UNIVERSITY of WISCONSIN
GREEN BAY

Chemical Hygiene Plan 2019

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Purpose

The purpose of this Chemical Hygiene Plan is:

- To comply with the OSHA Occupational Exposure to Hazardous Chemicals in Laboratories Standard, 29 CFR 1910.1450 (referred to as the Laboratory Standard in the remainder of this document).

Labs meeting the following four criteria are subject to the Laboratory Standard:

- Chemical manipulations are carried out on a laboratory scale. That is, chemical containers are of a size that could be easily and safely manipulated by one person.
- Multiple chemical procedures are used.
- The procedures involved are not part of a production process, nor in any way simulate a production process.
- Protective laboratory practices and equipment are available and commonly used.

Most research and teaching laboratories at UW Green - Bay meet these criteria and fall under the scope of the 29 CFR 1910.1450. 29 CFR 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories Standard, shall serve as the legal authority and be referred to when interpreting specific requirements not otherwise written in this plan. The following UW - Green Bay departments are covered by the Laboratory Standard and this Chemical Hygiene Plan: Natural and Applied Sciences, Human Biology and the Resch School of Engineering.

This plan will be available to all employees and students for review upon request. Printed copies will be located in the following areas:

- Natural and Applied Science Office, LS455
- Human Biology Office, LS 455
- Laboratory Science Stock Room, LS 204J
- Safety Manager, CL 720

This plan shall be reviewed annually and updated as necessary by the CHOs and Safety Manager.

Terminology

The following terms are used in the UW - Green Bay Chemical Hygiene Plan:

- "CHO" shall refer to the UW - Green Bay Chemical Hygiene Officers who have been delegated overall responsibility for implementation of this Chemical Hygiene Plan.
- "Laboratory Standard" shall refer to 29 CFR 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories Standard.
- "Laboratory supervisor" shall refer to any individual who supervises employees or has students working under their direction in a UW - Green Bay laboratory covered by the Laboratory Standard. This will include:
    - Department chair who supervises faculty in their area.
    - Laboratory managers who supervise student workers in their work area.
    - Laboratory instructors who supervise students in instructional labs.
    - PIs and researchers who supervise employees, student workers, and/or students conducting research in their work area.

    - Supervisors of non-laboratory employees who work in Laboratory Science Building (e.g. custodial and maintenance staff).
- "PEL" is the permissible exposure limit or threshold limit value as listed in 29 CFR 1910.1000, July 1, 1992 edition. These are the exposure limits currently enforced by Wisconsin Department of Safety and professional Services under SPS 332.35(1).

Enforcement and Authority

UW - Green Bay Chancellor has delegated authority to oversee implementation of this Chemical Hygiene Plan to the UW - Green Bay Chemical Hygiene Officers.

Issues concerning potential violation of laboratory safety policy and regulations shall be reported through normal reporting lines. Employee shall first report issue to their supervisor. If issue cannot be resolved, the supervisor shall report issue to CHO for resolution.

The CHOs have authority to enforce corrective actions for violations of policy and regulations. If violations cannot be resolved, a discrepancy notice shall be issued and sent to the area Chair, then Dean, then Provost and then Chancellor as needed for action.

The CHO and laboratory supervisors have the authority to suspend laboratory operations in part or in whole if deficiencies in laboratory procedures or equipment pose a significant safety threat.

The UW - Green Bay Facility project manager has the authority to stop work being completed by an outside contractor if the work poses a danger to UW - Green Bay staff and students in the area. This authority is limited to projects under the direction of the UW - Green Bay Facilities Management. A UW - Green Bay employee who observes outside contractor actions which potentially pose a danger to UW - Green Bay staff and students in the area shall immediately report conditions to their supervisor or the UW - Green Bay Facilities project manager for action.

Responsibilities

University Administration

The Chancellor, Provost, Vice Chancellor for Business and Finance, deans and department chairs are responsible for ensuring that individuals under their management have the training, authority and resources needed to implement policies and procedures outlined in this Chemical Hygiene Plan.

See Appendix A for list of key UW - Green Bay personnel.

Chemical Hygiene Officers

- Be familiar with all aspects of the Chemical Hygiene Plan.
- Have primary responsibility for implementation and maintenance of the Chemical Hygiene Plan.
- Assist in annual review and update of Chemical Hygiene Plan.
- Receive and review Incident Reports.
- Assist in conducting periodic lab inspections.
- Enforce corrective actions for violations of policy or regulations.
- Suspend unsafe operations if warranted.
- Review and approve use of particularly hazardous substances and operations that require prior approval. Facilitate PHS process and completion of necessary compliance steps. Be familiar with regulatory requirements for work with PHS.

- Participate in planning stages for all work projects that will impact safe use of chemicals in laboratories covered by the Laboratory Standard upon request.

Safety Manager

- Be familiar with all aspects of the Chemical Hygiene Plan.
- Assist in annual review and update of Chemical Hygiene Plan.
- Provide technical support to Chemical Hygiene Officers as requested.
- Investigate laboratory accidents reported on Incident Report forms.
- Conduct annual fume hood face velocity testing. Issue reports and retain records.
- Conduct air quality monitoring in laboratories when requested. Results of air quality monitoring will be sent to the CHOs.
- Conduct periodic lab inspections with the CHOs.
- Upon request, review new experiments and provide recommendations for engineering controls, administrative controls and personal protective equipment.
- Provide assistance to departments in developing and delivering necessary laboratory safety training.
- Participate in planning stages for all work projects that will impact safe use of chemicals in laboratories covered by the Laboratory Standard upon request.
- Assist in proper disposal of hazardous waste.

Laboratory Managers

- Maintain instructional laboratory and stockroom chemical inventories.
- Update inventories.
- Maintain inventories using safety storage methods.
- Ensure all hazardous chemical containers are correctly labeled.
- Maintain SDSs for all chemicals in their inventory.
- Properly dispose of all waste generated in instructional laboratories.
- Coordinate and document weekly flushing of eye wash stations in instructional laboratories.

Department/Area Chairs

- Be familiar with all aspects of the Chemical Hygiene Plan.
- Have overall responsibility for implementation and compliance with Chemical Hygiene Plan.
- Enforce corrective actions for violations of policy or regulations as needed.
- Ensure that all employees in their area receive the required laboratory safety training.

Laboratory Supervisors (see definition in Terminology)

- Be familiar with all aspects of the Chemical Hygiene Plan.
- Attend required training. Ensure students and employees under their supervision receive required training.
- Maintain safe standard operating procedures in area under their supervision.
- Maintain Safety Data Sheet file for all hazardous substances stored and used in their area – this applies to personal research areas.
- Ensure all hazardous substance containers in their area are properly labeled.
- Ensure proper disposal of all waste including hazardous waste.
- Maintain acceptable housekeeping in their area.

- Ensure employees in their area use appropriate personal protective equipment as needed including eye and glove protection.
- Will not permit laboratory operations to continue if ventilation is judged to be inadequate for the procedure being conducted.
- Promptly file an accident/incident report with the CHOs and Safety Manager if an accident or spill should occur.
- Promptly report any safety equipment maintenance issues to Facilities.
- Individuals with assigned personal research areas: coordinate and document weekly flushing of eye wash stations.

Facilities Management

- Safety equipment responsibilities
- Semi-annual flushing of body showers
- Coordinate annual fire extinguisher pressure checks
- Required fire alarm testing
- Response to safety equipment and building operation concerns
- Provide advance notification of pending projects that may impact laboratory operations to the CHO. Include the CHO or Safety Manager in the planning stages of the project.

Public Safety

- Monthly visual inspections of fires extinguishers

Employees and Students: all individuals who work in any capacity in UW - Green Bay laboratories must:

- Comply with all safety rules specified in this CHP.
- Wear personal protective equipment as directed.
- Ensure containers are properly labeled.
- Comply with waste disposal guidelines.
- Promptly report any equipment malfunctions.
- Promptly report any chemical spills or first aid incidents and complete an Incident Report Form if indicated.
- Know location of safety equipment and how and when equipment should be used.
- Know UW - Green Bay emergency procedures.
- Know the hazards of the chemicals they work with by referring to labels and Safety Data Sheets. Ask supervisor if there are any questions or further clarification is needed about the hazards of the chemicals they work with.
- Complete required safety training.

Hazard Identification

Labels

Laboratory supervisors are responsible for ensuring that all chemical containers in their work area are labeled in accordance with this section.

Container labels provide valuable health and safety information for hazardous substances. Vendors are responsible for ensuring that their products are delivered with the proper labeling. At a minimum, proper

labeling means a label that meets requirements as defined in Hazard Communication 29 CFR 1910.1200 (f)(1) and includes the following information: identity of hazardous chemical(s), appropriate hazard warning, and name and address of chemical manufacturer, importer or other responsible party. UW - Green Bay shall not accept delivery of a product that does not meet minimum labeling requirements.

The labels shall be maintained in a legible condition. Manufacturer's labels shall not be defaced or removed unless the container is immediately labeled with the required information. Any container without a label or with an illegible label shall be reported to the supervisor immediately.

Appropriate hazard warning is defined as words, pictures, symbols, or combination thereof, which provide at least general information regarding the hazards of the chemicals, and which in conjunction with other information immediately available to employees under the hazard communication program, will provide employees with the specific information regarding the physical and health hazards of the hazardous chemical, including any target organ effects, of the chemicals in the containers. The hazard warning may require a brief statement of the physical and health hazard effects of the chemical (i.e. "flammable," "causes lung damage"). Information provided on the manufacturer label or SDS should be used when developing secondary labels.

Portable containers that are for immediate use by one person during one class period or shift are not required to be labeled. To be defined as a portable container, the container cannot be used for storage nor can it be transferred to another person without passing on the chemical's name and hazard.

Hazardous waste containers shall have the contents, date of generation, and generators name listed on its label. Additional information which will aid in proper waste disposal should also be included on the label if known.

Safety Data Sheets

Laboratory managers shall maintain a Safety Data Sheet file for all hazardous chemicals in the Laboratory Science stockroom and those used in instructional laboratories. Laboratory supervisors (PIs and research advisors) assigned responsibility for personal research space shall maintain a Safety Data Sheet file for all hazardous chemicals in the assigned research area. Safety Data Sheets shall be readily available to employees and students during all work shifts.

The Safety Data Sheet shall be kept on file for thirty years after the chemical was last on campus. Outdated or discontinued Safety Data Sheets shall be archived.

Chemical Inventories

A current inventory of all hazardous chemicals used and stored in UW - Green Bay laboratories shall be maintained by departments with laboratory operations. Laboratory managers shall maintain inventories for the Laboratory Science stockroom and chemicals used in instructional laboratories. Supervisors (PIs and research advisors) assigned responsibility for personal research space shall maintain an inventory of all hazardous chemicals in their assigned area. Chemicals are to be identified by the name that appears on the label and the Safety Data Sheet for that substance.

Signage

The following signage shall be posted:

- Emergency procedures and telephone numbers
- Location signs for safety showers, eyewash stations, other safety and first aid equipment if not readily visible from all parts of the laboratory.
- Signage on refrigerators where food storage is not allowed.
- Labeling on food stuff that is not intended for human consumption.
- Caution signs indicating special or unusual hazards shall be posted as necessary and deemed appropriate by the laboratory supervisor, CHO or Safety Manager. Chemicals likely requiring signage are particularly hazardous substances as discussed in Appendix D.

Control Measures to Reduce Exposure to Hazardous Chemicals

Engineering Controls

Ventilation

Adequate ventilation is essential for maintaining safe levels of exposure. All laboratories located in the Laboratory Science Building have dilution ventilation providing 100% exhaust. Laboratories are at negative pressure to hallways. It is the responsibility of the laboratory supervisor to discontinue laboratory operations if ventilation is judged to be inadequate for any reason.

Chemical Fume Hoods

Fume hoods shall be used for all operations which have the potential to produce air contaminants exceeding the Permissible Exposure Level (PEL) or Threshold Limit Value (TLV) as listed in 29 CFR 1910.1000, July 1, 1992 edition.

In general, fume hoods shall not be used as chemical storage areas. Storing materials in fume hoods reduces their efficiency, and could lead to inadvertent mixing of incompatible chemicals. Long range chemical procedures and experiments are allowed in fume hoods as required and are not considered storage. Items in hoods should not be placed directly in front of air vents. Fume hoods shall be kept orderly and follow good housekeeping practices.

Fume hoods located in the Laboratory Science building operate continuously and are on a continuous monitor alarm system.

Fume hoods shall be checked annually by the Safety Manager using a separate meter to confirm minimum rates. Deficiencies will be reported to UW - Green Bay Facilities Management for repair. Ventilation for laboratory fume hoods shall follow WI SPS 332.24(6) which requires a minimum average 100 feet per minute face velocity at full open sash or sash stop position. When determining the minimum flow rate through the fume hood, the sash stop position may not be lower than 18 inches above the work surface. Inspection results shall be posted on each fume hood. Fume hoods with inadequate face velocities or other serious problems shall be prominently marked and taken out of service until repaired.

See Appendix G for additional information on fume hoods including user guidelines.

Biosafety Cabinets

Several biosafety cabinets are located in Laboratory Science Building. The Chair of Human Biology is responsible for coordinating testing as required. See Appendix G for additional information on biosafety cabinets.

Air Quality Monitoring

Air quality monitoring for hazardous air contaminants will be conducted as deemed necessary in consultation with the Chemical Hygiene Officer and the Safety Manager.

Administrative Controls

Standard Operating Procedures

Standard operating procedures (SOPs) for UW - Green Bay laboratories are found in Appendix B. These SOPs apply to all laboratory operations in UW - Green Bay laboratories.

