actual exposures. The results of all hazard evaluations and any air sampling data will be available to all occupants of the affected areas. The CHO can be contacted directly for information. In addition, the results of any personal air sampling will be given to the employee and kept on file with EH&S.

3.17 EMERGENCY SITUATIONS

Emergencies that may occur in a laboratory include fire, explosion, chemical spill or release, or medical or other health threatening accidents. General procedures to be followed in any emergency are the following:

1. Assist person(s) involved. Remove person(s) from exposure to further injury or a life-threatening situation, if it can be done safely.
2. Notify nearby persons who may be affected and call Campus Police to report the emergency and seek assistance.
3. Evacuate the area until help arrives.
4. Wait for emergency responders and assist them in handling the emergency.
5. Assist in the follow-up investigation of the emergency.

For specific emergencies that may occur in the laboratory space (i.e., chemical spills, fire, explosion, etc.), refer to the specific procedures established by the laboratory. Refer also to Appendix B.

- *Eye contact:* Eyes should be promptly flushed with water for 15 minutes (unless the chemical is water reactive). Medical attention should be sought immediately after flushing.
- *Skin contact*: Contaminated clothing should be removed as quickly as possible and the affected area flushed with water for 15 minutes. Medical attention should be sought immediately after flushing.
- *Cleanup with no injury:* If no one is injured, the cleanup of the spill should begin immediately. For assistance with large spills, call the Fitchburg State Emergency Coordinator. They will contact the appropriate individuals to provide assistance.
- *Cleanup with injury:* If someone is injured, that person should seek medical assistance immediately. Cleanup should be initiated by someone other than the injured person. For

assistance, call Campus Police. They will contact the appropriate individuals to provide assistance.

- Notify EH&S for advice and assistance, and to report spills and injuries no matter how minor.

3.18 EMERGENCY EQUIPMENT

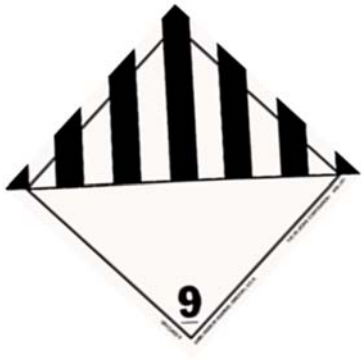
In any emergency, it is critical that all employees are familiar with the use and location of emergency equipment. These include fire extinguishers, fire alarms, safety showers, and eyewash stations.

All emergency equipment is on a preventive maintenance schedule. Fire alarms are tested periodically, and extinguishers are inspected monthly by Facilities. Safety showers are checked quarterly and eyewash stations are tested monthly. Eyewash stations (with adequate drainage) should be purged weekly by the laboratory when possible. Always keep emergency equipment free from obstruction. Fire extinguisher training can be coordinated through EH&S.

3.19 SHIPPING DANGEROUS GOODS

Any Fitchburg State laboratory or entity that sends materials designated as Dangerous Goods to international or domestic recipients must label and package these materials according to the standards of the U.S. Department of Transportation (DOT) and the International Air Transport Association (IATA). There are nine classes of Dangerous Goods recognized by these authorities:

Class	Division	Description
1	1-6	Explosives
2	1-3	Gasses
3	–	Flammable Liquids
4	1-3	Flammable Solids
5	1-2	Oxidizing Substances/Oxidizing Materials
6	6.1, 6.2	Toxic/Infectious Substances
7	–	Radioactive
8	–	Corrosive
9	–	Miscellaneous



Special training and certification is required to send ANY Dangerous Good to ANY domestic or international location, regardless of the method of transportation (aircraft, boat, rail, or motor vehicle). Employees must not ship or receive dangerous goods without the proper training. EH&S offers periodic training to prepare staff to properly prepare packages that contain Class 6.2 Dangerous Goods.

3.20 OVERSIGHT, ANNUAL REVIEW, RECORDKEEPING, COMPLIANCE, AND ENFORCEMENT

Environmental Health and Safety (EH&S) is responsible for establishing and maintaining records for employee training, employee and environmental monitoring, and type and quantity of chemicals stored in the work place.

