Regis College

# Lab Safety Manual and Chemical Hygiene Plan

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COMMITMENT & INTEGRITY DRIVE RESULTS

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## APPENDICES

# SUMMARY OF KEY PLAN IMPLEMENTATION REQUIREMENTS

The following table summarizes key compliance requirements, deadlines, and actions that must be performed to implement this plan and comply with the conditions of the regulations. Please refer to the full text of this plan for detailed requirements.

| Requirement | Due | Recordkeeping/Reporting Requirements |
|---|---|---|
| Provide initial and periodic refresher training to all employees exposed to hazardous chemicals in the Regis College laboratories. | At the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher training shall be determined by the employer. | Maintain records of the attendees, training date, and training content. |
| Provide initial laboratory safety training to all new students. | Each Semester | Maintain signed Student Laboratory Safety Agreement in Appendix E |
| Maintain Material Safety Data Sheets (MSDSs) and Safety Data Sheets (SDSs) for all chemicals received and enter them into the Regis College chemical tracking system. | Ongoing | Regis College chemical tracking system |
| Flush and visually inspect eyewash stations. | Weekly | Inspection log |
| Visually inspect safety showers. | Weekly | Inspection log |
| Flush and test safety showers. | Annually | Inspection tag |
| Test fire alarms and fire extinguishers in the areas occupied and used by Regis College. | Annually | Tags on the individual fire extinguishers and a posting on the fire alarm panel |
| Certification of chemical fume hoods by an outside contractor. Environmental, Health, and Safety Compliance (EHSC) is responsible for ensuring the certifications are performed annually. | Annually | Posting on the fume hood |
| Conduct formal, documented chemical hygiene/housekeeping inspections of laboratories and safety equipment. | Annually | Records maintained by the Chemical Hygiene Officer |
| Review and evaluate the effectiveness of the Chemical Hygiene Plan | Annually | Review Log in Appendix C |

# 1. PLAN OVERVIEW

## 1.1 PURPOSE OF THIS PLAN

This Laboratory Safety Manual and Chemical Hygiene Plan (CHP) describes the proper work practices, procedures, facilities and equipment used to help protect Regis College faculty, staff, contractors, vendors, and other visitors from the potential hazards associated with the handling, storage, and use of hazardous chemicals in laboratories. It is Regis College policy to provide a safe and healthy workplace in compliance with applicable regulations. Regis College administration, research, and supervisory personnel are responsible for knowing the contents of this CHP and following the provisions contained in this plan.

This plan addresses the regulatory requirements of OSHA's Occupational Exposure to Hazardous Chemicals in Laboratories Standard (29 C.F.R. § 1910.1450), which is also referred to as the OSHA Lab Standard. A regulatory cross reference table is provided in in Appendix B. The full text of the Lab Standard is available online at the following address: ecfr.gpoaccess.gov.

## 1.2 SCOPE AND APPLICATION

This CHP applies to all laboratory use of hazardous chemicals at the Regis College. OSHA defines "laboratory use" of hazardous chemicals as the handling or use of such chemicals in which all of the following conditions are met:

- Chemical manipulations are carried out on a "laboratory scale," which means that the containers used for reactions, transfers, and other handling procedures are designed to be easily and safely manipulated by one person;
- Multiple chemical procedures or chemicals are used;
- The procedures involved are not part of a production process, nor in any way simulate a production process; and
- Protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

The OSHA Lab Standard requires all employers engaged in the laboratory use of hazardous chemicals to develop and implement a CHP that is capable of protecting employees from health hazards associated with hazardous chemicals and keeping exposures below Permissible Exposure Limits (PEL). The Standard outlines required elements of the CHP and provisions for exposure determination, medical consultation and examination, employee training and information, protective measures, recordkeeping, and annual program review.

This CHP applies to all laboratory employees, including teaching assistants, technical staff, and faculty members who instruct academic laboratory classes. Regis College also has the special responsibility of administering instructional labs with relatively inexperienced students who must be introduced to the safety procedures necessary to conduct various laboratory operations. The students in the academic laboratory are not considered laboratory workers unless they are employed by the college. All students involved in laboratory operations, however, should be provided with information on safe work practices and Regis College's requirements. Safety policies and practices should be a regular part of the curriculum.

This CHP generally applies to the laboratory operations occurring onsite. Other activities involving the use of hazardous chemicals, such as those chemicals used in maintenance activities, are not subject to this plan, but instead, are governed by the college's written Hazard Communication Program. This plan is written to describe how Regis College employees comply with the Lab Standard and how Regis College expects specific responsibilities to be carried out at the college.