Laboratory supervisors are responsible for maintaining safe SOPs in laboratories under their supervision.

Particularly Hazardous Substances

Provisions for additional employee protection for work with particularly hazardous substances (PHSs) as defined by 1910.1450 (e)(3)(viii) have been established. For the purposes of UW-Green Bay's Chemical Hygiene Plan, PHS include:

- Carcinogens
- Reproductive toxins
- Substances with high degree of acute toxicity
- Reactive and explosive chemicals

Individuals must receive pre-approval before beginning work with a PHS. The pre-approval process starts with completion and submission of the Particularly Hazardous Substance Approval form. The CHO is responsible for reviewing and approving use of PHSs. Requirements for additional employee protection for work with PHS will include:

- Establishment of a designated area
- Use of containment devices such as a fume hood or glove box
- Procedures for safe removal of contaminated waste; and
- Decontamination procedures

Responsibility for identifying PHS and complying with the established approval process ultimately rests with faculty, PI or lab instructor. See Appendix D for additional information on UW - Green Bay policy for work with PHS and for a copy of the Particularly Hazardous Substance Approval form.

Prior Approval

The laboratory supervisor in consultation with the CHO and the Safety Manager is responsible for identifying lab operations which may require prior approval.

In general, the following will require prior approval:

- When it is likely that toxic limit concentrations could be exceeded or that other harm is likely
- Procedures using PHSs, radioactive or biohazardous substances

- First-time use of a particular piece of laboratory equipment which has a substantial chemical, physical or biological risk associated with its use.
- Use of volatile substance in cold room, warm rooms or other rooms with limited ventilation.
- When working alone in laboratories/ buildings with significant hazardous substances and operations
- Those involving unattended operation.

Chemical Storage

Chemical inventories shall be kept to a minimum in working laboratories. Chemicals shall be stored in a safe manner utilizing, for example, chemical storage cabinets for corrosives and flammables. Chemicals shall be segregated by chemical characteristics to avoid incompatibilities. Alphabetical storage may be used only if chemical characteristics are compatible. Secondary containment or other segregation options may be necessary to address compatibility concerns when storage is not adequate. Secondary containment is also a valuable tool to prevent spills.

Chemical containers shall be kept capped when chemicals are not being withdrawn, added or otherwise utilized. This includes hazardous waste containers.

Adequate security for chemical storage areas is essential to minimize the possibility of theft or unauthorized entry. Labs shall be locked when a competent individual is not present. Competent individuals shall be those persons trained by a supervising faculty/staff member or PI to perform their work safely, recognize hazards and take appropriate action in an emergency. Access to laboratories in the Laboratory Science Building is by key or electronic card access system. Laboratory supervisors shall ensure individuals meet competent person qualifications before requesting a room key or card access privileges to a laboratory under their control. The faculty advisor or course instructor has authority to grant card access.

The laboratory supervisor is responsible for maintaining compatible chemical storage in their area. The CHO and Safety Manager will provide assistance with establishing appropriate chemical storage schemes upon request.

Housekeeping

All laboratories shall be maintained at a satisfactory level of orderliness and cleanliness

- Chemicals and equipment that are not in use and may pose an imminent danger must be stored or disposed of.
- Walkways and exit routes must be free of obstructions.
- Access to safety equipment must be free of obstructions.
- Benches and active work spaces should be organized, leaving adequate workspace for safe work practices.
- No chemical storage above 6 feet from the floor.
- Chemical spills must be cleaned up promptly.
- A 36” clearance shall be maintained around and in front of electrical panels.

Laboratory supervisors are directly responsible for maintaining acceptable housekeeping in his/her work area. An audit of housekeeping will be included in the periodic lab audit.

Emergency Procedures

A copy of the UW - Green Bay Emergency Guide is found in Appendix I.

An abbreviated version of UW - Green Bay Emergency Guide will be posted near the exit doors of laboratories.

UW - Green Bay employees covered by the Laboratory Standard will receive training on emergency procedures. Laboratory supervisors are responsible for educating students concerning emergency procedures as outlined in the UW - Green Bay Emergency Guide.

Laboratory supervisors are also responsible for informing students and visitors of an emergency and for initiating emergency procedures when needed.

Incident Reports

Any event which requires a first aid response, activation of eye wash or body shower, activation of fire alarm, use of fire extinguisher and/or spill response requiring outside assistance must be reported using the UW - Green Bay Incident Report form found in Appendix C. Completed form shall be submitted to the CHO with a copy sent to the Safety Manager.

Chemical Spills

The cleanup of a spill must only be performed by knowledgeable and experienced personnel. Spill kits with absorbents, reactants and personal protective equipment are available for cleanup of minor spills. A minor spill is one that the laboratory staff is capable of handling safely without the assistance of safety and emergency personnel.

All other chemical spills are considered a major spill. In the event of a major spill, remove all persons from the area, close doors to affected area and call 911. Be prepared to provide the dispatcher with the exact location of the spill, the chemical name and amount spilled, and the actions taken by laboratory staff to isolate the spill. See Appendix H for additional information.

Laboratory Audits

The CHOs and Safety Manager shall conduct periodic audits of all UW - Green Bay laboratories covered by the Laboratory Standard. If possible, inspections shall be conducted while the laboratory is in use so that the operating procedures will be verified as being followed by all personnel and students. Inspection results and checklists used shall be communicated to the laboratory supervisor of the work area inspected after completion of the inspection. Inspection results shall also be copied to area department chair.

Hazardous Waste Management

All hazardous waste shall be disposed of according to WI Department of Natural Resources Hazardous Waste Administrative Rules and Statutes. The Safety Manager will provide assistance with waste characterization and will arrange all hazardous waste disposal through the UW - Green Bay Hazardous Waste Program. Contact the Safety Manager, 465-2273, for questions regarding disposal of hazardous waste. See Appendix J for UW - Green Bay Hazardous Waste Program.

Personal Protective Equipment

When working with hazardous chemicals, routine personal protective equipment may include a laboratory coat (or equivalent), appropriate gloves and protective eye wear. Special procedures may require special protective equipment on a case by case basis. For example, gloves, made of chemically

compatible material, should be worn with strong corrosives or with particularly hazardous substances as applicable. If such procedures are routinely encountered, they should be included in the standard operating procedures for the department.

Departments shall assess the laboratories to determine if hazards are present or are likely to be present which necessitate the use of personal protective equipment.

The laboratory supervisor is responsible for ensuring that all employees who wear PPE in laboratories receive required training and document training provided.

Defective or damaged personal protective equipment shall not be used.

When selecting PPE, it is critical that the PPE selected is compatible and rated properly for the specific chemical. There may be multiple sources that need to be investigated to find the proper PPE for the given application. All PPE that has limitation and ratings disclaimers must be reviewed.

Eye Protection

All UW Green - Bay employees and students shall use appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors and potentially injurious light radiation.

The employee's supervisor is responsible for ensuring appropriate eye protection is provided at no cost to the employee based on an assessment of exposure hazards. The Safety Manager will provide assistance with completing a hazard assessment and provide training upon request. Training documentation will be retained by the laboratory supervisor and copied to the Safety Manager.

University departments with instructional and/or research laboratories shall determine what type of eye protection is required for students enrolled in each instructional lab and for students conducting research in University laboratories. Students will be responsible for purchasing required eye protection.

Laboratory supervisors shall ensure that employees and students in their work area wear appropriate eye protection for the task being performed and shall ensure the employees and/or students who are not wearing the correct eye protection are removed from the laboratory until eye protection is available and they are able to comply.

See Appendix E, UW - Green Bay Eye Protection Policy, for additional information.

Glove Protection

Determination of the need for glove protection shall be made on the basis of a hazard assessment that considers the chemical, chemical concentration, potential of harm to chemical exposure and use conditions. Special procedures may require glove protection. The review process for work with PHS shall include a glove requirement assessment.

Laboratory supervisors are responsible for determining if and what type of glove protection is required in their work area. The Safety Manager will provide assistance with the glove assessment process upon request.

See Appendix F, Glove Use and Selection in UW - Green Bay Laboratories, for additional information on the glove selection process and resources available.

Respirators

Respirators may only be worn when engineering controls cannot keep exposure to chemicals below PELs currently enforced by the WI Department of Commerce. Consult with the Safety Manager when considering use of a respirator. Employees may not wear a respirator until they have completed required elements of the UW - Green Bay Respiratory Protection Program administered by the Safety Manager.

Additional PPE may be required (e.g. lab coat) based on a hazard assessment of the procedure.

Safety Equipment

Fume hood face velocities shall be checked annually by the Safety Manager. A label shall be placed on the fume hood documenting annual certification. Maintenance issues shall be reported to Facilities Management for remediation.

Biosafety cabinet certification will be coordinated by the Chair of Human Biology. A label shall be placed on the biosafety cabinet documenting certification. The laboratory supervisor shall be responsible for biosafety cabinet maintenance.

Emergency eye washes weekly flushing shall be coordinated by the laboratory manager or area laboratory supervisor. Flushing shall be documented on a tag attached to the eye wash. Maintenance issues shall be reported to Facilities Management for remediation.

Emergency body showers semi-annual flushing and maintenance shall be done by Facilities Management. Flushing shall be documented on a tag attached to the body shower.

Fire extinguisher monthly visual inspections shall be completed and documented by Public Safety. Monthly inspections shall be documented on a tag attached to the fire extinguisher.

Fire extinguisher annual pressure checks shall be coordinated by Operations. Operations shall retain records of annual pressure checks.

Fire alarm testing and inspection shall be completed by Facilities Management. Records of testing and inspection shall be retained by Facilities Management.

Training

UW - Green Bay will provide employees and students working in laboratories covered by the Laboratory Standard with information and training to ensure that they are apprised of the hazards or chemicals present in their work area.

Such information will be provided at the time of initial assignment to the work area where hazardous chemicals are present. Laboratory supervisors are responsible for providing additional training when new chemical hazards are introduced into the work area. The frequency of refresher information and training shall be determined by the CHOs and Safety Manager.

Lecture and on-line training options will be offered. Department chairs and laboratory supervisors shall provide names of employees requiring training to the Safety Manager. The Safety Manager will coordinate employee training and retain training documentation.

Laboratory supervisors shall ensure students enrolled in their courses or conduct research in their work areas receive required training. The Safety Manager will provide assistance with student training upon request. Laboratory supervisors shall retain documentation of student training.

Employees shall be informed of:

- The contents of the Lab Standard and its appendices which shall be made available to employees;
- The location and availability of the UW - Green Bay Chemical Hygiene Plan;
- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory;
- The location and availability of known reference materials on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Safety Data Sheets received from the chemical supplier.

Training shall include:

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

Medical Surveillance and Consultation

The Laboratory Standard mandates that employers provide medical attention, examinations, and follow-up examinations at the physician's discretion for employees. This medical attention, etc. is required under the following circumstances:

- Whenever an employee develops signs and/or symptoms associated with a hazardous chemical to which they may have been exposed; or
- Whenever exposure monitoring reveals an exposure level above the OSHA action level or exposure above the permissible exposure level (PEL) for OSHA regulated substances ("PEL" is the permissible exposure limit or threshold limit value as listed in 29 CFR 1910.1000, July 1, 1992 edition. These are the exposure limits currently enforced by Wisconsin Department of Safety and professional Services under SPS 332.35(1)); or
- Whenever an event takes place in the work area such as a spill, leak, explosion, or other occurrence which results in the likelihood of a hazardous exposure. Such an occurrence requires an opportunity for medical consultation for the purpose of determining the need for a medical examination.

The CHO or Safety Manager shall provide the examining physician the following information:

- Identity of the hazardous chemical to which the employee may have been exposed,
- A description of the conditions of exposure including exposure date if available,
- A description of the signs and symptoms of exposure, if any, that the employee is experiencing, and
- A copy of the relevant Safety Data Sheet or other information.

The CHO or Safety Manager shall request a written opinion from the physician including:

- Recommendation for future medical follow-up
- Results of examination and associated test,
- Any medical condition revealed which may place the employee at increased risk as the result of chemical exposure, and
- A statement that the employee has been informed by the physician of the results of the examination or consultation and told of any medical conditions that may require additional examination or treatment.

The material returned by the physician shall not include specific findings and/or diagnoses which are unrelated to occupational exposure.

The Human Resource Department has responsibility to maintain an employee file concerning any events and resultant medical examinations or consultations.

All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place. The employee along with the employee supervisor must complete a Worker's Compensation report for any of the above incidents.

Appendix A: Personnel

Position	Name	Contact – phone number
Interim Chancellor	Sheryl Van Gruensven	465-2207
Provost	Michael Alexander	465-5161
Vice Chancellor of Business and Finance	Sheryl Van Gruensven	465-2210
Dean of College of Natural & Applied Sciences	John Katers	465-2278
Chemical Hygiene Officer	Carly Kibbe	465-2246
Chemical Hygiene Officer	Mandeep Bakshi	465-5169
University Safety Manager	Jill Fermanich	465-2273
University Risk Manager	Christopher Paquet	465-2172
Director, Public Safety	David Jones	465-2300
Director Student Health Services	Amy Henniges	465-2380

Appendix B: Standard Operating Procedures

1. Accidents and Spills:
   - Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention.
   - Ingestion: Follow directions on SDS
   - Skin Contact: Promptly flush the affected area with water and remove contaminated clothing. If a symptom persists after washing, seek medical attention. Use safety shower if necessary.
   - Clean-Up: Promptly clean up spills, using appropriate protective apparel and equipment and proper disposal.

2. Avoidance of Routine Exposure:
   - Use appropriate personal protective equipment.
   - Do not smell or taste chemicals except as directed by instructor. Vent apparatus which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices.
   - Inspect gloves and test glove boxes before use.