The **Responsible Faculty Member** (Faculty Member) enforces the CHP by making sure the Chemical Hygiene requirements are known and followed. The CHO advises and assists in this work and helps with documentation.

The **Chemical Hygiene Officer (CHO)** will assist with chemical hygiene and housekeeping inspections. When there are significant changes in existing policies or work practices, an inspection will be conducted soon after the new process is implemented.

The **Chemical Hygiene Officer** annually reviews and updates the CHP, and notifies Faculty Members when any significant changes to the CHP are made.

4.0 LABORATORY STANDARD OPERATING PROCEDURES

Laboratories may insert their individual SOPs in this section.

APPENDIX A

HAZARDOUS PROPERTIES/HEALTH EFFECTS OF CHEMICALS

HAZARDOUS PROPERTIES/HEALTH EFFECTS OF CHEMICALS

Adverse health effects are generally classified into eight categories. The extent of the damage to the body depends on the concentration and duration of the exposure. It is also important to recognize that some chemicals may exhibit more than one toxic property and this must be considered when choosing protective equipment.

1. **Poisons** interfere with vital bodily processes. Examples include the following.
   a. Cyanide ions interfere with tissue oxidation by combining with cytochrome oxidase. Overdose leads to death by chemical asphyxiation.
   b. Arsenic compounds combine with enzyme sulfhydryl groups and interfere with enzymatic action.
   c. Methyl butyl ketone and acrylamide can cause peripheral neuropathy.
   d. Chromates, fluorides, and corrosive gases can be absorbed or particles can act as poisons.
   e. Silica and asbestos are considered poisonous particulates as they form fibrosis (scar tissue formation) in the lung, which then interferes with normal pulmonary functions.

2. **Irritants** cause immediate pain or reddening of exposed areas. The most common sites of exposure are the eyes, skin, throat, and breathing passages. Their major long-term effect is scar tissue formation at the site of injury. Site of action depends on solubility. Examples include the following.
   a. Upper respiratory irritants include soluble gases such as ammonia, hydrogen chloride, and sulfur dioxide.
   b. Upper respiratory/lung tissue irritants include bromine, chlorine, cyanogen bromide, dimethyl sulfate, and ozone.
   c. Lung tissue irritants include poorly soluble agents such as nitrogen dioxide, phosgene, and arsenic trichloride.

3. **Asphyxiants** interfere with oxygen and/or its availability and include the following.
   a. Simple asphyxiants may not normally be dangerous (e.g., nitrogen, argon, helium, or nitrous oxide), but if present in high enough concentrations, can displace oxygen in air and cause suffocation.
   b. Chemical asphyxiants chemically combine with oxygen carrying sites (carbon monoxide) or with oxygen utilization (cyanide).

4. **Anesthetics/narcotics** depress the central nervous system. Many solvents (chloroform, ether) have an anesthetic effect.

5. **Sensitizers** do not harm the body upon first exposures, but upon re-exposure can do so, often at extremely low levels. Response is generally of an allergic nature, with skin, eye, or lung

reactions. Examples are toluene diisocyanate (TDI) used to make urethane materials, epoxy resins, and formaldehyde.

6. **Corrosives** cause rapid death of the body cells they contact. Exposure may cause pain, burning, bleeding, and fluid loss. Acids and bases are corrosives. Bases and some acids may cause pain only after exposure. Any contact with acids or bases requires careful washing with water for at least 15 minutes.

7. **Reproductive Toxins** defines a broad class of chemicals that can:
   a. Affect the reproductive organs (e.g., atrophied testicles, enlarged breasts, etc.)
   b. Affect adult sexual functions (e.g., libido, fertility, menstruation, ovulation, etc.)
   c. Affect the offspring of males or females who were exposed by causing structural abnormality, functional deficiencies, altered growth, or death of the conceptus.

   Some **mutagens** can affect the offspring due to parental exposures before conception takes place.