## 1.3 CHEMICAL HYGIENE ROLES AND RESPONSIBILITIES

All Regis College employees covered under the scope of this plan comply with the specific requirements for safe use, handling and storage of hazardous chemicals outlined within the CHP. In addition, there are several key roles involved in the management and continuous improvement of the CHP, including the following.

### 1.3.1 Chemical Hygiene Officer (CHO)

The CHO is an employee who is qualified by training or experience, to provide technical guidance for the continuing implementation of the CHP. The Regis College CHO is the Environmental Health and Safety Compliance (EHSC) Manager. Specific responsibilities of the CHO include:

- Implement and maintain this CHP for activities conducted at Regis College, including appropriate chemical hygiene policies and practices.
- Provide initial and annual training for the Laboratory Safety Committee and instructors concerning requirements of the program and their responsibilities.
- Review and approve requests for chemicals.
- Work with the Laboratory Safety Committee to post a signs at the entrances to laboratories, storage areas, and associated facilities.
- Provide standardized labels and signs for use in the laboratories.
- Ensure weekly inspections of emergency eyewashes, safety showers, and hazardous waste storage areas are conducted.
- Ensure that accurate records are maintained for each Regis College employee of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions. Medical records will be maintained by Human Resources.
- Collect and manage hazardous waste generated in the laboratory areas for proper disposal in accordance with all municipal, state and federal regulations, including the segregation, containment, and labeling of containers in the central accumulation area.
- Provide spill cleanup assistance.
- Conduct annual chemical hygiene/housekeeping inspections of laboratories and safety equipment and bring issues to the attention of the appropriate, responsible individual(s).
- Conduct accident investigations and assist the Laboratory Safety Committee in their efforts to reduce the potential for recurrence of these events by implementing appropriate work practice or personal protective equipment (PPE) changes.
- Review the CHP annually and make changes as needed.

### 1.3.2 Laboratory Safety Committee

The Laboratory Safety Committee is comprised of Regis College Science Department Faculty and is led by the CHO and the Department Head.

- Work with the CHO to determine the required levels of PPE.
- Ensure that all hazardous waste generated and stored in the laboratory areas is managed in accordance with all municipal, state and federal regulations, including the segregation, containment and labeling of containers.

- Define “Designated Areas” within the laboratory space for accumulation and storage of hazardous waste.
- Work with the CHO to determine the need for medical surveillance for staff working in the laboratories.
- Provide lab-specific information and training about the handling of hazardous chemicals in the laboratory.
- Monitor the procurement, use, and disposal of chemicals used in laboratories.
- Ensure that proper equipment is available, in working order and provide staff training in the proper use and maintenance of equipment.
- Assist in the design and development of safe facilities and ensure that safe facilities are maintained at all times.
- Coordinate or conduct industrial hygiene exposure assessments, as needed. Provide a copy of the results to EHSC.
- Ensure periodic monitoring requirements are satisfied, when necessary.

### 1.3.3 Instructors

- Label all chemical containers in accordance with Regis College policies.
- Label and dispose of hazardous waste in compliance with Regis College policies.
- Conduct weekly visual inspections of hazardous waste storage areas in the laboratories.
- Conduct weekly visual inspection and testing of the emergency eyewash stations.
- Conduct weekly visual inspection of the safety showers.
- Update and maintain the chemical inventory and Material Safety Data Sheets (MSDSs)/Safety Data Sheets (SDSs) for chemicals stored and used in the laboratory.
- Read, understand, and follow the policies and procedures outlined in this CHP.
- Request information and assistance when unsure or concerned about risks from hazardous chemicals.
- Obtain prior approval from the CHO when working with particularly hazardous substances.
- Wear appropriate PPE and follow the safe work practices as outlined in this CHP.
- Report any incident or accident involving a hazardous chemical in the laboratory to the CHO and institute necessary work practices or procedures to prevent the recurrence of such events.
- Notify the CHO when equipment malfunctions or safety apparel is not available.

### 1.3.4 Students

- Read, understand, and follow the policies and procedures outlined in Student Laboratory Safety Agreement included in Appendix E.

## 1.4 PLAN AVAILABILITY, REVIEW, AND UPDATE

Hard copies of the CHP are available in the EHSC office. Electronic copies are available on the Regis College server. At least annually, the CHP is evaluated by the CHO to determine its continued effectiveness and identify opportunities for improvement. This evaluation is coordinated by the Regis College CHO, with assistance and input from the Laboratory Safety Committee and Instructors. The annual review and a description of any amendments made to the CHP are documented in the Review Log included in Appendix C.