3. Choice of Chemicals: Use only those chemicals for which the quality of the available ventilation system is appropriate.

4. Eating, smoking etc.: Do not eat, smoke, drink, chew gum or apply cosmetics in areas where laboratory chemicals are present; wash hands before conducting these activities.

5. Equipment and Glassware:
   - Handle and store laboratory glassware with care to avoid damage. Do not use damaged glassware.
   - Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur. Use equipment only for its designed purpose.
   - Compressed gas tanks: Handle with care. Do not move without protective cap. Secure tank at all times.

6. Exiting: Wash areas of exposed skin well before leaving the laboratory.

7. Horseplay: Avoid practical jokes or other behavior which might startle or distract another worker.

8. Mouth Suction: Do not use mouth suction for pipetting or starting a siphon.

9. Personal Apparel: Confine long hair and loose clothing. Long pants may be required at the discretion of the professor of the lab course. Wear shoes at all times in the laboratory but do not wear sandals or perforated shoes.

10. Personal Protection:
    - See Appendix E for eye protection policy.
    - Wear appropriate gloves when the potential for contact with toxic materials exists; inspect the gloves before each use, wash them before removal, and replace them periodically.
    - Use any other protective and emergency apparel and equipment as appropriate.
    - Recommend contact lenses not be used in laboratory.
    - Remove laboratory coats immediately on significant contamination.

11. Planning: Seek information and advice about hazards, plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation. This includes reading the Safety Data Sheet for substances to be used.

12. Use of Hood:
    - Use the fume hood for operations which might result in release of toxic vapors or dust. As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substances with a PEL (Permissible Exposure Limit) of less than 50 ppm.
    - Confirm adequate hood performance before use. Keep materials stored in hoods to a minimum and do not allow them to block vents or air flow.
    - Leave the hood on when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is off.

13. Vigilance: Be alert to unsafe conditions and see that they are corrected when detected.

14. Waste Disposal:
    - Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan.
    - Refer to the *University of Wisconsin Green Bay Hazardous Waste Disposal Guide* for information on correct disposal of hazardous waste.

15. Working Alone: The following policy has been adopted for all persons using NAS and HB facilities:
    - **University Employees** (faculty, staff, LTEs, student employees and graduate students): Researchers and laboratory workers are strongly encouraged to prioritize work and research so that work with hazardous chemical, biological, or physical agents occurs only during normal working hours when others are present in the vicinity. After-hours work (on nights and weekends) should be restricted to non-hazardous activities. If hazardous materials must be used at night or on weekends, ensure that at least one other person is within sight and ear-shot to provide help in an emergency. According to UW-Green Bay's *Building Access Policy*,

University employees (faculty, staff, LTEs, student employees and graduate students) working in laboratories outside of building hours (6:00 a.m. to 11:00 p.m.) must have approval by their Academic Dean or their designee and must show university identification to Public Safety upon request.

- During any after-hours work, it is advisable to use the buddy system or notify another person of your presence in a laboratory.

- **Undergraduate Students**:
  - ***Scheduled Courses***: Students in scheduled courses must be supervised at all times. The instructor will be present in the laboratory or in the vicinity of the laboratory during scheduled laboratory hours. Students may not work outside of class hours for any scheduled course unless specific permission is granted by the faculty person supervising the lab and students will not be doing any manipulations using hazardous chemicals and hazardous conditions do not exist.

  - ***After-hours Laboratory Access***:
    - Students who work in laboratories between the hours of 6:00 a.m. - 7:30 a.m. and/or 6:00 p.m. – 11:00 p.m. must either be supervised or have specific faculty permission and must acquire a 'Blue Pass' from their Department Chair or designee and show it to Public Safety upon request consistent with UWGB OP-15-17-1.
      - Two or more students may perform unsupervised work together if they all have Blue Passes and they are not performing hazardous work.
      - In order for students to work alone after hours, the Department must:
        - Conduct an assessment and eliminate or control the dangers of working alone. These guidelines serve as the assessment:
          - Working alone safety assessment for students in the lab sciences
        - Provide students with specific written standard operating procedures
          - Standard Operating Procedures for students working alone in UW – Green Bay Laboratories

    - No students may be present in any campus buildings between the hours of 11 p.m. and 6 a.m. unless they are supervised and have specific permission from a faculty member.

- In research laboratories, the research supervisor or designated faculty supervisor will be present in the laboratory or available in the department for consultation or supervision as needed. The degree of supervision for research students in various circumstances requires the judgment of the faculty supervisor and will vary with the risks involved. Projects such as data analysis, computational projects, or certain types of spectroscopic measurements (as examples) do not require supervision. However, under no circumstances are student researchers (both graduate and undergraduate) allowed to conduct potentially hazardous

procedures when the faculty supervisor or designated substitute is not present in the vicinity. Student researchers (both graduate and undergraduate students) may never work alone if working with hazardous chemicals or if hazardous conditions exist. Ultimately it is the responsibility of the Principal Investigator to ensure safe supervision of undergraduate and graduate researchers.

STANDARD OPERATING PROCEDURES FOR STUDENTS

1. No eating, drinking or smoking is permitted in any laboratory.
2. Eye protection must be worn when required by the lab instructor. Contact lenses are not advisable, even under splash goggles.
3. Wear sensible clothing. Loose fitting clothing and open sandals or open footwear should not be worn. Long pants may be required at the discretion of the professor of the lab course.
4. Long hair must be confined.
5. No unauthorized experimentation is allowed. Do not change written laboratory procedures without permission of the instructor.
6. Students may not work in the laboratory without an instructor present in the laboratory or in the vicinity of the laboratory. (Exceptions may be made depending on the course.)
7. Students are not allowed to work in instructional laboratories outside of regularly scheduled hours without specific permission of instructor.
8. Students should know locations of all available safety equipment. This includes eye wash stations, safety showers, fire extinguishers and first aid supplies.
9. Pipetting by mouth is not allowed. Never place anything in the mouth except as directed by instructor while in the laboratory. Smell chemicals only by wafting a small amount of vapor toward the nose with the hand.
10. Personal protective equipment besides eye protection (eye protection should be worn at all times) should be used at the direction of the laboratory instructor. This equipment includes gloves when working with certain corrosives and organic solvents and laboratory aprons.
11. Keep lab bench clear of book bags and outer clothing. These should be placed in provided areas. Students are responsible for maintaining a safe and clean work area.
12. Laboratory fume hoods should be used for all operations which have the potential to release fumes, gases or volatile solvent vapors in excess of recommended exposure levels. Follow written laboratory procedures and the laboratory instructor's directions. Notify the instructor if you think the fume hood is not functioning properly.
13. Read lab procedures before entering the laboratory. Do not proceed with an experiment if you do not understand the procedure. All chemical names and identities should be carefully double-checked prior to any use. Check labeling before using a chemical so that potential hazards are known.
14. Report all injuries, no matter how minor, to the laboratory instructor. The instructor will give guidance on any appropriate treatment which may be needed or call Public Safety if necessary.
15. Proper disposal of laboratory waste is essential. Do not dispose of any chemical down sewer/sink without approval from the instructor. Use appropriate waste containers when provided.
16. Clean up spills promptly. If you should break a mercury thermometer, notify the instructor so that the mercury is promptly recovered. If you have questions on spill clean-up, ask your instructor.
17. Only students registered for the class are allowed into the laboratory.

18. Students should clean work area and wash hands thoroughly before leaving the laboratory.

Detach and return this bottom portion to your instructor.

I have read and I understand the above standard operating procedures. I understand that it is my responsibility to follow the above procedures and I agree to follow these procedures.

Date: _____ Signature: _____

Appendix C: Incident Reports

Natural and Applied Science and Human Biology policy requires an Incident Report Form be filled out for the following occurrences:

1. Significant personal injuries, such as those incurred because of cuts, burns, electric shock, etc.
    - Report any incident where first aid is involved with the exception of minor cuts or burns.
    - Report any incident which requires treatment by an emergency responder or treatment at Health Services
    - Report any incident when the eye wash or body wash is activated for response.
2. Fires that require the use of a fire extinguisher.
3. Mercury spills other than breakage of a standard mercury thermometer.
4. Concentrated (> 6 N) acid and base spills exceeding 100 mL.
5. All spills of flammable (flash point < 100^0F) chemicals exceeding 100 mL.
6. All spills of toxic chemicals exceeding 100 mL.
    - If TLV < 50 ppm, report spills exceeding 10 mL.
7. Large water spills including use of safety showers and eye wash fountains.
8. Exposure incidents involving blood or other potentially infectious materials.
9. Any spill where a chemical is accidentally released into the sewer system or where a chemical is spilled onto ground outside.

INCIDENT REPORT FORM

Date of Incident:_____

Type of Incident: ☐ First Aid Injury (personal injury) ☐ Chemical Spill
☐ Fire ☐ Large Water Spill

Personnel Involved (include student names):

_____
_____
_____
_____
_____

Location:_____

Description of Incident (please use reverse side if more space is needed for information):

_____
_____
_____
_____
_____

Description of response/treatment (please use reverse side if more space is needed for information):

_____
_____
_____
_____
_____

Cause of Incident (if known):_____

Name of Person Submitting Incident Report:

Name:_____ **Title:**_____

(Please Print)

Signature:_____ **Date:**_____

Please send a copy of Incident Report to the following:
Jill Fermanich – Safety Manager
Mandeep Bakshi – Chemical Hygiene Officer
Carly Kibbe – Chemical Hygiene Officer

Appendix D: Particularly Hazardous and High Risk Substances (PHS)

Although many chemicals pose hazards, certain chemicals pose a higher than average hazard and therefore require special precautions. This appendix delineates procedures for those chemicals.

OSHA has established three categories of chemicals that pose health hazards. These are referred to as *particularly hazardous substances* (PHS) and include select carcinogens, reproductive toxins and chemicals with high acute toxicity. In addition, certain reactive and explosive chemicals that pose physical hazards, such as pyrophorics, can be considered high risk chemicals also. For the purposes of this Chemical Hygiene Plan (CHP), these reactive and explosive chemicals shall be included in the category of PHS. PHS require special approval and controls. UW-Green Bay faculty and staff shall complete the steps listed below under 'Approval Procedure' before beginning work with a PHS.

PHS include select carcinogens, reproductive toxins, substances with a high degree of acute toxicity and reactive and explosive chemicals.

Reactive & explosive chemicals

For the purposes of this Chemical Hygiene Plan (CHP), chemicals will be considered high risk from the standpoint of physical hazards if they meet any of these Globally Harmonized System (GHS) hazard classifications and categories:

- Pyrophoric liquid or solid: category 1
  - The solid/liquid ignites within 5 minutes of exposure to air
- Self-reactive or organic peroxide: type A or B
  - Can detonate rapidly
- Explosive: Divisions 1.1 – 1.3
  - 1.1: has a mass explosion hazard
  - 1.2: has a projection hazard, but not a mass explosion hazard
  - 1.3: has a fire hazard and either a minor blast hazard or a minor projection hazard, but not a mass explosion hazard
- Self-heating: category 1
  - Undergoes dangerous self-heating when tested by methods given in the UN Recommendations on the Transport of Dangerous Goods, Manual of Tests & Criteria
- In contact with water emits flammable gas: category 1 or 2
  - Any substance which reacts vigorously with water at ambient temperatures and has a tendency for the gas produced to ignite spontaneously

The OSHA Laboratory Standard defines the following categories of chemicals as posing particularly hazardous health risks:

Select Carcinogens – A carcinogen is a substance capable of causing cancer. Carcinogens are chronically toxic substances; that is, they cause damage after repeated or long-duration exposure, and their effects may become evident only after a long latency period. A chemical is considered a select carcinogen by OSHA if it is included in any of the following carcinogen lists:

- OSHA-regulated carcinogens as listed in Subpart Z of the OSHA standards. Table 1 lists the chemicals currently regulated as carcinogens by OSHA.

Table 1 – OSHA Regulated Carcinogens

OSHA citation	Chemical	Comment
1910.1001	asbestos	
1910.1003	4-nitrobiphenyl	Commonly referred to as the OSHA 13 carcinogens
	Alpha-naphthylamine	
	Methyl chloromethyl ether	
	3,3'dichlorobenzidine (and its salts)	
	Bis-chloromethyl ether	
	Beta-naphthylamine	
	Benzidine	
	4-aminodiphenyl	
	ethyleneimine	
	Beta-propiolactone	
	2-acetylaminofluorene	
	4-dimethylaminoazobenzene	
	N-nitrosodimethylamine	
1910.1017	Vinyl chloride	Expanded standard chemicals
1910.1018	Inorganic arsenic	
1910.1025	Lead	
1910.1026	Chromium VI	
1910.1027	Cadmium	
1910.1028	Benzene	
1910.1029	Coke oven emissions	
1910.1043	Cotton dust	
1910.1044	1,2,-dibromo-3-chloropropane	
1910.1045	Acrylonitrile	
1910.1047	Ethylene oxide	
1910.1048	Formaldehyde	
1910.1050	Methylenedianiline	
1910.1051	1,3-butadiene	
1910.1052	Methylene chloride	

- Under the category "known to be carcinogens" in the *Annual Report of Carcinogens* published by the National Toxicology Program (**NTP**) latest edition
- Group 1 ("carcinogenic to humans") of the International Agency for Research on Cancer (**IARC**), latest edition. Chemicals listed in Group 2A or 2B ("reasonably anticipated to be carcinogens") that cause significant tumor incidence in experimental animals under specified conditions are also considered carcinogens under the OSHA Laboratory Standard.