   Teratogens affect the developing embryo or fetus due to exposures in the womb. Exposure to teratogens during the first three weeks of pregnancy may result in severe damage or death of the embryo. Exposure to teratogens during weeks four through nine may result in birth defects since this is the period of organogenesis. Special precautions may be needed to ensure that exposures do not occur during these critical periods.

8. **Carcinogens** cause cancer, which is the irreversible, uncontrolled growth of cells in an organ or tissue. It is believed that there is no known minimum dose that can remove all danger of cancer. Benzene is a known carcinogen.

When will health effects occur? Another factor that should be considered in evaluating the health hazards of chemicals is *when will the effect occur*, immediately after the exposure or sometime after.

An acute reaction is one that occurs in the body as an immediate response to exposure. Effects are apparent and can often be traced without difficulty. Acute reactions are normally short lived and may be followed by recovery or occasionally cause permanent damage.

Unlike an acute effect, a chronic effect may not be obvious. The onset of symptoms is gradual. It is much harder to trace the cause of a chronic effect, since the exposure could have been as long as 20-30 years before an effect becomes apparent.

APPENDIX B

EMERGENCY RESPONSE FOR LABORATORY ACCIDENTS

EMERGENCY RESPONSE FOR LABORATORY ACCIDENTS

EMERGENCY PROCEDURES IN THE EVENT OF A SERIOUS INCIDENT IN A LABORATORY

It is the policy of Fitchburg State that all occupants are informed and aware of the correct emergency procedures to take in the event of a serious laboratory incident or accident.

Participation in laboratory work may present exposure to potentially hazardous materials or situations. Some of the more serious accidents/incidents that can occur in laboratories include: fire, explosion, chemical spills (toxic or corrosive), release of toxic compressed gases, or failure of power that may adversely affect chemical fume hoods and/or the ventilation system.

While the procedures outlined below tend to be general in nature, there are instances where handling hazardous materials will require that detailed safety procedures be followed (in the event of an accident/incident). Detailed procedures for every possible situation would be too lengthy to be contained in general emergency procedures. Therefore, it is the responsibility of the Responsible Faculty Members and Chemical Hygiene Officer (CHO) to ensure specific emergency procedures and appropriate decontamination methods are available and utilized for all potential hazards associated with materials used within their particular laboratories (i.e., refer to the Fitchburg State Chemical Hygiene Plan). They must also inform and train all laboratory personnel of these specific hazards and procedures. Detailed emergency procedures should be maintained, and procedures should be conspicuously posted in the laboratory. Copies of specific procedures must be sent to Environmental Health and Safety (EH&S) and the Facility Manager.

FIRES INVOLVING ONE OR MORE LABORATORIES

Rescue

- Remove person(s) from fire room, only if you do not put yourself in danger by doing so.
- Close door(s) to the fire room.

Alarm

- Pull the nearest fire alarm **and** call out FIRE and room location.
- Dial the Emergency Coordinator at (978-665-) 3115 (or 911), give the exact location of the fire, and identify yourself.

Contain

- Close doors to all rooms in zone.
- Close smoke/fire doors.

Evacuate

- Move injured persons to safe zones, **when** directed by a responsible person. Prepare for evacuation in accordance with fire plan procedures.

Procedures Specific to Laboratories

Person reporting the fire must alert on scene fire and emergency response personnel of particular hazards (chemical, toxic, radioactive, biological) present in the laboratory of concern.

FAILURE OF POWER INVOLVING CHEMICAL FUME HOODS AND/OR VENTILATION

The failure of electrical power serving chemical fume hoods and/or building ventilation systems in a laboratory building can present a serious and formidable hazard. Emergency procedures should include:

1. Alert the Emergency Coordinator at (978-665-) 3115 immediately of the power failure.
2. Alert the EH&S Office at (978-665-) 3756 and the Emergency Coordinator at (978-665-) 3115 if hazardous or toxic materials are stored in affected area.
3. Close containers and lower sashes on chemical fume hoods.
4. Be prepared to evacuate the building if necessary.