# 2. HAZARDOUS SUBSTANCE IDENTIFICATION AND CONTROL

Most hazardous chemicals can be easily classified into generic categories (e.g., corrosive, reactive, ignitable, and toxic) and are labeled on the primary container as such. Other means of identifying hazardous chemicals include:

- Lists of known or suspect human carcinogens, as evaluated by the International Agency for Research on Cancer (IARC) and the National Toxicology Program (NTP), are available through the Centers for Disease Control and Prevention (CDC);
- Lists of reproductive hazards as evaluated by the NTP Center for the Evaluation of Risks to Human Reproduction;
- The National Fire Protection Association (NFPA) has categorized a wide variety of chemicals; and
- MSDSs/SDSs, as required by the OSHA Hazard Communication Standard, 29 C.F.R. 1910.1200, are sent to the company for each new chemical ordered.

## 2.1 CHEMICAL PROCUREMENT

All chemical requests must be sent to the CHO for approval prior to purchase. The purpose of this approval is to help Regis College determine if the total quantities of chemicals onsite subject the Regis College to regulatory reporting requirements and to help determine the potential impacts the chemical could have to Regis College employees and equipment and other building occupants. Knowledge of the specific chemicals that are onsite is imperative to being able to conduct the assessment. Chemical requests should be documented in writing using the form in Appendix F. The CHO will review all new chemical requests and whenever possible suggest alternatives to eliminate the use of hazardous materials or substitute a less hazardous material.

The CHO may also request that the particular process, experiment or operation be modified to reduce the quantity of the hazardous material(s) necessary or limit the potential emission release rate or exposure time.

## 2.2 EMPLOYEE EXPOSURE DETERMINATION

The use of properly inspected and certified fume hoods is expected to minimize exposure to airborne chemicals in the laboratory. The results of laboratory inspections and the chemical inventory process help determine potential need for exposure assessment. Laboratory workers with concerns regarding potential exposure to airborne chemical contaminants (e.g., for operations that cannot be conducted in a fume hood) should consult with the CHO. The CHO will be responsible for arranging or conducting any industrial hygiene exposure assessments and monitoring within the partner areas, in accordance with the following provisions:

- Initial employee exposure monitoring will be performed if there is reason to believe that exposure levels for a substance routinely exceed the action level or, in the absence of an action level, the PEL.
- Periodic monitoring will be performed if the initial monitoring performed discloses employee exposure over the action level (or in the absence of an action level, the PEL). In these cases, Regis College and the employee will immediately comply with the exposure monitoring provisions of the relevant OSHA standard. Monitoring may be terminated in accordance with the relevant OSHA standard.
- Within 15 working days after the receipt of any monitoring results, the employee will be notified of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.
- Employees concerned about chemical exposure should consult with the CHO, who will arrange for exposure monitoring, if needed. The CHO must be notified of monitoring requests.

The CHO ensures periodic monitoring requirements are satisfied, when necessary. The Human Resources SVP will ensure that the Regis College establishes and maintains an accurate record of any measurements taken to monitor Regis College employee exposures, including any medical consultations and examinations and will ensure that these records are kept, transferred and made available in accordance with 29 C.F.R. 1910.1020, "Access to employee exposure and medical records."

## 2.3 EXPOSURE CONTROL

### 2.3.1 Control Hierarchy

To control the hazards of chemicals used in the laboratory, CHOs will use the following hierarchy of controls, to the extent feasible:

1. Material Substitution
2. Engineering Controls
3. Administrative Controls
4. PPE

Less hazardous chemicals will be substituted for more hazardous chemicals whenever possible. Facility design and the use of containment equipment are critical to control chemical hazards in the laboratory, as described in Section 2.4, "Laboratory Design." In addition, the safe work practices outlined in this CHP are administrative controls used to minimize employee exposure. PPE is used as a last line of defense to supplement engineering and administrative controls.

### 2.3.2 Application of Exposure Limits and Guidelines

A chemical's MSDS/SDS may state recommended limits (e.g., Threshold Limit Value or TLV) or OSHA-mandated limits (e.g., Permissible Exposure Limit or PEL, Short-Term Exposure Limit or STEL, and Action Limit or AL), or both. Where available, these limits will be used by the CHO to assist in determining the safety precautions and control measures required when handling toxic materials. The following outline the exposure limits and guidelines that will be followed in Regis College laboratories:

- When a volatile chemical's TLV or PEL is less than 50 parts per million (ppm), the chemical must be used in a chemical fume hood.
- If a TLV or PEL is not available for a chemical, the animal or human median lethal dose, $LD_{50}$, or the median inhalation lethal dose, $LC_{50}$, will be used. If the $LD_{50}$ is less than 500 mg/kg or the $LC_{50}$ is less than 200 ppm, the chemical must be used in a chemical fume hood.