For the purposes of this CHP, a chemical will be considered a carcinogen if it is listed as:

- GHS carcinogenicity category 1A or 1B
- IARC Group 1 or NTP "known to be human carcinogen" or OSHA Table 1
- GHS category 2 and IARC Group 2A or 2B and NTP "reasonably anticipated human carcinogen"

Reproductive Toxins – Reproductive toxins are chemicals that may affect the reproductive process including those that produce chromosomal damage (mutations) and substances with lethal or teratogenic effects on fetuses. It also includes substances that can affect the male or female reproductive organs and the ability to reproduce. Although no definitive or regulatory list of reproductive toxins exists, for the purposes of this CHP, a chemical will be considered a reproductive toxin if it is listed as:

- GHS reproductive toxin classification category 1A or 1B
    - 1A: known human reproductive toxicant
    - 1B: presumed human reproductive toxicant

A list of additional resources is located at the end of this appendix.

Substances with a High Acute Toxicity – High acute toxicity includes any chemical that falls within any of the following OSHA-defined categories:

- A chemical with a median lethal dose (LD_{50}) of 50 mg or less per kg of body weight when administered orally to certain test populations
- A chemical with an LD_{50} of 200 mg or less per kg of body weight when administered by continuous contact for 24 hours to certain test populations
- A chemical with a median lethal concentration (LC_{50}) in air of 200 parts per million (ppm) by volume or less of gas or vapor, or 2 mg per liter or less of mist, fume, or dust, when administered to certain test populations by continuous inhalation for one hour, provided such concentration and/or condition are likely to be encountered by humans when the chemical is used in any reasonably foreseeable manner

For the purposes of this CHP, chemicals will be considered to have high acute toxicity if they meet any of these GHS hazard classifications and categories:

- Acute toxicity by oral exposure: category 1
- Acute toxicity by inhalation or dermal exposure: category 1 or 2
- Specific target organ toxicity (single exposure): category 1

Responsibility for working safely with particularly hazardous and high risk substances ultimately rests with faculty, PI or lab instructor. Faculty, PI and lab instructors will work with the Safety Manager to identify PHS and will be responsible for complying with the operating procedures outlined in the approval form.

Approval Procedure

Laboratory workers must determine if a chemical that they plan to use is a PHS. If it is, they must then create customized operating procedures for that chemical. (Please note: PHS determinations have already been made for several chemicals that are commonly used in chemistry and biology teaching labs. If a lab worker plans to use one of these chemicals, s/he must review the SDS and follow the customized operating procedures for that chemical. A list of these chemicals will be placed on the lab sciences shared drive (labsciences$).

A completed version of the attached form (***PHS Operating Procedures***) will determine if a chemical is a PHS and will serve as these customized operating procedures. This form must be reviewed and signed by the user before beginning any work with the chemical. Sections 1 and 2 of the form contain questions that must be answered in order to determine if the chemical in question is considered a PHS. Sections 3 through 7 constitute the customized operating procedures for that chemical.

When a chemical is ordered, the Safety Manager will review the SDS and complete sections 1 and 2 of the ***PHS Operating Procedures.*** If the chemical is determined to be a PHS, the Safety Manager will forward the form to the user, who will then complete sections 3 through 7.

The following steps shall be taken:

1. When a chemical is ordered, the lab managers will forward the SDS to the Safety Manager, who shall complete sections 1 and 2 of the ***PHS Operating Procedures*** form. Information required in sections 1 and 2 includes:
    - Identity of the substance;
    - physical and health hazards of the substances involved;

    If any of the boxes in section 2 are checked "yes," then the substance is considered a PHS and sections 3 through 7 of the form must be completed. The Safety Manager shall forward the PHS Operating Procedures form to the user, who shall then complete those sections. Information required in sections 3 through 7 includes:
    - Consideration of exposure controls such as fume hoods, glove boxes and personal protective equipment
    - Designation of an area (hood, glove box, portion of lab, entire lab) specifically for experimental procedures with the substances involved
    - Plans for storage and secondary containment
    - Procedures for safe removal of contaminated waste
    - Decontamination procedures

2. The laboratory worker shall sign the form, thereby agreeing to follow the safe work practices outlined in the completed form. Work with PHS may not begin until these steps have been completed.

3. The area where the PHS will be used shall be posted as a designated area. Signs for this purpose should include the information indicated in the box on the right, as appropriate for the specific chemical. Please note that this sign may be removed upon completion of the experiment.

DANGER
DESIGNATED AREA
for select carcinogens, reproductive toxins, high acute toxicity chemicals and high risk chemicals
AUTHORIZED PERSONNEL ONLY

4. The laboratory worker shall proceed with the experiment, following the practices outlined in the ***PHS Operating Procedures*** form and the work practices listed in the section titled "Working Safely with Particularly Hazardous Substances" found below. All work shall be conducted within the Designated Area.

5. The laboratory worker shall decontaminate all equipment and dispose of waste promptly, as outlined in the ***PHS Operating Procedures*** form.

Working Safely with PHS

The increased hazards associated with PHS call for stricter operating procedures in the laboratory:

Training

The faculty, PI or lab instructor must ensure that all laboratory personnel who work with or may be exposed to PHS are adequately trained and have a working knowledge of the following:

- The hazards/ toxicological effects associated with the chemicals in use
- Experimental methods and techniques for the safe use of the chemicals
- Decontamination practices and procedures (for both emergency and routine use)
- Emergency practices and procedures.
- A review of the SOPs and safety data sheets.

Continuing training shall be conducted as needed to maintain a working knowledge of hazards for all staff members that work with PHS.

Work Habits

- There shall be no eating, drinking, smoking, chewing of gum or tobacco, application of cosmetics or storage of utensils, food or food containers in laboratory areas where PHS are used or stored.
- All personnel should wash their hands and arms immediately after the completion of any procedure in which a PHS has been used and when they leave the laboratory.
- Each procedure should be conducted with the minimum amount of the substance, consistent with the requirements of the work.
- If necessary, work surfaces, including fume hoods, should be fitted with a removable liner of absorbent plastic-backed paper to help contain spilled materials and to simplify subsequent cleanup and disposal.

Personal Protective Equipment (PPE)

- PHS may require more stringent use of personal protective equipment. Refer to the specific chemical's Safety Data Sheet for information on proper gloves, lab clothing and respiratory protection.
- Proper personal protective equipment must be worn at all times when handling PHS.
- Lab clothing that protects street clothing, such as a fully fastened lab coat or a disposable jumpsuit, should be worn when PHS are being used. Laboratory clothing used while manipulating PHS should not be worn outside the laboratory area.
- Disposable gloves should be discarded after each use and immediately after overt contact with a PHS.

Engineering Controls

- Benchtop work with PHS should be avoided whenever practical in favor of contained systems (such as fume hoods or glove boxes) and is not permitted if there is a reasonable likelihood of workers exceeding regulatory exposure limits.
- Chemical fume hoods used as containment areas for particularly hazardous chemicals must have a face velocity of 100 fpm, averaged over the face of the hood and must be certified annually.
- Laboratories and rooms where particularly hazardous chemicals are used shall have general room ventilation that is at negative pressure with respect to the corridors and external environment. The laboratory/room door must be kept closed at all times.
- Highly toxic gases must be used and stored in a vented gas cabinet connected to a laboratory exhaust system.

Special Handling & Storage Requirements

- Stock quantities of PHS should be stored in a designated storage area or cabinet with limited access. Segregate the chemicals from incompatible materials. Additional storage precautions (i.e., a refrigerator, a hood, a flammable liquid storage cabinet) may be required for certain compounds based upon other properties.
- Containers must be clearly labeled.
- Double containment should also be considered. Double containment means that the container will be placed inside another container that is capable of holding the contents in the event of a leak and provides a protective outer covering in the event of contamination of the primary container.
- Containers should be stored on trays or pans made of polyethylene or other chemically resistant material.
- Persons transporting PHS from one location to another should use double containment to protect against spills and breakage.
- Additional requirements for the safe storage of a specific chemical may be found in the manufacturer's instructions or in the SDS.

Spill & Accident Procedures:

- Immediate measures must be available to prevent the possible spread of contamination.
- The contaminated area shall be decontaminated and cleaned as soon as possible.
- If necessary, the affected area should be evacuated as soon as an emergency is determined.
- **Call 911** if unable to safely contain and clean up spill.
- If skin contact is involved, the worker shall be required to shower or flush the affected areas for a minimum of 15 minutes.
- Report the spill to CHO and complete an incident report.

Decontamination Procedures

- Laboratory work surfaces shall be decontaminated at the conclusion of each procedure and at the end of each day.
- Decontaminate all equipment before removing them from the designated area.
- Decontamination should be carried out in a glove box or fume hood.
- Contaminated PPE must not be removed from the designated area until properly decontaminated.
- After working with these chemicals, immediately remove gloves, wash hands and arms with soap and water

Waste Disposal Procedures

- Waste materials that are contaminated with particularly hazardous chemicals must be disposed of as hazardous waste. Check with Safety Manager for guidance on appropriate hazardous waste disposal methods.

Designated Area

- Working quantities of particularly hazardous chemicals should be kept as small as practical
- Designated area(s) for use and storage of particularly hazardous chemicals must be established. This may be a specific work bench or chemical fume hood. When particularly hazardous chemicals are present, access to this area shall be limited to personnel following appropriate procedures who are knowledgeable in working with these particularly hazardous chemicals.
- Signage is required for the container, designated work area and storage location.
    - Sign wording must state the following (as appropriate for the specific chemical hazard):
        - "DANGER: CANCER HAZARD"
        - "DANGER: REPRODUCTIVE TOXIN"
        - "DANGER: ACUTE TOXIN"
        - "DANGER: EXPLOSION or REACTION HAZARD"
- Work surfaces should be stainless steel, plastic trays, dry absorbent plastic backed paper, chemically resistant epoxy surfaces, or other chemically impervious material.

Reproductive Hazards Resources:

- Reproductive Health and the Workplace (NIOSH)
- Preventing Reproductive Hazards in the Workplace (UC San Diego)
- Iowa State University Carcinogens, Reproductive Toxins and Teratogens

UW-Green Bay

Appendix D - Particularly Hazardous & High Risk Substance (PHS) Operating Procedures

UW-Green Bay faculty or staff shall submit this completed form and receive approval from the CHO before beginning any work with a particularly hazardous or high-risk chemical. Please consult with UW-Green Bay CHO for assistance in completing form. Attach Safety Data Sheet to completed form and submit to UW-Green Bay CHO for review and approval.

Instructor Name and class (if for classroom use): Or Researcher Name:

Phone: Date:

1. Substance Information

A. Chemical name: CAS number: Manufacturer/vendor:

B. Estimated Rate of Use (e.g., grams/month): C. ☐ Continuous use or ☐ one-time use

D. Manufacturer-specific SDS reviewed and readily available ☐ Yes ☐ No

---

2. Hazards

List the health hazards: *Review SDS Section 2 (Hazards Identification) and Section 11 (Toxicological information)*

Carcinogen:

GHS carcinogenicity category 1A or 1B	☐Yes	☐No
IARC Group 1 or NTP "known to be human carcinogen" or OSHA Table 1	☐Yes	☐No
GHS category 2 AND IARC Group 2A or 2B **AND** NTP "reasonably anticipated human carcinogen"	☐Yes	☐No

Reproductive toxin:

GHS reproductive toxicity category 1A or 1B	☐Yes	☐No

Acute toxicity:

GHS Acute toxicity by inhalation or dermal exposure category 1 or 2	☐Yes	☐No
GHS Acute toxicity by oral exposure category 1	☐Yes	☐No
GHS Specific target organ toxicity (single exposure) category 1	☐Yes	☐No

Significant Route(s) of Exposure

Inhalation Hazard	☐Yes	☐No
Skin Absorption	☐Yes	☐No

List the physical hazards: *Determine GHS classification and category of the chemical by looking in Section 2.1 of the SDS.* Check 'yes' if the chemical meets any of these criteria:

GHS Class	Category		
Pyrophoric liquid	1	☐Yes	☐No
Pyrophoric solid	1	☐Yes	☐ No
Organic peroxide	Type A or B	☐Yes	☐No
Explosive	Divisions 1.1 – 1.3	☐Yes	☐No
Self-reactive	Type A or B	☐Yes	☐No
Self-heating	1	☐Yes	☐No
In contact with water emits flammable gas	1 or 2	☐Yes	☐No

Known incompatibilities:

3. Procedure

A. Briefly describe how the material will be used, including how/where/by whom the work will be prepped (if applicable):

B. Vacuum system used ☐Yes ☐No

C. If yes, describe method for trapping effluents:

4. Exposure Controls

Ventilation/Isolation

A. Chemical fume hood required ☐Yes ☐No

If yes, hood currently operates at a minimum 100 feet per minute face velocity ☐Yes ☐No

B. Glove box required ☐Yes ☐No C. Vented gas cabinet required ☐Yes ☐No

D. Personal Protective Equipment (PPE) (Check all that apply)

☐ Safety glasses ☐ Chemical splash goggles ☐ Face shield

☐ Lab coat ☐ Apron ☐ Gloves (type:)

☐ Respirator (use of any type of respirator requires prior approval from Safety Manager, 465-2273)

☐ Other, please describe:

5. Location/Designated Area

A. Building: B. Room:

C. Describe below the area where substance(s) will be used and the method of posting as a designated area.

D. Location where substances will be stored:

E. Storage Method/Precautions

☐ refrigerator/freezer ☐ hood ☐ flammable storage cabinet

☐ double containment ☐ vented cabinet ☐ other, describe:

6. Spills and Decontamination

A. Spill control materials readily available ☐ Yes ☐ No

B. Decontamination method:

7. Waste Disposal

A. In-lab neutralization ☐ Yes ☐ No B. Deactivation ☐ Yes ☐ No

C. Dispose as hazardous waste ☐ Yes ☐ No

8. Authorization

I have reviewed these PHS Operating Procedures and the SDS for the substance of concern. I plan to handle the substance in accordance with safety procedures outlined in these documents.