APPENDIX C

CHEMICAL SPILL RESPONSE/
RELEASE OF OTHER HAZARDOUS MATERIALS

CHEMICAL SPILL RESPONSE/RELEASE OF OTHER HAZARDOUS MATERIALS

It is the policy of Fitchburg State that all staff are aware of the correct emergency procedures to take in the event of a chemical spill.

Chemical spills, either toxic or corrosive, even in small quantities can present a potential exposure hazard to Fitchburg State staff.

MINOR CHEMICAL SPILLS

(Unlikely to Produce a Harmful Concentration in the Air)

- Alert people in immediate area of spill.
- Refer to the safety data sheet (SDS) for the spilled chemical, don personal protective equipment, including safety goggles, gloves, and long-sleeved laboratory coats.
- Confine spill to a small area.
- Use appropriate kit to neutralize and absorb inorganic acids and bases. Collect residue, place in container, label, and dispose as chemical hazardous waste.
- For other chemicals, use appropriate spill kit or absorb spill with vermiculite or diatomaceous earth. Collect residue, place in container, label, and dispose of as a chemical hazardous waste.
- Clean spill area with water.
- Contact EH&S at (978-665-) 3756 to report the spill and cleanup efforts.

CHEMICAL SPILLS INVOLVING 1 GALLON OR LESS

(Likely to Produce a Harmful Concentration in the Air)

- Attend to injured or contaminated persons and remove them from exposure, but only do so if you do not place yourself in danger.
- Alert people in the immediate area to evacuate.
- If spilled material is flammable, turn off ignition and heat sources (if you can do so without putting yourself at risk).
- Notify, from a safe location, Environmental Health and Safety (EH&S) at (978-665-) 3756 or the Emergency Coordinator at (978-665-) 3115. The EH&S representative will be contacted to respond to the spill.
- Be prepared to provide the following information:
  - Name of the material spilled.
  - Toxicity and flammability of the material.
  - Quantity of the material spilled.
  - Presence of other chemicals, ignition sources, etc., that could aggravate the problem.
  - Your location and phone extension.

- Close doors to affected area (post a warning sign or secure area to prevent unauthorized personnel from entering the room).
- Ensure that a person knowledgeable of the incident and work area is available to provide information to the emergency response personnel.

CHEMICAL SPILLS GREATER THAN 1 GALLON

- Notify, from a safe location, EH&S at (978-665-) 3756 or the Emergency Coordinator at (978-665-) 3115. If deemed necessary, EH&S will notify the proper agency or outside contractor to respond to the spill.

APPENDIX D

INCIDENT REPORT FORM

INCIDENT REPORT

Location of Incident: _____

Date of Incident: _____ Time of Incident: _____

Date Incident reported: _____ Time Incident Reported: _____

Type of Incident: (circle all that apply)

Spill, Fire, Explosion, Near Incident, Employee Exposure, Other (specify) _____

Investigation Follow-up Responsibility: _____

Names of Investigation Team Members: _____

_____

Describe the incident. Include tasks or operations being performed at the time of the incident.

List the chemical, physical, or biological agent(s) involved.

Determine all potential causes of the incident with descriptions:

Describe any injuries, illnesses, or exposures which may have occurred:

Describe what PPE was used and which hazard controls were operating at the time of the incident:

Describe any Health and Safety Policies which may apply to the incident including emergency response and first aid. Determine if the policies were followed prior to the incident.

Determine when the last training was performed concerning these policies. Determine if the training was received by person(s) involved in the incident.

Determine how the incident could have been prevented:

Determine if similar incidents have occurred in the past:

Describe what actions must be taken to prevent future occurrences.

Determine responsible person(s) for corrective action, e.g. policy revisions, etc. with timetable for completion.

Name: _____

Submitted to: _____

APPENDIX E

EFFECTIVE USE OF GLOVES

EFFECTIVE USE OF GLOVES

REASONS FOR WEARING GLOVES

The hands are the part of the body that will most likely to come into contact with chemicals. Skin contact can result in dermatitis that is caused by a chemical or allergic irritation of the skin. In addition, some chemicals penetrate the skin and can cause illness in other parts of the body. Wearing gloves protects workers from skin irritation and other effects of chemical exposure.