## 2.4 LABORATORY DESIGN

Regis College laboratory facilities contain the following design features:

- General ventilation with air intakes and exhausts located to avoid intake of contaminated air;
- Laboratory fume hoods and biological safety cabinets where necessary for work with hazardous materials;
- Sinks, eyewash stations, and emergency drench showers;
- Storage facilities for hazardous waste; and
- Specialized storage cabinets for flammable materials and corrosive materials.

The college is also provided with fire alarms and fire extinguishers.

## 2.5 LABORATORY INSPECTION, CALIBRATION, AND CERTIFICATION

The instructors are responsible for conducting weekly visual inspections of the emergency eyewashes, safety showers, and hazardous waste storage in their laboratory areas; the CHO conducts annual formal inspections of all laboratories; Physical Plant is responsible for annually testing all of the safety showers and for retaining outside contractors to complete the following:

- Annual testing of fire alarms and fire extinguishers
- Annual certification of chemical fume hoods.

## 2.6 HAZARD COMMUNICATION

### 2.6.1 Signs

Signs are used to inform personnel about hazards or precautions to be followed in a particular area. The CHO will work with the Laboratory Safety Committee to post signs at the entrances to laboratories, storage areas, and associated facilities as necessary to warn emergency personnel and custodians of unusual or severe hazards therein. Examples of unusual hazards that may require signs are unstable chemicals, toxic or carcinogenic materials, chemical spills, high-powered lasers, water reactive chemicals, and radioactive materials. Radioactive or biohazardous substances used in laboratories require special signs on access doors to laboratories. Signs indicating the location of fire blankets, safety showers, fire extinguishers and other safety devices are posted in and around the laboratories. “No Smoking” signs should be posted in areas where flammable liquids or gases are used or stored.

### 2.6.2 Labeling

All containers must be labeled as to their content. Chemicals received from outside vendors will have labels indicating the name and physical and chemical hazard data. Hazard warning signs or symbols should be prominently visible on the labels. The labels on incoming chemical containers will not be removed or defaced.

All containers of chemicals that have been decanted from the original container must be labeled with the chemical name and the primary hazard(s).

All containers of chemical waste must be labeled, as they are being filled, with the full chemical name, the primary hazard associated with its use, and the name of the generator. Hazardous waste labels are available from EHSC.

All containers of chemicals prepared in the laboratory must be marked with the chemical name, primary hazard(s), person responsible, and date. Labeling must be provided for chemicals synthesized in the laboratory or prepared by other processes such as distillation or extraction.

Chemicals developed in the laboratory must be assumed to be toxic if no data on toxicity are available, and suitable handling procedures must be prepared and implemented, including the training of users in controls necessary to handle safely. If the substance is produced for use by an individual outside of the laboratory, an MSDS/SDS and labels must be prepared and provided to such individuals (in accordance with the provisions of OSHA’s Hazard Communication Standard, 29 C.F.R. 1910.1200).

### 2.6.3 Material Safety Data Sheets and Safety Data Sheets

Chemical manufacturers and distributors must evaluate hazards associated with the chemicals they produce and convey this information to purchasers by preparing and distributing MSDSs. To comply with OSHA’s adoption of the Globally Harmonized System in the Hazard Communication Standard, chemical manufacturers and distributors may

begin to send Regis College Safety Data Sheets (SDSs) that have been revised to meet the new requirements being implemented. Regis College will maintain an MSDS or SDS for onsite chemicals. By 2016, Regis College will maintain SDSs in compliance with OSHA's revised Hazard Communication Standard. Shipments of hazardous chemicals received by Regis College must be accompanied by MSDSs/SDSs. When chemicals are ordered, the department/person submitting the order is responsible for requesting a MSDS/SDS from the supplier or manufacturer. Personnel receiving chemicals must request a MSDS/SDS if one is not present with the shipment.