_____

Faculty or PI signature/Date

Using this form

For purposes of this form, a particularly hazardous or high risk chemical includes known or suspected human carcinogens, reproductive toxins, substances with acute toxicity and certain physical hazards. A more complete definition is included in Appendix D of the UW-Green Bay Chemical Hygiene Plan (CHP).

Each individual planning to use a High Risk Chemical shall complete and sign this form and submit it to the UW-Green Bay Chemical Hygiene Officer (CHO) prior to initial use.

Responsibility for determining whether a chemical is high risk and completing this form rests jointly with the PI/supervisor and the individual seeking use approval. UW-Green Bay CHO can be consulted in determining whether substance is a PHS.

1. Substance Information

A. Enter name, CAS (Chemical Abstract Service) number of the PHS, and manufacturer/vendor as they appear on the Safety Data Sheet (SDS).

B. Self-explanatory

C. Check whether the chemical will be in continuous use or if it will only be used one time

D. SDS may be available in hard copy or via the internet.

2. Hazards

A. List the health hazards as found in Sections 2 and 11 of the product Safety Data Sheet (SDS).

B. List the physical hazards as found in Section 2.1 of the product SDS.

C. List chemicals or materials that might cause instability or adverse conditions if mixed with the PHS. Refer to Section 10 (*Stability and Reactivity*) of the product SDS.

D. *Inhalation*: inhalation of the substance may cause adverse health effects. *Skin exposure:* substance is readily absorbed through the skin or can cause significant damage to skin upon contact.

E. Some chemicals can accumulate in body tissues and may require initial or periodic medical surveillance. Contact the UW-Green Bay Chemical Hygiene Officer for more information.

3. Procedure

A. Briefly describe the part of the experimental procedure that involves the substance, with particular attention to how the chemical will be manipulated. Include information on who will prep the material, how, and where.

B. Vacuum systems include central vacuum systems and vacuum pumps within the lab.

C. Describe what will be done to ensure that the substance is not accidentally drawn into the vacuum system. Cold traps or filters are some examples of such measures.

4. Exposure Controls

A. A fume hood should be used for chemicals that may produce vapors, mists, or fumes, or if the procedure may cause generation of aerosols.

The hood must have a minimum average face velocity of 100 feet per minute. If the hood has a sticker that says "Passed," it met this criterion on the date it was inspected. If the hood is equipped with a built-in monitor, the face velocity should also be checked prior to completing this form and while the hood is in use.

B. A glove box should be used if protection from atmospheric moisture or oxygen is needed or when a fume hood may not provide adequate protection from exposure to the substance; e.g., a protection factor of 10,000 or more is needed.

C. Highly toxic gases must be used and stored in a vented gas cabinet connected to a laboratory exhaust system. Gas feed lines operating above atmospheric pressure must use coaxial tubing.

D. ***Safety glasses*** protect from flying particles and minor chemical splashes, for instance, from opening a centrifuge tube.

Chemical splash goggles shall be worn when there is a possibility of a chemical splash. Most chemical manipulations, particularly where pressure is involved, warrant goggles.

Face shield, worn with splash goggles, provides full face protection when working with large volumes of chemicals.

Gloves should be worn when working with any particularly hazardous substance. Since not all gloves offer significant protection from every chemical, it is important to choose the glove that offers the best resistance. Sources of information:

- https://www.cdc.gov/niosh/ncpc/
- Glove manufacturer websites

Lab coats should be worn when working with hazardous substances. The coat should not be worn outside the laboratory and should be laundered separately from other clothing.

Aprons offer chemical resistance and protection from splashes and can be used in conjunction with a lab coat.

Respirators offer protection from inhalation of substances when engineering controls are not sufficient. Use of respirators must be approved by the Safety Manager, 465-2273, to ensure compliance with UW -Green Bay Respiratory Protection Plan.

5. Location/Designated Area

A and B. Building and room number where the substance will be used.

C. Describe where in this room the substance will be used. For example, in a hood, on a specific benchtop, in several areas of the laboratory, etc. This room or area must be posted with a *Designated Area* sign.

D. Describe where the substance will be stored. Be specific, e.g, on a shelf, in a refrigerator, in a hood, etc.

E. Self-explanatory. *Double containment* means that the container will be placed inside another container that is capable of holding the contents in the event of a leak and provides a protective outer covering in the event of contamination of the primary container.

6. Spills and Decontamination

A. Self-explanatory

B. Describe how the work area will be decontaminated after use, in the event of a spill, or upon completion of the work and before removal of the designated area signage. Refer to Section 6 (*Accidental Release Measures*) of the SDS.

7. Waste Disposal

A. Some corrosive chemicals may be neutralized before disposal via the drain or the hazardous waste program. All neutralization must be reported to the Safety Manager, 465-2273.

B. Some materials, such as ethidium bromide, can be chemically deactivated before disposal via the drain or the hazardous waste program.

C. Contact the Safety Manager for additional information on hazardous waste disposal.

Appendix E: Eye Protection

All UW Green Bay employees and students shall use appropriate eye or face protection when exposed to eye or face hazards from:

1. Flying particles
2. Molten metal
3. Liquid chemicals
4. Acids or caustic liquids
5. Chemical gases or vapors
6. Potentially injurious light radiation

In general, employees and students exposed to flying particles shall wear safety glasses (referred to as spectacles in the ANSI Z87.1 standard) with side shields. Employees and students exposed to molten metal, liquid chemicals, acids or caustic liquids, and/or chemical gases or vapors shall wear chemical splash goggles with indirect ventilation or no ventilation. Employees and students exposed to potentially injurious light radiation shall use equipment with filter lenses that have a shade number appropriate for the work being performed for protection from injurious light radiation.

Experiments that involve special hazards such as concentrated acids or bases, systems under high pressure or reduced pressure, and techniques that use active metals such as sodium shall be conducted with extra precautions. The employee supervisor, laboratory supervisor or instructor shall determine what additional eye protection shall be used such as a full face shield in addition to chemical splash goggles and may also require that the experiment be conducted in a hood with a safety window.

Eye protection selected must comply with relevant requirements of OSHA 1910.133. OSHA is currently in the process of updating 29 CFR 1910.133 to include ANSI Z87.1-2015 "American National Standard Practice for Occupational and Educational Eye and Face Protection." This version shall be used when selecting eye protection.

Check for a "Z87" marking somewhere on the eye protection device to ensure that all eye protection used in University laboratories complies with the Z87.1 standard.

Responsibilities

- The employee's supervisor is responsible for ensuring appropriate eye protection is provided at no cost to employee based on an assessment of exposure hazards. Eye protection should be personally assigned for individual employee use whenever possible. If eye protection is shared, the employee supervisor shall ensure eye protective devices are cleaned and disinfected prior to being used by a different individual.
- University departments with instructional and/or research laboratories shall determine what type of eye protection is required for students enrolled in each instructional lab and for students conducting research in University laboratories. Eye protection requirements will be communicated to students no later than the first class period or first day of research. Only Department approved eye protection is allowed.

- Departments will require students to purchase required eye protection.
- Laboratory supervisors shall ensure that employees and students working within his/her laboratory wear appropriate eye protection for the task being performed and shall ensure that employees and/or students who are not wearing the correct eye protection are removed from the laboratory until eye protection is available and they are able to comply.
- Students enrolled in laboratory courses and/or conducting research in University laboratories shall purchase appropriate eye protection as directed by the laboratory instructor or research supervisor, shall wear appropriate eye protection when working in the laboratory as required and shall comply with supervisor/laboratory instructor instructions.

Types of Eye Protection

Safety glasses (referred to as spectacles in ANSI Z87.1) look very much like normal glasses but have lenses that are impact resistant and frames that are much stronger than standard prescription glasses. Safety glasses **must have side shields** and shall be worn whenever there is a possibility of objects striking the eye, such as particles, glass or metal shards. Safety glasses may not provide adequate protection from chemical splashes because they do not seal to the face.

Goggles are protective devices designed to fit snugly but not necessarily seal completely to wearer's face. Goggles are commonly available in two styles:

- Eyecup goggles that cover eye sockets completely
- Cover goggles which may be worn over spectacles

Three types of ventilation are available:

- Direct ventilation goggles permit the direct passage of air from the work environment into the goggle. Direct ventilation goggles should not be used for use in protection against liquid splash hazards.
- Indirect ventilated goggles permit the passage of air and may prevent the direct passage of liquid and/or optical radiation.
- Goggles with no ventilation minimize passage of dusts, mists, liquid splash and vapor.

UW Green Bay policy requires chemical splash goggles with indirect or no ventilation shall be worn in University laboratories when employees or students may be exposed to molten metal, liquid chemicals, acids or caustic liquids, and/or chemical gases or vapors.

Face shields are protective devices designed to shield the wearer's face, or portions thereof, in addition to the eyes, from various hazards. Face shields are in order when working with large volumes of hazardous materials, either for protection from splash to the face or flying particles. **Face shields must be used in conjunction with safety glasses or goggles.** Face shields are not a substitute for safety glasses or goggles.

Prescription (Rx) Eyewear is not a substitute for appropriate eye protection. Wearers of prescription (Rx) eyewear shall wear eye protection that incorporates the prescription in its design or that can be worn over prescription lenses without disrupting either the prescription eyewear or the protective eyewear.

Contact lenses are not eye protective devices and wearing them does not reduce the requirement for eye and face protection. Wearers of contact lenses shall wear appropriate eye protection in hazardous environments. Although contact lens use is allowed with appropriate eye protection in University laboratories, there are situations when contact lens use should be avoided including exposure to intense heat, molten metals, highly particulate environment and certain chemicals.

Selection of Eye Protection

The type of eye protection required for an employee or student at the University will depend on the hazards that they work with or which they encounter in the specific work activity, and shall be determined by undertaking a hazard assessment. The hazard assessment should take account of the hazards that are present in the laboratory for most of the time, and consider the work of the group as a whole, not just that of an individual.

Resources for selection of eye protection:

- ANSI Z87.1-2003 Annex 1- Selection Chart (see below)
- Safety Data Sheets
- UW Green Bay Chemical Hygiene Officer

Sample Hazard Assessment Guide

The following hazard assessment procedure can be used to assess the need for eye and face protective equipment.

1. Survey work area. Consideration should be given to the following hazards:
    a. Impact
    b. Heat
    c. Chemical (liquid splash and vapor) (includes inorganic, corrosive, organic and toxic chemicals)
    d. Dust
    e. Glare
    f. Optical radiation
2. Identify source of hazards
    a. Source of motion
    b. Sources of high temperature
    c. Types of chemical exposures
    d. Sources of dusts
    e. Sources of optical radiation
    f. Layout of workplace and location of other personnel
    g. Any electrical hazards
3. Organize and analyze data – each of the basic hazards should be reviewed and a determination made as to type and level of each of the hazards found in the area. The possibility of exposure to several hazards simultaneously should be considered.
4. Use ANSI Z87.1-2015 Annex J - Selection Chart as an aid for selection of appropriate eye and face protection. Consult with Safety Data Sheets, UW Green Bay Chemical Hygiene Officer and/or UW Green Bay Safety Manager.
5. Periodically reassess hazards.

Appendix F: Glove Use and Selection in UW Green Bay Laboratories

Determination of the need for glove protection shall be made on the basis of a hazard assessment that considers the chemical, chemical concentration, potential of harm to chemical exposure and use conditions (including an assessment of the potential for exposure e.g. splash or immersion). Special procedures may require glove protection. For example, gloves made of chemically compatible material should be worn for work with strong corrosives or with particularly hazardous substance. Review process for work with particularly hazardous substances shall include a glove requirement assessment.

Lab instructors are responsible for determining if and what type of glove protection is required in their instructional labs. Research supervisors are responsible for determining if and what type of glove protection is required in their research areas.

General Rules for glove use:

1. Identify the hazards of the material(s) that you will be working with:
    - Select gloves which are resistant to the chemicals you may be exposed to. Consult relevant Safety Data sheets which may recommend a particular glove material. Consult chemical resistance guides and manufacturer's sites for brand specific glove recommendations.
    - Consider these factors when selecting gloves:
        - Chemical type, pH, toxicity
        - Chemical contact time
        - Chemical concentration
        - Incidental splash or immersion protection
        - Temperature of chemical
        - Glove thickness
        - Glove re-use
        - Dexterity requirements
        - Cut and puncture resistance
2. Select gloves of the correct size and fitting.
3. Check gloves before use for physical damage such as tears or pinholes. This is especially important when handling hazardous materials.
4. When removing gloves, prevent skin contact with the contaminated exterior of the glove.
5. Wash hands after gloves have been removed.
6. Do not wear contaminated gloves outside of the laboratory or to handle phones, keyboards, doorknobs, elevator buttons, etc.
7. Dispose of gloves appropriately:
    - Disposable gloves must be discarded after removal. Do not save for future use.
    - Dispose of contaminated gloves properly.
    - Non-disposable/reusable gloves must be washed and dried, as needed, and then inspected for tears and holes prior to reuse.
8. If for any reason a glove fails, and chemicals come into contact with skin, consider it an exposure and seek medical attention.