CHOOSING THE RIGHT GLOVES

Safety data sheets (SDSs) may detail appropriate gloves for use with each chemical. In addition, chemical compatibility charts for specific glove materials can be obtained from the glove manufacturer. The chart on the following page is an example of a compatibility chart.

EFFECTIVE USE OF GLOVES

Improper removal of gloves can be a source of contamination. The procedure, which works for thin gloves that may have to be changed often, is as follows:

1. Using the fingers of one gloved hand, pinch the material of the other glove at the base of the palm and peel off the glove.
2. Continue to hold the glove.
3. With the ungloved hand, reach about an inch under the other glove on the palm side of the wrist, pinch, and peel off the other glove.
4. Both gloves have now been removed without skin contact and the contaminated sides of the gloves are facing in.
5. Gloves used with highly toxic materials should be disposed as hazardous waste before leaving the work area.

Studies have shown that up to 5% of new gloves have holes in them. Substances leaking through gloves are held in contact with skin, increasing absorption into the body. Gloves that have been improperly selected or have holes in them can sometimes be worse than no gloves at all. Gloves used for dangerous chemicals can be tested for leaks by filling them with air and immersing them in water. This should not be done with PVA laminated gloves, since they may not be water resistant. If certain types of gloves consistently leak, the manufacturer should be notified.

HAND PROTECTION SELECTION CHART			
Chemical	Excellent	Good	DO NOT USE
Acetaldehyde	None	Natural Rubber, Neoprene	Nitrile, PVA, PVC
Acetic acid, glacial	Neoprene	Natural Rubber, Nitrile	PVA, PVC
Acetone	None	Natural Rubber, Neoprene	Nitrile, PVA, PVC
Benzene	None	PVA	Natural Rubber, Neoprene, Nitrile
Butanol	Natural Rubber, Neoprene, Nitrile	PVC	PVA
Butyl cellosolve (2-ethoxyethanol)	Neoprene, Nitrile	Natural Rubber	PVA, PVC
Butyl acetate	PVA	Nitrile	Natural Rubber, Neoprene, PVC
Cellosolve (2-ethoxyethanol)	Neoprene	Nitrile	Natural Rubber, Neoprene, PVC
Chloroform	PVA	None	Natural Rubber, Neoprene, Nitrile, PVC
Ethyl acetate	None	Natural Rubber, Neoprene, PVA	Nitrile, PVC
Ethylene glycol	Natural Rubber, Neoprene, Nitrile, PVC	None	PVA
Formaldehyde (>10%)	Nitrile	Natural Rubber, Neoprene, PVC	PVA
Hexane	Neoprene, Viton	PVA	Natural Rubber, PVC
Isoproponal	Natural Rubber, Nitrile, Viton	PVC	PVA
Methanol	Natural Rubber, Neoprene	PVC	PVA
Methylene chloride	None	PVA, Viton	Natural Rubber, Neoprene, PVC
Methyl ethyl ketone	None	Natural Rubber, PVA	Neoprene, Nitrile, PVC
Methyl isobutyl ketone	None	Natural Rubber, PVA	Neoprene, Nitrile, PVC
Mineral spirits	Nitrile, PVA	Neoprene	Natural Rubber, PVC
Nitric acid (70%)	Neoprene	PVC	Natural Rubber, Nitrile, PVA
Perchlorethylene	PVA, Viton	None	Natural Rubber, Neoprene, PVC
Sodium hydroxide	Natural Rubber, Neoprene, Nitrile	PVC	PVA
Sulfuric acid (95%)	PVC	Neoprene	Natural Rubber, Nitrile, PVA
Toluene	Viton	PVA	Natural Rubber, Neoprene, PVC
1,1,1-Tirchloroethane	PVA	None	Natural Rubber, Neoprene, PVC
Xylene	PVA, Viton	None	Natural Rubber, Neoprene, PVC