Binders of active MSDSs/SDSs are readily available to employees in the departments/areas where they work, as appropriate. Missing MSDSs/SDSs are obtained from suppliers and/or manufacturers of chemicals by the MSDS/SDS Coordinators. As a general rule, MSDSs/SDSs kept on file are up-to-date. When a product's use is discontinued and no remaining product is on-site, the product's MSDS/SDS is removed from the active MSDS/SDS binder and put into an inactive MSDS/SDS binder. In accordance with OSHA's rules for access to employee exposure records, Regis College will maintain MSDSs/SDSs for hazardous chemicals discontinued from use for at least 30 years. See 29 C.F.R. §§ 1910.1200(g) and 1910.1020(a)(5)(iii).

### 2.6.3.1 SDS Content

In accordance with Appendix D to § 1910.1200, the SDS must follow the standardized 16 section format outlined in Figure 2-1. If no relevant information is found for any given subheading within a section, the SDS must clearly indicate that no applicable information is available. Sections 12-15 may be included in the SDS, but are not mandatory.

**Figure 2-1: Minimum Information Required for a SDS**

| Heading | Subheading |
|---|---|
| 1. Identification | (a) Product identifier used on the label;<br>(b) Other means of identification;<br>(c) Recommended use of the chemical and restrictions on use;<br>(d) Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party;<br>(e) Emergency phone number. |
| 2. Hazard(s) identification | (a) Classification of the chemical in accordance with paragraph (d) of § 1910.1200;<br>(b) Signal word, hazard statement(s), symbol(s) and precautionary statement(s) in accordance with paragraph (f) of § 1910.1200. (Hazard symbols may be provided as graphical reproductions in black and white or the name of the symbol, e.g., flame, skull and crossbones);<br>(c) Describe any hazards not otherwise classified that have been identified during the classification process;<br>(d) Where an ingredient with unknown acute toxicity is used in a mixture at a concentration ≥1% and the mixture is not classified based on testing of the mixture as a whole, a statement that X% of the mixture consists of ingredient(s) of unknown acute toxicity is required. |
| 3. Composition/information on ingredients | Except as provided for in paragraph (i) of § 1910.1200 on trade secrets: |
| | For Substances |
| | (a) Chemical name; |
| | (b) Common name and synonyms; |

| Heading | Subheading |
|---|---|
| 3. Composition/information on Ingredients (Cont.) | (c) CAS number and other unique identifiers; |
| | (d) Impurities and stabilizing additives which are themselves classified and which contribute to the classification of the substance. |
| | For Mixtures |
| | In addition to the information required for substances: |
| | (a) The chemical name and concentration (exact percentage) or concentration ranges of all ingredients which are classified as health hazards in accordance with paragraph (d) of § 1910.1200 and |
| | (1) Are present above their cut-off/concentration limits; or |
| | (2) Present a health risk below the cut-off/concentration limits. |
| | (b) The concentration (exact percentage) shall be specified unless a trade secret claim is made in accordance with paragraph (i) of § 1910.1200, when there is batch-to-batch variability in the production of a mixture, or for a group of substantially similar mixtures with similar chemical composition. In these cases, concentration ranges may be used. |
| | For All Chemicals Where a Trade Secret is Claimed |
| | Where a trade secret is claimed in accordance with paragraph (i) of § 1910.1200, a statement that the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret is required. |
| 4. First-aid measures | (a) Description of necessary measures, subdivided according to the different routes of exposure, i.e., inhalation, skin and eye contact, and ingestion;<br>(b) Most important symptoms/effects, acute and delayed.<br>(c) Indication of immediate medical attention and special treatment needed, if necessary. |
| 5. Fire-fighting measures | (a) Suitable (and unsuitable) extinguishing media.<br>(b) Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products).<br>(c) Special protective equipment and precautions for fire-fighters. |
| 6. Accidental release measures | (a) Personal precautions, protective equipment, and emergency procedures.<br>(b) Methods and materials for containment and cleaning up. |
| 7. Handling and storage | (a) Precautions for safe handling.<br>(b) Conditions for safe storage, including any incompatibilities. |
| 8. Exposure controls/personal protection | (a) OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the safety data sheet, where available.<br>(b) Appropriate engineering controls.<br>(c) Individual protection measures, such as personal protective equipment. |