An understanding of the following terms is useful when making a glove selection:

Permeation is a process by which a chemical can pass through a protective film without going through pinholes, pores, or other visible openings. ASTM Method F739 standards is one methodology used for measuring permeation. A specimen is cut from the glove and clamped into a test cell as a barrier membrane. The "exterior" side of the specimen is exposed to the hazardous chemical. At timed intervals, the unexposed "interior" side of the test cell is checked for the presence of the permeated chemical and the extent to which it may have permeated the glove material. Permeation data are reported in two values:

- **Breakthrough times** (most commonly used) are the times observed from the start of the test to first detection of the chemical on the other side of the sample.
- **Breakthrough rates** are the highest flow rates recorded for the permeating chemicals through the glove samples during a six-hour or eight-hour test.

Degradation is the physical change in glove after chemical exposure. Typical effects may be swelling, wrinkling, deterioration or delamination. There are no accepted standards for measuring degradation.

Cut Resistance – There are no consistent standards for measuring cut resistance.

Several glove selection resources are listed below. Available on each site are the glove compatibility or chemical resistance information for those gloves supplied by those companies. Not all chemicals will be listed on these charts. Also note that two similar gloves supplied by two separate manufacturers may not provide the same level of protection to a specific chemical. Therefore, it will be necessary to consult the manufacturer's specific compatibility chart for the brand of gloves being used. A few more things to consider when using these resources:

- There are two basic components to consider when making glove selection: glove material and glove thickness. Common glove materials are latex, nitrile, neoprene, butyl, PVC and PVA. There are other specialty glove materials available. Glove thickness is typically measured in mm. Most resources below will make a brand specific glove recommendation which will consider both basic components. Additional research must be done if a recommendation does not consider both basic components.
- Glove protection requirements differ on whether protection is needed from splash (and incidental contact) or immersion (significant contact over time). Some resources make distinctions in their recommendation based on whether one anticipates splash or immersion exposure.
- Similar gloves supplied by separate manufacturers may not provide the same level of protection to a specific chemical.
- Most of these sites are considering industrial applications when making glove recommendations. Industrial and lab applications often differ. This emphasizes the importance of considering conditions of use and potential for chemical exposure when making the hazard assessment.
- Concentration of chemical used is a variable that should be considered when making a glove selection. Not all sites specify chemical concentration. Additional research must be done if guidance does not allow consideration of chemical concentration.

- Not all chemicals will be listed.
- Each guide and site uses slightly different rating keys. It is important to understand the rating system used for the site you are using.
- There are limits to the ability of these guides and on-line selection tools for making glove recommendations considering the number of variables that should be considered when making glove selection. Other resources should also be considered when making glove selections. Consult the chemical's Safety Data Sheet. Consult with UW Green Bay's CHO or Safety Manager. Most glove companies and safety supply companies have technical phone support.

Listed below are several websites that can be used to access chemical resistance guides and glove selection tools. This is not an all-inclusive list.

Glove Compatibility Charts:

Ansell: Chemical Resistance Guide
Specware: Chemical Application & Recommendation Guide
Cole-Palmer: Safety Glove Chemical Compatibility Database
MAPA Professional: Chemical Protection
MCR Safety Training: Permeation Guide

Appendix G: Fume Hoods

Use of appropriate ventilation is an important way of protecting laboratory workers from exposure to hazardous airborne substances generated in a lab procedure. There are two types of ventilation used in the Laboratory Science Building:

- Dilution ventilation
- Local ventilation

With dilution ventilation no air is recirculated back in to the building; all air from the lab and building is exhausted directly to the outside. Airborne contaminants created at the lab bench mix with room air which reduces the concentration of contaminants. This diluted mixture is exhausted from the laboratory. Dilution ventilation is limited to control of vapors and gases of low toxicity or very small amounts of moderately toxic vapors or gases. Dilution ventilation is **not** sufficient when working with acutely hazardous substances or moderate to large quantities of moderately toxic vapors or gases.

Local ventilation works on the principle of capturing toxic material at their source before they reach the breathing zone of the lab worker and before they contaminate the general air in the room. The most common type of local ventilation in the laboratory is the chemical fume hood. Over 50 chemical hoods are located throughout the laboratories in the Laboratory Science Building. All of these hoods are designed to provide a face velocity of 100 fpm (optimal contaminant capture) when sash opening is at 18". Hoods are equipped with air flow monitors. See accompanying page for explanation of monitor controls. The Safety Manager does annual certification to verify face velocity is a minimum 100 fpm with a sash opening at 18". A label verifying hood certification is affixed to the front of the hood.

Two other types of local ventilation are in use in Laboratory Sciences. Snorkel hoods are used to control contaminants emitted from some lab equipment. Several biological safety cabinets (BSC) are also located in Laboratory Sciences. BSCs are designed to contain aerosols generated during work with infectious agents. Check with the laboratory supervisor before using a BSC. Most BSCs are vented into the lab after contaminants pass through a HEPA filter. Therefore, many BSCs are not suited for work with toxic or flammable material.

Chemical Fume Hood Components

Hood Body is the visible part of the hood that serves to contain hazardous gases and vapors.

Hood Baffles are the moveable partitions used to create slotted openings along that are located on the back wall of the hood. They keep air flow uniform across the hood opening, eliminate dead spots and optimize capture efficiency.

The **Sash** is the sliding door to the hood. It improves containment of contaminants and provides some protection to the user in case of an incident in the hood. Sashes can be designed to move vertically and horizontally. Some of the chemical hoods located in the Laboratory Sciences building have a combined vertical/horizontal sash.

The **Sash Stop** located on the frame of the hood is designed so that face velocity will be maintained at 100 fpm if the sash opening is kept below the sash stop level. One can override the sash stop. But this should only be done when setting up or taking down equipment. Hood alarm will sound if one over rides the sash stop signaling that face velocity has gone below the 100 fpm capture rate.

The **Airfoil** is the bent metal piece at the front edge of the hood. It prevents creation of eddy currents which can carry vapors out of the hood.

Spill control – a raised lip surrounds the work surface providing some spill containment in case of a spill. Keep in mind that this is limited spill containment. A spill kit should be readily available and additional secondary containment should be considered when working with some hazardous substances.

Lab sinks in hoods are connected to the sanitary sewer system. Do not pour substances down the hood sinks unless you have permission from the laboratory supervisor.

Mechanical controls are located on the frame of the hood. Depending on the hood these may include: natural gas, compressed air, vacuum, light switch and electrical outlets.

Hood monitors are located on the front frame of the hood. They serve as an alarm system to alert you when face velocity falls below 100 fpm.

Safe Operating Procedures

- Confirm hood is running properly. Check for current (within one year) hood certification. Check hood monitor to ensure face velocity is 100 fpm at a minimum at a sash opening of 18". If not, immediately notify the laboratory supervisor. Do not proceed with experiment until hood face velocity is a minimum 100 fpm at a sash opening of 18".
- Keep sash as low as possible when working in hood to optimize contaminant capture and provide additional protection in case of incident in hood. Never work with the sash raised higher than 18" – the sash stop level.
- Keep head out of hood except when installing and dismantling equipment.
- Work at least 6" into hood to optimize contaminant capture.
- Raise large lab equipment 1-2" from work surface to minimize air flow disruption.
- Keep hood free of clutter. Avoid blocking baffle exhaust slots in any manner. Objects in hood tend to increase turbulence and increase possibility of accidental fire and/or spill.
- Minimize movement in front of the hood. People walking in front of the hood create competing currents at hood face potentially causing hazardous gases or vapors to flow out of the hood.
- Use of a fume hood is not a substitute for required eye protection. Wear required eye protection at all times when in the laboratory.

Lab Science Fume Hood Monitors

Energy use indicator shows the relative amount of energy in use. When sash is completely closed, the indicator is near the mid-point. When sash is open to the sash stop, indicator moves to the high end. If the exhaust ramps up and needle does not move when you raise sash there is a system malfunction that should be reported.

Standard Operation – fume hood face velocity is 100 fpm when sash is open up to the sash stop level.

Emergency Exhaust activates when hood operator presses the "Emergency" button. Hood will then operate on maximum exhaust (780 cfm) regardless of sash level. General room exhaust will then operate at maximum and room air supply will be minimized. This will increase negative pressure in the hood/room and increase exhaust rate of any harmful contaminant. Press the "Emergency" button to return to standard exhaust conditions.

Caution – Flow Alarm activates when face velocity goes under 100 fpm. Two reasons for this alarm to activate:
-sash is raised above sash stop level
-hood exhaust is not operating properly
If Caution-Flow Alarm activates on all room hoods, the exhaust system is malfunctioning and you should evacuate the area.

The energy waste alarm activates when an optical sensor determines room lights are off and sash is left open more than 4.75". Alarm will only stop when sash is lowered.

Mute – Pressing the mute button will turn off the audible alarm. The alarm light will continue to flash. Audible can be turned back on by pressing the mute button or remediating the cause for the alarm.

Appendix H: Chemical Spills

For the purpose of chemical spill response planning at UW-Green Bay, spills will be classified as either:

- A simple spill – a spill you can safely clean up yourself.
- A complex spill – a spill which requires outside assistance for cleanup.

Simple Spills

A simple spill is defined as one that you can safely clean up yourself and

- Does not spread rapidly
- Does not endanger people or property except by direct contact, and
- Does not endanger the environment

To determine whether a spill is simple or complex you need to know the hazard(s) posed by the spilled chemical and the spill's potential impact. The spill's size is another important factor. UW – Green Bay's *Spill Prevention, Control, and Countermeasure Plan* defines an incidental spill of oils (i.e. petroleum, fuel oil, etc.) as less than one gallon. The following information will help you determine whether you have a simple spill:

- The type of chemical spilled
- The amount
- The hazardous characteristics of the spilled chemical(s)
- The location
- The proper method for cleaning up the spill
- The personal protective equipment available
- The training of the laboratory personnel

Simple spill management is explained in the section below.

Complex Spills

If you say "yes" to any of the following when evaluating a chemical spill, you are dealing with a complex spill which requires outside assistance. **Call 911** to report the spill and request outside assistance. Also call the Safety Manager, x2273 for assistance in managing situation.

- Has a person been injured?
- Is there fire present or has an explosion occurred?
- Is the spill spreading beyond the immediate area?
- Is the identity of the spilled chemical unknown?
- Is there a risk of the spilled chemical entering sewer or contaminating soil?
- Is the spill located in confined space or poorly ventilated area?
- Are flammable vapors and ignition sources present?
- Are toxic vapors or dusts present?
- Spilled chemical is a strong oxidizer?
- Spilled chemical is reactive with air or water or is otherwise highly reactive?
- Spill is in high occupancy/frequently traveled area and evacuation is required to secure scene?

Remember, if you say "yes" to any of the above, you are dealing with a complex spill – **Call 911.**

Simple Spill Management

The following section explains how to handle a simple spill or release in the laboratory.

A. Preplanning

1. A spill containment/clean-up plan should be established to handle chemicals you use in the laboratory. Consideration must be given to the maximum amount used and concentrations of chemicals. Familiarize yourself with spill clean-up equipment available. If necessary, obtain sufficient supplies to handle potential spills.
2. The person causing a spill or release is responsible for clean up to the extent of his/her ability. Laboratory managers may be available for assistance but they are not responsible for cleanup. Persons who work with chemicals are expected to know how to safely clean up spills of these chemicals.

B. Simple Spill Cleanup

1. Prevent the spread of dusts and vapors. If the substance is volatile or can produce airborne dusts, close the laboratory door and increase ventilation (through fume hoods, for example) to prevent the spread of dusts and vapors to other areas.
2. Neutralize acids and bases if possible. Spills of most liquid acids or bases, once neutralized can be mopped up and rinsed down the drain (to the sanitary sewer). However, be careful because the neutralization process is often vigorous, causing splashes and yielding large amounts of heat. Neutralize acids with soda ash or sodium bicarbonate. Bases can be neutralized with citric acid or ascorbic acid. Use pH paper to determine when acid or base spills have been neutralized.
3. Control the spread of the liquid. Contain the spill. Make a dike around the outside edges of the spill. Use absorbent materials such as vermiculite, cat litter, or spill pillows.
4. Absorb the liquid. Add absorbents to the spill, working from the spill's outer edges toward the center. Absorbent materials, such as cat litter or vermiculite, are relatively inexpensive and work well, although they are messy. Spill pillows are not as messy as other absorbents, but they are more expensive. Note that special absorbents are required for chemicals such as hydrofluoric and concentrated sulfuric acids.
5. Collect and contain the cleanup residues. The neutralized spill residue or absorbent should be scooped, swept, or otherwise placed into a plastic bucket or other container. For dry powders or liquids absorbed to dryness, double bag the residue using plastic bags. Additional packaging may be required before the wastes can be transported from the laboratory. Be sure to label containers.
6. Dispose of the wastes. Keep cleanup materials separate from normal trash. Contact the Safety Manager, x2273, for guidance in packaging and labeling cleanup residues. Promptly place cleanup wastes in an appropriate hazardous waste receptacle.
7. Decontaminate the area and affected equipment. Ventilating the spill area may be necessary. For most spills, conventional cleaning products, applied with a mop or sponge, will provide adequate decontamination.