PVA polyvinyl alcohol
PVC polyvinyl chloride

APPENDIX F

INCOMPATIBLE CHEMICALS IN STORAGE AND REACTIONS

INCOMPATIBLE CHEMICALS—IN STORAGE AND REACTIONS

Acetic acid:	with chromic acid, nitric acid, ethylene glycol, perchloric acid, peroxides, and permanganates.
Acetone:	with concentrated sulfuric and nitric acid mixtures.
Acetylene:	with copper (tubing) fluorine, bromine, chlorine, iodine, silver, mercury, and their compounds.
Alkali metals:	such as calcium, potassium, and sodium with water, carbon dioxide, carbon tetrachloride, and other chlorinated hydrocarbons.
Ammonia, anhydrous:	with mercury, halogens, calcium hypochlorite, hydrogen fluoride.
Ammonium nitrate:	with acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, and finely divided organics or combustibles.
Aniline:	with nitric acid and hydrogen peroxide.
Bromine:	with ammonia, acetylene, butadiene, butane, hydrogen, sodium carbide, turpentine, and finely divided metals.
Carbon:	activated with calcium hypochlorate, all oxidizing agents.
Chlorates:	with ammonium salts, acids, metal powders, sulfur, finely divided organics, combustibles, or carbon.
Chromic acid:	with acetic acid, naphthalene, camphor, alcohol, glycerine, turpentine, and other flammable liquids.
Chlorine dioxide:	with ammonia, methane, phosphine, and hydrogen sulfide.
Chlorine:	with ammonia, acetylene, butadiene, benzine, and other petroleum fractions; hydrogen, sodium carbide, turpentine, and finely-divided powdered metals.
Copper:	with acetylene and hydrogen peroxide.
Cyanides:	with acids and alkalies.
Flammable liquids:	with ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, and halogens.
Hydrogen peroxide:	with copper, chromium, iron, most metals or their respective salts, flammable fluids and other combustible materials, aniline, and nitromethane.
Hydrogen sulfide:	with fuming nitric acid and oxidizing gases.
Hypochlorites:	with acids and activated carbon.
Iodine:	with acetylene, ammonia (aqueous or anhydrous), and hydrogen.

Mercury:	with acetylene, fulminic acid, and ammonia.
Nitrates:	with sulfuric acid.
Nitric acid:	with acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen (concentrated) sulfide, flammable liquids, flammable gases, copper, brass, and any heavy metals.
Nitrites:	with acids.
Nitroparaffins:	with inorganic bases and amines.
Oxalic acids:	with silver and mercury.
Oxygen:	with oils, grease, hydrogen, flammable liquids, solids, or gases.
Perchloric acid:	with acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, and oils.
Peroxides, organic:	with acids, (organic or mineral), avoid friction, store cold.
Phosphorous (white):	with air, oxygen, alkalis, and reducing agents.
Potassium:	with carbon tetrachloride, carbon dioxide, and water.
Potassium chlorate:	with sulfuric and other acids.
Potassium perchlorate (see also chlorates):	with sulfuric and other acids.

Potassium permanganate: with glycerol, ethylene glycol, benzaldehyde, and sulfuric acid.

Selenides:	with reducing agents.
Silver:	with acetylene, oxalic acid, tartaric acid, ammonium compounds, and fulminic acid.
Sodium:	with carbon tetrachloride, carbon dioxide, and water.
Sodium nitrite:	with ammonium nitrate and other ammonium salts.
Sodium peroxide:	with ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, and furfural.
Sulfides:	with acids.
Sulfuric acid:	with potassium chlorate, potassium perchlorate, and potassium permanganate (similar compounds of light metals, such as sodium, lithium).
Tellurides:	with reducing agents.

SAFE CHEMICAL STORAGE

1. ACIDS

- Store large bottles of acids on low shelves or in acid cabinets.
- Segregate oxidizing acids from organic acids, flammables, and combustible materials.
- Segregate acids from bases and active metals such as sodium, potassium, etc.
- Use a bottle carrier for transporting acid bottles.
- Have spill control pillows or acid neutralizers available in case of spill.