| Heading | Subheading |
|---|---|
| 9. Physical and chemical properties | (a) Appearance (physical state, color, etc.); |
| | (b) Odor; |
| | (c) Odor threshold; |
| | (d) pH; |
| | (e) Melting point/freezing point; |
| | (f) Initial boiling point and boiling range; |
| | (g) Flash point; |
| | (h) Evaporation rate; |
| | (i) Flammability (solid, gas); |
| | (j) Upper/lower flammability or explosive limits; |
| | (k) Vapor pressure; |
| | (l) Vapor density; |
| | (m) Relative density; |
| | (n) Solubility(ies); |
| | (o) Partition coefficient: n-octanol/water; |
| | (p) Auto-ignition temperature; |
| | (q) Decomposition temperature; |
| | (r) Viscosity. |
| 10. Stability and reactivity | (a) Reactivity; |
| | (b) Chemical stability; |
| | (c) Possibility of hazardous reactions; |
| | (d) Conditions to avoid (e.g., static discharge, shock, or vibration); |
| | (e) Incompatible materials; |
| | (f) Hazardous decomposition products. |
| 11. Toxicological information | Description of the various toxicological (health) effects and the available data used to identify those effects, including: |
| | (a) Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact); |
| | (b) Symptoms related to the physical, chemical and toxicological characteristics; |
| | (c) Delayed and immediate effects and also chronic effects from short- and long-term exposure; |

| Heading | Subheading |
|---|---|
| 11. Toxicological information (Cont.) | (d) Numerical measures of toxicity (such as acute toxicity estimates). |
| | (e) Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition), or by OSHA. |
| 12. Ecological information (Non-mandatory) | (a) Ecotoxicity (aquatic and terrestrial, where available);<br>(b) Persistence and degradability;<br>(c) Bioaccumulative potential;<br>(d) Mobility in soil;<br>(e) Other adverse effects (such as hazardous to the ozone layer). |
| 13. Disposal considerations (Non-mandatory) | Description of waste residues and information on their safe handling and methods of disposal, including the disposal of any contaminated packaging. |
| 14. Transport information (Non-mandatory) | (a) UN number; |
| | (b) UN proper shipping name; |
| | (c) Transport hazard class(es); |
| | (d) Packing group, if applicable; |
| | (e) Environmental hazards (e.g., Marine pollutant (Yes/No)); |
| | (f) Transport in bulk (according to Annex II of MARPOL 73/78 and the IBC Code); |
| | (g) Special precautions which a user needs to be aware of, or needs to comply with, in connection with transport or conveyance either within or outside their premises. |
| 15. Regulatory information (Non-mandatory) | Safety, health and environmental regulations specific for the product in question. |
| 16. Other information | The date of preparation of the SDS or the last revision. |

### 2.6.4 MSDS/SDS Distribution

MSDSs/SDSs for all hazardous chemicals are immediately available to all employees in a centralized location in the Science Center. The Laboratory Safety Committee must ensure that they are readily available for review or in case of emergency. In the event of an employee exposure to a hazardous chemical, a copy of the MSDS/SDS must accompany the employee to the medical facility for reference if seeking treatment.

MSDSs/SDSs are prepared by chemical manufacturers to summarize health and safety information about their products. Chemical suppliers provide SDSs for each chemical they supply. A complete file of MSDS/SDS for chemicals, substances, or materials used at the Regis College is maintained in the EHCS office and are accessible to any faculty staff and students.

# 3. SAFETY EQUIPMENT AND CONTAINMENT

## 3.1 CHEMICAL FUME HOODS

General building ventilation systems provide a source of air for breathing and for input into local exhaust ventilation devices; they are not meant to protect workers from toxic substances released into the laboratory. Laboratory fume hoods are provided in areas where workers spend much of their time working with chemicals. Chemical fume hoods are certified annually by an outside contractor through Physical Plant. All chemical fume hoods are exhausted to the exterior of the building.

The experimental work conducted at Regis College must be appropriate to the physical facilities available; this is especially true for the ventilation system. If future work is not anticipated to be safely contained in the current facilities, Physical Plant must be notified. This is necessary because buildings are designed and ventilated as a unit and alterations to the ventilation of any given area can affect the rest of the building. Any modifications being considered must be approved by Physical Plant.

The most effective way to prevent exposure to airborne substances is to work with them in a chemical fume hood. Vapors and particulate matter of concern are contained within the hood and are prevented from entering the workspace, thus reducing employee exposure to the chemicals they work with.

The proper use of a chemical fume hood includes the following:

- Ensure the fume hood is operating correctly.
- Do not block exhaust vents and air foils in the fume hood.
- Minimize traffic by the hood.
- Conduct work at least 6 inches into the hood to allow for proper capture of vapors and aerosols.
- Do not place the face inside the hood to check on the experiment.
- Conduct work with the sash in the lowest position possible. The sash may act as a barrier should something go wrong with the experiment.
- Do not clutter the hood with bottles or equipment. Only materials actively in use should be in the fume hood to provide containment and reduce risk of extraneous chemicals being involved in fire or explosions that may occur in the hood.
- For large pieces of equipment, separate and elevate each instrument by using blocks or racks to safely and securely position equipment so that air can flow easily around all apparatus.