C. Special Precautions

1. *Flammable liquids:* **Remove all potential sources of ignition.** Vapors are what actually burn, and they tend to accumulate near the ground. Flammable liquids are best removed though the use of **spill pillows or pads** or with other absorbents specifically designed for solvents. Spill pads backed with a vapor barrier are available from most safety supply companies. Before resuming work, make sure the spill has been adequately ventilated to remove flammable vapors.
2. *Volatile Toxic Compounds:* Use appropriate absorbent material to control the extent of the spill. Spill pillows or similar absorbent material usually work best because they do not have the dust associated with cat litter or vermiculite. Place all used absorbent materials in heavy-duty poly bags. Seal the bags, label them and hand them over to the Safety Manager, x2273. Again, make sure the spill area has been adequately ventilated before resuming work.
3. *Direct Contact Hazards:* Carefully select suitable personal protective equipment. Make sure all skin surfaces are covered and that the gloves you use protect against the hazards posed by the spilled chemical. Often it is a good idea to wear two sets of gloves: one as the primary barrier, the second as a thin inner liner in the event the primary barrier fails. When the cleanup is complete, be sure to **wash hands** and other potentially affected skin surfaces.
4. *Mercury Spills:* Mercury spills rarely present an imminent hazard unless the spill occurs in an area with extremely poor ventilation. The main exposure route of mercury is via vapor inhalation. Consequently, if metallic mercury is not cleaned up adequately, the tiny droplets remaining in surface cracks and crevices may yield toxic vapors for years.

Appendix I: Emergency Action Procedures

Situation	Action	Call
Accident	• If anyone is injured or property is damaged	2300
Bomb Threat If you receive a bomb threat listen carefully and find out:	• When is the bomb to go off? • Where is the bomb now? • What kind of bomb is it? • What does it look like? • Why did the caller place the bomb?	911, Then 2300
Chemical Incidents In case of hazardous vapors, gases or spills.	• Inform others to evacuate using the nearest exit. • If spreading, pull a fire alarm. • Evacuate to nearest parking lot or designated assembly area.	2300
Crimes Theft, Vandalism, assault, etc:	• Assaults: get victim to safety. • Stay with victim and call for help	2300
Disruptive Person	• Staff: contact a supervisor in the area. • Students: contact a faculty or staff member. • Keep something between you and the person. • Call for assistance if you cannot locate the supervisor or faculty-staff, or if person is threatening.	2300
Explosion	• Evacuate to nearest parking lot.	911, Then 2300
Fire Smoke or fire	• Activate the Fire alarm. • Evacuate building using the nearest exit. • DO NOT USE ELEVATORS • Wheelchair users wait for assistance in stairwell. • Help those needing assistance. • Before opening any door, use back of hand to check for heat. IF HOT, DO NOT OPEN! • If heavy smoke or fire blocks an exit, use alternate exit. • Evacuate to nearest parking lot or designated assembly area.	911, Then 2300

Medical Attention Needed Minor injuries:	• Students: go to Student Health Services Office.	2300
Medical Attention Needed Unconscious person or serious injuries:	• Check for medic alert tag/bracelet; call for help.	911, Then 2300
Tornado Watch Conditions are favorable for tornado:	• Monitor weather conditions.	
Tornado Warning Tornado sighted: siren emits steady tone for 3 minutes. An all-clear message is not announced.	• Evacuate to lowest level, interior room or hall. • Stay away from window, glass, large open areas. • Protect your head and face; get under a sturdy surface or structure. • Monitor weather by radio or weather alert radio. Weather Alert Radio Locations: • Public Safety ext.2300 • Cofrin Library ext.2540 • Residence Life ext.2040 • Computing ext.2308 • University Information Center/Main Desk ext.2400	
Violence Actual or Threat:	• Go to a safe location; get help.	911, Then 2300

For additional information, contact Public Safety at 465-2300

Appendix J: Quick Disposal Guide for Lab Sciences 2019

Quick Disposal Guide for the Lab Sciences

University of Wisconsin – Green Bay
Last Revision July 2019

Material/Service	What do I do?	Notes	Whom do I contact?
Acidic/Basic Solutions (lab waste)	Neutralization may be performed by qualified personnel	See Neutralization section of UW-Green Bay Hazardous Waste Disposal Guide. Contact NAS lab managers with questions	Joe Schoenebeck x2585 schoenej@uwgb.edu
Aerosol Cans	**Empty** cans (EXCEPT those that contained pesticides such as wasp spray) may be disposed of in co-mingled recycling. Remove caps and nozzles.	Contact EHS to dispose of non-empty waste aerosol cans and those that contained pesticides.	Jill Fermanich x2273, fermanij@uwgb.edu
Appliances/Instrumentation	Complete a Declaration of Surplus Property Form	Contact Surplus with questions	x2215 surplus@uwgb.edu
Asbestos Containing Items	If you suspect an item contains asbestos, contact EHS	Asbestos containing items	Jill Fermanich x2273, fermanij@uwgb.edu
Ballasts	Contact Operations for disposal	PCB-containing ballasts must be disposed of by a contractor.	Jason Willard x2241, willardj@uwgb.edu
Batteries	**Collect** NiCad, Lithium/ Lithium Ion, Nickel Metal Hydride, Lead gel, Silver Oxide, Mercury Oxide or "button" cells. **Cover electrodes with tape.**	**Alkaline** batteries may be placed in the normal trash.	Jill Fermanich x2273, fermanij@uwgb.edu
Sealed lead acid batteries	These are collected at the Facilities shop for recycling		Mike Vanlanen 676-1324 vanlanem@uwgb.edu
Broken Glass	Package *non-infectious* broken glass in a sturdy cardboard box lined with a trash bag. Label box "Broken Glass - Trash." Seal with tape and set next to trash receptacle for custodial pick-up.	Infectious sharp items (needles, glass contaminated with human blood) should be placed in a sharps container	Jason Willard x2241 willardj@uwgb.edu
Chemical Containers (empty)	Triple rinse the container, obliterate the label with permanent marker or paint, dispose of in comingled recycling or normal trash as appropriate	2.5 Liter and 4 Liter glass and plastic bottles can be reused for storing lab waste. Contact NAS lab managers with questions.	Joe Schoenebeck x2585 schoenej@uwgb.edu
Chemicals (unwanted)	Call NAS lab managers for chemical redistribution	Material and container should be in good condition	Joe Schoenebeck x2585 schoenej@uwgb.edu

Material/Service	What do I do?	Notes	Whom do I contact?
Electronics: computers, monitors, printers, phones, other electronic waste	Complete a Declaration of Surplus Property Form	Contact Surplus with questions	x2215 surplus@uwgb.edu
Fluorescent Bulbs, projector lamps, misc. bulbs & lamps	Notify Operations or custodian on your floor	Fluorescent bulbs are Universal Waste. These items are disposed of by a contractor.	Jason Willard x2241, willardj@uwgb.edu
Gas Cylinders	Transport empty cylinders to designated area for pick up by vendor. Use a dolly designed for transporting gas cylinder	Notify whoever orders cylinders for your department	
Gas Lecture Bottles (empty)	Remove valve and place in your satellite accumulation area		
Hazardous Waste	Clearly label the waste container with identity of hazardous constituents. Deposit in your department's designated satellite accumulation area. If you do not have an accumulation area, contact EHS.	If you are unsure if a waste is hazardous contact EHS.	Jill Fermanich x2273, fermanij@uwgb.edu
Infectious Waste/Blood	Biohazardous waste must be properly disinfected and labeled.	Biological or medical waste that cannot be disinfected is disposed of by a licensed service.	Jill Fermanich x2273, fermanij@uwgb.edu
Mercury	Broken thermometers and instrumentation are handled as hazardous waste. Deliver to satellite accumulation area or contact EHS. Replace with mercury free device.	Broken Thermometers and small mercury spills should be cleaned up with a mercury spill kit.	Jill Fermanich x2273, fermanij@uwgb.edu
Paint, Latex based	Latex paint can be mixed with kitty litter, vermiculite, or sand and disposed of in normal trash when solid. Large amounts should be recycled	Call EHS with questions	Jill Fermanich x2273, fermanij@uwgb.edu
Paint, Oil based	Dispose of as hazardous waste.		Jill Fermanich x2273, fermanij@uwgb.edu
Peroxide forming chemicals	Check condition of container before disposal. If solid appears around the neck DO NOT HANDLE. If container appears to be in good shape, dispose of as haz waste.	Peroxide forming chemicals should be tested according to schedule. See list at https://ehs.uky.edu/ohs/peroxide.htm	Jill Fermanich x2273, fermanij@uwgb.edu
Photographic fixer	Label the container with contents as and store in your satellite accumulation area or call for pick up.	This waste contains silver which is handled as hazardous waste.	Jill Fermanich x2273, fermanij@uwgb.edu
Sharps	Dispose of in a red plastic "sharps container." Deposit in satellite area or call for pick-up	Needles, scalpels, razor blades	Jill Fermanich x2273, fermanij@uwgb.edu
Solvent soaked rags	Store in a metal can in a well-ventilated area. Bag up (double bag) prior to disposal		Jill Fermanich x2273, fermanij@uwgb.edu
Surplus Equipment (furniture, office supplies, etc.)	Complete a Declaration of Surplus Property Form	Contact Surplus with questions	x2215 surplus@uwgb.edu

Material/Service	What do I do?	Notes	Whom do I contact?
Used Oil/Antifreeze	This material is collected at the Facilities shop. ***If the material is known to be contaminated*** with a hazardous material, it must be disposed of as hazardous waste	Normally these materials are not hazardous waste, but their disposal is regulated. *Contaminated* oil must be treated as hazardous waste	Mike Vanlanen 676-1324 vanlanem@uwgb.edu
Used Toner Cartridges	These items are recycled. Place old cartridge in the University Staff toner cartridge recycling boxes located throughout campus	See University Staff website for cartridge drop locations around campus	usc@uwgb.edu
Waste cooking oil	Small amounts of waste cooking oil can be taken to the Union for recycling		Corey Arndt x2521 arndtc@uwgb.edu
Waste Solvent	Dispose of as hazardous waste	Common solvents used in painting/stripping	Jill Fermanich x2273, fermanij@uwgb.edu

Appendix K: LS Room Assignments

Rm #	Room Name	Responsible Party	Eye Wash
105	Animal Room	P. Forsythe, D. Meinhardt, P. Mueller, A. Nelson	X
105B		D. Brusich	
109	Radiochemistry Lab		X
109C	Storage		
110	Loading Dock	C. Cowling	X
112	Chemical Storage	M. Damie	X
115	Earth Science Research	J. Luczaj; K. Fermanich	X
115A	Earth Science Research	J. Luczaj, K. Fermanich	
116	Earth Science Teaching Lab	J. Luczaj	X
117	Earth Science Prep	J. Luczaj, K. Fermanich	
118	Soil and Water Teaching Lab	K. Fermanich; J. Luczaj	X
204	Chem Prep	J. Schoenebeck	X
204C	Bio Prep	M. Damie	X
204J	Chem Storage/Stock Room	M. Damie	X
206	Intro Chemistry Lab	J. Schoenebeck	X
207	Lab Support	J. Schoenebeck	X
208	Intro Chemistry Lab	J. Schoenebeck	X
210	Biology Lab	M. Damie	X
211	Lab Support	M. Damie	
212	Biology Lab	M. Damie	X
213	Ecology Research	M. Dornbush, M. Draney, P. Forsythe, L. Grubisha, K. Stahlheber, A. Wolf	X
214	Ecology	Joe Schoenebeck	X
214A	Ecology	Joe Schoenebeck	
215	Green House	K. Stahlheber, V. Medland	X
301	Biology Instrumentation	P. Mueller, G. Heyrman	
302	Lab Support	M. Damie	
303	Biology Instrumentation	P. Mueller, G. Heyrman	X
303A	Cell Bio Research	G. Heyrman, P. Mueller	
303B	Dark Room	L. Grubisha	

Rm #	Room Name	Responsible Party	Eye Wash
305	Cell/Molecular Biology Research	L. Grubisha, D. Meinhardt, P. Mueller, D. Pearson, U. Pott, G. Heyrman	XX
305A	Cell/Molecular Biology Research	G. Heyrman	X
306	Cell Bio Lab	M. Damie	X
307	Athletic Training	W. Gear, S. Buboltz-Dubs, A. Nelson	X
308	Lab Support	A. Nelson, W. Gear, S. Buboltz-Dubs	
309	Cadaver Room	A. Nelson, J. Marker	
310	Bio Micro Lab	M. Damie	X
311	Physiology Research	G. Heyrman, J. Marker, B. Merkel, L. Zhu, C. Kibbe, D. Pearson	X
311A	Clinical Procedures	J. Marker, D. Pearson	
316	Anatomy Lab	M. Damie	X
318	Lab Support	M. Damie	
318A	former cadaver room	*Unknown at present*	
319	Upper Level Biology Lab	J. Marker, A. Nelson, D. Brusich	X
401	Instrument Analysis	M. Zorn	X
406	Organic Lab	J. Schoenebeck	X
408	Lab Support	J. Schoenebeck	X
418	Environmental Systems Research	M. Dornbush, K. Fermanich, J. Katers, P. Terry, M. Holly	X
419	Chemical Analysis	J. Schoenebeck	X
420	Chemical Research	J. Wondergem, J. Intemann, F. Chen	X
421	Nutritional Science	J. Ludke	
428	Chemical Research	M. McIntire, M. Zorn, M. Bakshi	X
436	Chemical Research	M. McIntire, M. Zorn	X
437	Electron Microscope	J. Luczaj	

Appendix L: Laboratory Self - Inspection Checklist

For each item check Yes, No, or N/A. Take corrective action for "No" items.