Strong Oxidizing Acids

Chromic acid	Iodic acid	Perchloric acid
Hydrobromic acid	Nitric acid	Sulfuric acid

Organic Acids

Acetic acid	Benzoic acid	Phenol	Trichloracetic acid

2. BASES

- Segregate bases from acids.
- Store solutions of inorganic hydroxides in polyethylene containers.
- Have spill control pillows or caustic neutralizers available for spills.

Ammonium hydroxide	Carbonates	Potassium hydroxide
Bicarbonates	Calcium hydroxide	Sodium hydroxide

3. FLAMMABLES

- Store in approved safety cans or cabinets.
- Segregate from oxidizing acids and oxidizers.
- Keep away from any source of ignition, flames, heat, or sparks.
- Know where firefighting equipment is stored and how to use.
- If volatile flammable liquids are stored in a refrigerator, they must be in an explosion-proof (lab-safe) refrigerator.

Flammable Solids

Benzoyl peroxide	Calcium carbide	Phosphorous, yellow	Picric acids

Flammable Gases

Acetylene	Ethane	Formaldehyde	Propane
Ammonia	Ethyl chloride	Hydrogen	Propylene
Butane	Ethylene	Hydrogen sulfide	
Carbon monoxide	Ethylene oxide	Methane	

4. OXIDIZERS

- Store in a cool, dry place.
- Keep away from flammable and combustible materials, such as paper or wood.
- Keep away from reducing agents such as zinc, alkaline metals, formic acid.

Oxidizers—Solids

Ammonium dichromate	Nitrates
Ammonium perchlorate	Periodic acid
Ammonium persulfate	Permanganic acid
Benzoyl peroxide	Peroxides, salts of
Bromates	Potassium dichromate
Calcium hypochlorite	Potassium ferricyanide
Chlorates	Potassium permanganate
Chromium trioxide	Potassium persulfate
Ferric trioxide	Sodium chlorite, hypochlorite
Ferric chloride	Sodium dichromate
Iodates	Sodium nitrate
Iodine	Sodium perborate

5. PYROPHORIC SUBSTANCES

These ignite spontaneously on contact with air. Store in cool, dry place.

Boron	Diborane	Manganese*
Cadmium	Dichloroborane	Nickel*
Calcium	2-Furaldehyde	Phosphorous, Yellow*
Chromium*	Iron*	Titanium*
Cobalt*	Lead*	Zinc*

* Finely divided metals form a pyrophoric hazard.

6. LIGHT SENSITIVE CHEMICALS

- Avoid exposure to light.
- Store in amber bottles in a cool, dry place.

Bromine	Oleic acid
Ethyl ether	Potassium ferricyanide
Ferric ammonium citrate	Silver salts
Hydrobromic acid	Sodium iodide
Mercuric salts	Mercurous nitrate

7. CARCINOGENS

- Label all containers as Cancer Suspect Agents.
- Store according to hazardous nature of chemicals (e.g., flammable, corrosive).
- When necessary, store securely.

Antimony compounds	Acrylonitrile
Arsenic compounds	Benzene
Benzidine	Chloroform
Beryllium	Dimethyl sulfate
Cadmium compounds	Dioxane
Chromates, salts of	Ethylene dibromide
Beta-Naphthylamine	Hydrazine
Vinyl chloride	Nickel carbonyl

APPENDIX G

COMMON REACTIVE LABORATORY CHEMICALS

COMMON REACTIVE LABORATORY CHEMICALS

PEROXIDE FORMERS

To determine age:

- ***Look for dates when received and opened***
- ***Look at expiration date***
- ***Look for visible crystal formation***

Examples Include:

- Isopropyl ether
- Ethyl ether
- Tetrahydrofuran
- Dioxane

SHOCK SENSITIVE

Look for:

- ***Contamination***
- ***Age***
- ***Metal capped containers***
- ***Dry compounds***
- ***Discoloration***

Examples Include:

- Dipicrylamine
- Picric acid (Trinitrophenol)
- Sodium azide
- Other polynitrated compounds

COMPOUNDS NOT LIKELY TO DEGRADE:

WATER REACTIVES

Examples Include:

- Sodium hydride
- Lithium metal
- Sodium metal
- Borohydrides

TEMPERATURE SENSITIVE

Examples Include:

- Azobis-compounds
- Organic peroxides (i.e., benzoyl peroxide)
- Cumene hydroperoxide
- Methyl ethyl ketone peroxide

AIR REACTIVE (PYROPHORICS)

Examples Include:

- Methyl lithium
- Phosphorous metal
- Metal dusts
- Butyl lithium

APPENDIX H

CHEMICAL STORAGE GUIDELINES

CHEMICAL STORAGE GUIDELINES

The following information is designed to aid in proper chemical storage in the Fitchburg State laboratories. Chemicals are to be stored according to the following hazard classes. Storing all classes together alphabetically is prohibited. Chemicals may be organized alphabetically once they are segregated according to hazard class.

Oxidizers: Incompatible with **flammables** and organics.
Common Oxidizers—ammonium persulfate, silver nitrate, silver nitrite, hydrogen peroxide, potassium permanganate, sodium dichromate.

Toxic: Poisons
Common Toxics—arsenic compounds, cyanides, osmium tetroxide, formaldehyde, formalin, naphthalene, chloroform, acrylamide.

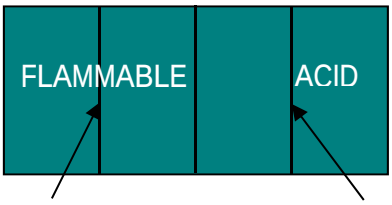
Flammables: Incompatible with **oxidizers**. Ignitable/flammable chemicals must be stored in a **flammable cabinet**. Flammable chemicals requiring refrigeration must be stored in a refrigerator rated for flammable storage.
Common Flammables—ethanol, methanol, acetone, benzene, ethyl acetate, butanol, alcohols, furans, toluene, Sigmacote, TEMED, paraformaldehyde (flammable solid)

Corrosive: Three kinds of Corrosives: **Bases, Organic Acids, and Inorganic Acids.** All 3 of these corrosives have this pictogram; however, must be separated from each other.
Common Bases—sodium hydroxide, potassium hydroxide, developer.
Common Organic Acids—acetic acid, glacial acetic acid, phenol, formic acid.
Common Inorganic Acids—sulfuric acid, hydrochloric acid, perchloric acid, nitric acid, chromic acid.

Irritants: chemicals producing irritation. Often, the majority of chemicals in a dry chemical storage area in Fitchburg State laboratories.
Common Irritants—sodium carbonate, sodium bicarbonate, Trizma, putrescine, antifoam.

Chemical Storage Shelving Example

Chemical Fume Hood Cabinet



Flammable Storage

Corrosive Storage – Segregate inorganic acids, organic acids, and bases.

APPENDIX I

CLEARANCE FORM FOR DEPARTING PERSONNEL

CLEARANCE FORM FOR DEPARTING PERSONNEL

Fitchburg State will not clear laboratory personnel for departure unless this form is completed and returned to the Environmental Health and Safety Office. The clearance process should be initiated at least one month prior to the separation date. Principal users that have active protocols in their name should notify the Environmental Health and Safety Office at least 60 days prior to separation.

Name: _____

Department: _____

Date: _____

Department Chairperson: _____

Are you a principal user for any protocols? ☐ Yes ☐ No

All hazardous waste generated during my work or research has been disposed of properly via Fitchburg State hazardous waste policies. Research samples, chemical solutions, and unused chemicals that are to be retained in the laboratory have been properly labeled with compound name, amount, and date (include isotope and activity for radioactive material). These materials have been turned over to the following individual(s)

_____

_____

_____

Who will serve as custodian(s)? The custodian(s) is responsible for the care and the disposal of all transferred materials.

_____

_____

Departing Personnel Signature

_____

Custodian's Signature(s)