**If you suspect that your fume hood is not functioning properly, contact the CHO immediately.**

## 3.2 EMERGENCY EYEWASHES AND SHOWERS

Emergency eyewashes and showers are present in each laboratory at the Regis College. In addition, emergency eyewashes and showers are located outside of the chemical waste storage room. All pathways to emergency eyewashes and showers must be kept clear and accessible. Refer to Section 2.5, “Laboratory Inspection, Calibration, and Certification,” for information about the inspection frequencies of emergency eyewashes and safety showers.

**If your eyewash or safety shower is not functioning properly, contact the CHO immediately.**

## 3.3 FLAMMABLE STORAGE CABINETS

UL or FM-Approved self-closing flammable storage cabinets are to be used for the storage of compatible flammable liquids. Small quantities of flammable liquids may be kept out of the cabinets, but in general, the storage of flammable liquids outside the cabinets should be minimized. The intent of these cabinets is to prevent those flammable liquids stored inside from being involved in a fire for a limited period so that occupants have time to evacuate. All cabinets must comply with OSHA and NFPA requirements.

## 3.4 SPILL EQUIPMENT

EHSC maintains an inventory of absorbents and chemical spill equipment near the central accumulation area and within the laboratories. This inventory is reviewed and maintained as part of inspections performed by the CHO.

**Regis College employees are only authorized to clean up incidental spills. For an "Incidental" Spill (known material, small quantity that can be safely absorbed, neutralized, etc. at the time of the release by trained employees in the immediate area):**

1. **Identify the type of material spilled.**
2. **Contact the CHO (Campus Police if the CHO is unavailable).**
3. **The CHO will notify MassDEP if required.**
4. **Clean up the spill using available absorbent supplies.**
5. **Collect spill cleanup materials for proper disposal.**

**For All Spills That Are Not "Incidental":**

1. **DO NOT attempt to clean up the spill.**
2. **Identify the type of material spilled, if possible.**
3. **Contact the Campus Police.**
4. **Evacuate the immediate area if directed to do so by Campus Police.**
5. **The CHO will notify MassDEP if required.**

# 4. LABORATORY SAFE WORK PRACTICES

The following sections provide safe work practices that must be followed in Regis College laboratories. These safe work practices are intended to protect personnel in the laboratory and, as a result, people in other parts of the building. It is the responsibility of personnel working in Regis College laboratories to understand and adhere to these safe work practices and those developed for each laboratory. Questions regarding safe work practices should be presented to the CHO.

## 4.1 PREPARATION FOR WORK WITH LABORATORY CHEMICALS

Preparation is essential for safe laboratory work with hazardous chemicals. Before beginning work involving hazardous chemicals consider and plan for: the chemicals, equipment and other materials needed; the proper sequence of steps to be followed; and the necessary protective measures and other safety considerations.

Preparation for work with laboratory chemicals includes the following:

- **Chemicals** – Make sure employees are familiar with the hazards of the chemical(s) before beginning work (e.g., flammability, reactivity, volatility). Review MSDSs/SDSs and/or consult the CHO as appropriate. Where feasible, consider how the procedure could be conducted using a less hazardous substitute, or using smaller quantities.
- **Equipment** – Ensure that equipment is assembled and/or functioning properly before use. Use equipment only for its intended use. Inspect equipment and materials to be sure they are free of defects or damage and that necessary guards are in place.
- **Written Protocol** – Develop/use written experimental protocols wherever feasible. Step-by-step instructions help to minimize the possibility of errors and identify steps where special precautions may be necessary.
- **Set-up** – Check that equipment and supplies are in place before actual work begins, including the necessary protective equipment. Check that there is sufficient working space and that the work area is uncluttered and orderly. Remove unnecessary materials, equipment, and supplies. Avoid placement of chemicals and equipment on the floor of working areas where they may be knocked over or may create a tripping hazard.
- **Clean-up** – Think through ahead of time the necessary steps and materials for proper clean-up, including as appropriate: hazardous waste to be collected in satellite accumulation areas; surfaces to be decontaminated; glassware to be washed; other disposables to be generated; and similar considerations.