Y	N	N/A	General Safety
			1. Housekeeping is satisfactory - floors clear, dry and free of slip hazards; bench tops (including hoods) reasonably organized and clean?
			2. Area around fire extinguishers, pull alarms, emergency showers, eye wash and electrical panels kept clear?
			3. Eye wash present, clearly labeled and flushed weekly?
			4. Fire extinguisher present, mounted, accessible, seal intact, date tested?
			5. Eighteen-inch vertical clearance maintained from fire sprinkler heads?
			6. Food and drink absent?
			7. Refrigerators/freezers labeled either "Food & Drink Only" or "No Food & Drink"?
			8. Extension cords and power strips not daisy chained and no permanent extension cords in use?
			9. No exposed wiring or damaged electrical cords?
			10. Personal protective equipment available and used?
			11. Personnel are trained on chemical hazards?
			12. Emergency contacts current?
			Hazardous Materials & Waste
			13. Chemical inventory is current?
			14. SDSs are kept in a central location?
			15. All containers, including non-hazardous chemicals and wastes, legibly labeled with the full chemical or trade name and hazard warning when needed?
			16. Chemical and waste containers in good condition and closed except during use?
			17. All waste containers have "Hazardous Waste" label?
			18. Incompatible materials segregated?
			19. Flammable liquids >10 gallons (including flammable waste and acetic acid) stored in flammable liquid storage cabinets?
			20. Flammables that are refrigerated are placed in explosion-proof or flammables refrigerators only?
			21. Storage in fume hoods minimized and sashes kept closed when not in use?
			22. Hazardous material spill cleanup kits and first aid kits available?
			23. Biohazardous waste managed properly?
			24. Gas cylinders properly secured, labeled, and stored?

Appendix M: Safety Training Checklist for Instructors

All "*" items should be covered in the introductory laboratory safety lecture. Other items should be covered as it applies in the laboratory course.

	***Regulatory information**
	1. Chemical Hygiene Plan
	***Standard Operating Procedures**
	***Hazard Identification**
	1. labeling requirements
	2. hazard symbols
	3. NFPA labeling systems
	4. SDSs
	***Emergency Procedures**
	1. evacuation routes
	2. fire emergencies
	3. clothing fire
	4. corrosive spill
	5. emergency equipment
	a. fire extinguishers
	b. eye/body wash
	***Personal Protective Equipment**
	1. splash goggle use
	2. glove and apron use
	3. appropriate attire
	Biosafety
	1. BBP issues
	2. basic rules of biosafety
	Toxins
	1. identification
	2. routes of entry
	3. exposure limits (TLVs, PELs)
	Fire Hazards
	1. identification
	2. flash point
	3. fire prevention
	Corrosives
	1. identification
	2. pH and safety issues

Appendix N: Center for Disease Control Chemical Storage Guidelines

Safe chemical handling requires routine inspections of chemical storage areas and maintenance of stringent inventory control. The inherent hazards of chemicals can be reduced by minimizing the quantity of chemicals on hand. However, when chemicals must be used, proper storage and handling can reduce or eliminate associated risks. All chemical storage areas and cabinets should be inspected at least annually and any unwanted or expired chemicals should be removed.

Typical storage considerations may include temperature, ignition control, ventilation, segregation and identification. Proper segregation is necessary to prevent incompatible materials from inadvertently coming into contact. A physical barrier and/or distance is effective for proper segregation.

Proper storage information can usually be obtained from the Safety Data Sheet (SDS), label, or other chemical reference material. As required by 29 CFR 1910.1200, an SDS must be on hand for every hazardous chemical in your workplace. SDSs must be provided by the manufacturer or distributor of chemicals purchased. The internet can also be used to find SDSs.

Considerations for proper storage:

- Ensure all containers of hazardous chemicals are properly labeled with the identity of the hazardous chemical(s) and appropriate hazard warnings.
- Segregate all incompatible chemicals for proper storage of chemicals by hazard class. In other words, store like chemicals together and away from other groups of chemicals that might cause reactions if mixed.
- Do not store chemicals alphabetically except within a grouping of compatible chemicals.
- Flammable materials should be stored in an approved, dedicated flammable materials storage cabinet or storage room if the volume exceeds ten gallons. Keep cabinet doors closed.
- Chemicals should be stored no higher than eye level and never on the top shelf of a storage unit. Do not overcrowd shelves. Each shelf should have an anti-roll lip.
- Avoid storing chemicals on the floor (even temporarily) or extending into traffic aisles.
- Liquids should be stored in unbreakable or double-contained packaging, or the storage cabinet should have the capacity to hold the contents if the container breaks.
- Store acids in a dedicated acid cabinet. Nitric acid may be stored there also but only if it is kept isolated from all other acids.
- Store highly toxic or controlled materials in a locked, dedicated poison cabinet.
- Volatile or highly odorous chemical shall be stored in a ventilated cabinet. Chemical fume hoods shall not be used for storage as containers block proper air flow in the hood and reduce available work space.

- All chemicals should be labeled and dated upon receipt in the lab and on opening. This is especially important for peroxide-forming chemicals such as ethers, dioxane, isopropanol, and tetrahydrofuran. Solutions should be labeled and dated when prepared.
- Look for unusual conditions in chemical storage areas, such as:
    - Improper storage of chemicals
    - Leaking or deteriorating containers
    - Spilled chemicals
    - Temperature extremes (too hot or cold in storage area)
    - Lack of or low lighting levels
    - Blocked exits or aisles
    - Doors blocked open, lack of security
    - Trash accumulation
    - Open lights or matches
    - Fire equipment blocked, broken or missing
    - Lack of information or warning signs ("Flammable liquids", "Acids", "Corrosives", "Poisons", etc.)

- First aid supplies, emergency phone numbers, eyewash and emergency shower equipment, fire extinguishers, spill cleanup supplies and personal protective equipment should be readily available and personnel trained in their use.
- Chemicals stored in explosion-proof refrigerators or cold rooms shall be sealed and labeled with the name of the person who stored the material in addition to all other required hazard warnings.
- Only compressed gas cylinders that are in use and secured in place shall be kept in the laboratory. All others, including empties, shall be sent to the compressed gas cylinder storage area for the particular facility.
- Keep all stored chemicals, especially flammable liquids, away from heat and direct sunlight.

Table 1. Examples of Incompatible Chemicals

The following list is not a complete listing of incompatible materials. It contains some of the more common incompatible materials. Always research materials you work with in order to work safely in the lab.

Chemicals listed in Column A should not be stored with or used near items in Column B.

Column A	Column B
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetic anhydride	Hydroxyl-containing compounds such as ethylene glycol, perchloric acid
Acetone	Concentrated nitric and sulfuric acid mixtures, hydrogen peroxide
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Alkali and alkaline earth metals such as powdered magnesium, sodium, potassium	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury, halogens, calcium hypochlorite, hydrofluoric acid
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids, heavy metals and their salts, oxidizing agents
Calcium oxide	Water
Carbon, activated	All oxidizing agents, calcium hypochlorite
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible material
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Chromic acid and chromium trioxide	Acetic acid, alcohol, camphor, glycerol, naphthalene, flammable liquids in general
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens, other oxidizing agents
Fluorine	All other chemicals
Hydrides	Water
Hydrocarbons (e.g., butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, peroxides
Hydrocyanic acid	Nitric acid, alkalis
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)

Column A	Column B
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, any flammable liquid (i.e., alcohols, acetone), combustible materials, aniline, nitromethane
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Metal hydrides	Acids, water
Nitrates	Acids
Nitric acid (concentrated)	Acetic acid, acetone, alcohol, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Mercury and silver and their salts
Oxygen	Oils, grease, hydrogen; flammable liquids, solids, or gases
Perchloric acid	Acetic anhydride, alcohol, bismuth, paper, wood, grease, oils
Permanganates	Concentrated sulfuric acid, glycerol, ethylene glycol, benzaldehyde
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus, white	Air, oxygen, alkalis, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids, ammonium salts, metal powders, sulfur, finely divided organics, combustibles
Potassium perchlorate (see also chlorates)	Sulfuric and other acids
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Silver and silver salts	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, other chlorinated hydrocarbons, water
Sodium nitrate	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Chlorates, perchlorates, permanganates

Adapted from *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals*, National Research Council, 1995, with additions from OHS.

Table 2. Basic Chemical Segregation

Hazard Class of Chemical	Recommended Storage Method	Examples	Incompatibilities
Compressed gases - Flammable	Store in a cool, dry area, away from oxidizing gases. Securely strap or chain cylinders to a wall or bench.	Methane Hydrogen Acetylene Propane	Oxidizing and toxic compressed gases, oxidizing solids.
Compressed gases – Oxidizing	Store in a cool, dry area, away from flammable gases and liquids. Securely strap or chain cylinders to a wall or bench.	Oxygen Chlorine Bromine	Flammable gases
Compressed gases - Poisonous	Store in a cool, dry area, away from flammable gases and liquids. Securely strap or chain cylinders to a wall or bench.	Carbon monoxide Hydrogen sulfide Nitrogen dioxide	Flammable and/or oxidizing gases.
Corrosives – Acids	Store separately in acid storage cabinet. Segregate oxidizing acids (i.e., Chromic, nitric, sulfuric, and perchloric acids) from organic acids	Acetic acid Phenol Sulfuric acid Chromerge Nitric acid Perchloric acid Chromic acid Hydrochloric acid	Flammable liquids, flammable solids, bases, oxidizers
Corrosives – Bases	Store in separate corrosive storage cabinet. Store solutions of inorganic hydroxides in labeled polyethylene containers.	Ammonium hydroxide Sodium hydroxide Calcium hydroxide	Flammable liquids, oxidizers, poisons, and acids
Flammable Liquids	Store in flammable storage cabinet and away from sources of ignition. Store highly volatile flammable liquids in an explosion-proof refrigerator.	Acetone Benzene Diethyl ether Methanol Ethanol Toluene Glacial acetic acid	Acids, bases, oxidizers, and poisons
Flammable Solids	Store in a separate dry, cool area away from oxidizers, corrosives, flammable liquids	Phosphorus, yellow Calcium carbide Picric acid Benzoyl peroxide	Acids, bases, oxidizers, and poisons
Hazard Class of Chemical	**Recommended Storage Method**	**Examples**	**Incompatibilities**

Hazard Class of Chemical	Recommended Storage Method	Examples	Incompatibilities
General Chemicals - Non-reactive	Store on general laboratory benches or shelving preferably behind glass doors and below eye level.	Agar Sodium chloride Sodium bicarbonate Most non-reactive salts	See specific SDS.
Oxidizers	Store in a spill tray inside a chemical storage cabinet. Separate from flammable and combustible materials.	Ammonium persulfate Ferric chloride Iodine Sodium hypochlorite Benzoyl peroxide Potassium permanganate Potassium dichromate The following are generally considered oxidizing substances: Peroxides, perchlorates, chlorates, nitrates, bromates, superoxides.	Separate from reducing agents, flammables, and combustibles.
Poisons/Toxic Compounds	Store separately in vented, cool, dry area, in unbreakable chemically-resistant secondary containers and in accordance with the hazardous nature of the chemical.	Aniline Carbon tetrachloride Chloroform Cyanides Heavy metals compounds, i.e., cadmium, mercury, osmium Oxalic acid Phenol Formic acid	Flammable liquids, acids, bases, and oxidizers. See specific SDS.
Water-Reactive Chemicals	Store in dry, cool location, protect from water fire sprinkler.	Sodium metal Potassium metal Lithium metal Lithium aluminum hydride	Separate from all aqueous solutions and oxidizers.

Hazard Class of Chemical	Recommended Storage Method	Examples	Incompatibilities
Carcinogens	Label all containers as "Cancer Suspect Agents". Store according to the hazardous nature of the chemical, using appropriate security when necessary.	Benzidine Beta-naphthylamine Benzene Methylene chloride Beta-propiolactone	See specific SDS.
Teratogens	Label all containers as "Suspect Reproductive Hazard". Store according to the hazardous nature of the chemical, using appropriate security when necessary.	Lead and mercury compounds Benzene Aniline	See specific SDS.
Peroxide-Forming Chemicals	Store in air-tight containers in a dark, cool, dry area. See Table 3 for recommended storage time limits.	Diethyl ether Acetaldehyde Acrylonitrile	See specific SDS.
Strong Reducing Agents	Store in cool, dry, well-ventilated location. Water reactive. Segregate from all other chemicals.	Acetyl chloride Thionyl chloride Maleic anhydride Ferrous sulfide	See specific SDS.

Table 3. Suggested Storage Time Limits for Common Peroxidizable Compounds
Under proper conditions, these chemicals will form explosive peroxides which can be detonated by shock or heat.

MOST DANGEROUS: Discard after 3 months. Peroxide formation hazard during storage.	
Diisopropyl ether Divinyl acetylene Isopropyl ether	Potassium metal Sodium amide Vinylidene chloride

DANGEROUS: Discard after one year. **OR** Discard one year after opening Peroxide formation hazard during storage and on concentration (i.e., distillation) of compound.		
Acetal Acetaldehyde Cumene Cyclohexene Diacetylene	Dicyclopentadiene Diethyl ether 1,4-Dioxane Ethylene glycol dimethyl ether Methyl acetylene	Methyl cyclopentane Methyl isobutyl ketone Tetrahydrofuran Tetrahydronaphthalene Vinyl ethers

DANGEROUS: Discard after one year. **OR** Discard one year after opening

Peroxide formation causes initiation of hazardous polymerization.		
Acrylic acid	Chloroprene	Tetrafluoroethylene
Acrylonitrile	Chlorotrifluoroethylene	Vinyl acetate
1,3-Butadiene	Methyl methacrylate	Vinyl acetylene
2-Butanol	2-Propanol	Vinyl chloride
	Styrene	Vinyl pyridine

Safety Hints:

- Do not purchase these compounds in quantities greater than can be used in the specified storage time period.
- Label containers with receiving, opening and disposal dates.
- Ethers should be stored in the dark and under nitrogen if possible.
- Always check for the presence of peroxides before distilling any peroxide-former.
- Consult safety references (i.e., SDSs) before working with peroxidizable compounds.
- If old containers of peroxide-forming chemicals are found, do not move them. Contact the Office of Health and Safety for assistance in disposing of the container.

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