## 4.2 GENERAL CHEMICAL SAFETY

The following safe work practices should be followed when handling chemicals:

- Review MSDS/SDS and other chemical safety information prior to working with unfamiliar hazardous materials.
- Minimize exposure to chemicals, even when handling chemicals of no known risk. Avoid skin contact and inhalation of all chemicals.
- Assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.
- Use laboratory carts designed to prevent bottles from spilling when transporting hazardous chemicals.

- Mouth pipetting of any substance is prohibited.
- Obtain approval from the CHO whenever extremely toxic, carcinogenic, or physically hazardous agents will be used.
- Horseplay, practical jokes, and other behavior that may startle or distract a fellow worker are not permitted.

## 4.3 STANDARD OPERATING PROCEDURES

The OSHA Lab Standard requires the development and implementation of Standard Operating Procedures (SOPs) relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals. An SOP is a written set of instructions or guidelines that details the uniform procedures to be followed routinely, and safety precautions to take when carrying out a particular experiment or procedure. Each laboratory needs to have SOPs that are clear, concise, and useful to laboratory personnel for training and safety purposes. SOPs may be developed according to a process or procedure, to classes of hazardous chemicals, individual hazardous chemicals, or any other reasonable approach that address health and safety concerns of an experimental protocol. The following sections outline SOPs by the type of chemical hazard and are generally applicable to all Regis College laboratories. These general safety procedures are designed to ensure basic levels of personnel health and safety in the laboratory, for routine and common practices, uses, and chemicals. As necessary, each laboratory is responsible for developing and documenting process-specific SOPs.

### 4.3.1 Flammables: SOP

Storage and use of flammable liquids within Regis College laboratories is regulated by the Massachusetts Board of Fire Prevention Regulations 527 CMR 14.00. Hazardous chemicals (flammable liquids, flammable solids, oxidizers, unstable/reactive) may be stored only in amounts that comply with the Weston Fire Department "License for Storage of flammables and combustibles."

It is the responsibility of the Laboratory Safety Committees and each Instructor to ensure that flammable liquids stored in the laboratory are properly identified, labeled, and managed. The hazard presented by flammable chemicals in the laboratory depends on the specific substance's characteristics (e.g., flashpoint[1]) and the conditions under which it is used (e.g., quantity). Flammable chemicals can be liquids, solids, or gases. A flammable liquid is any liquid having a flash point below 100°F (37.8°C). Flammable liquids are also known as Class I liquids and subdivided according to flash point and boiling point as indicated in the table below. A combustible liquid is any liquid having a flash point at or above 100°F, and is known as a Class II or III liquid as indicated in the following table.

| | Flammables | | | Combustibles | |
|---|---|---|---|---|---|
| **Class** | IA | IB | IC | II | III |
| Flash Point | <73°F | <73 °F | 73 °F - 100 °F | 100 °F - 140 °F | >140 °F |
| Boiling Point | <100 °F | ≥100 °F | <100 °F | | |

Source: OSHA 29 C.F.R. 1910.1450(b)

[1] The flashpoint of a liquid is the lowest temperature at which it gives off enough vapor to form an ignitable mixture with the air and produce a flame when a source of ignition is present.

Potential hazards of flammable chemicals include:

**Flammable Chemicals**

**Fire** – For flammable liquids and gases, a sufficient concentration of vapors in air is required in order to be ignited and produce a flame. There is a range of concentrations in air for each material that is optimal for the ignition and the sustenance of combustion; this is called the flammable range (outside this range, the mixture is "too lean" or "too rich"). Within a material's flammable range, fire can result when an ignition source, including open flames, electrical sparks, friction sparks, etc., is present or introduced.

**Autoignition** – At temperatures above a material's autoignition temperature, fire can result from autoignition of flammable and combustible liquids without an obvious ignition source. Most common flammable and combustible liquids have autoignition temperatures in the range of about 570°F to 1000°F (~300°C -550°C). Some flammable liquids have very low autoignition temperatures, such as ethyl ether (356°F/160°C) where its vapors have been ignited by hot steam pipes.

**Flashback** – Flashback can occur with flammable gases. Many flammable compressed gases are heavier than air, so if a cylinder leaks in a poorly ventilated area, gases can settle and collect in low lying areas such as pits, sewers, or trenches. The gas trail can spread far from the cylinder. If the gas trail contacts an ignition source, the fire produced can flash back to the cylinder.

**Fire Byproducts** – Flammable liquid fires tend to burn very fast and may also give off a lot of heat and clouds of thick, black, toxic smoke. Certain chemicals may produce toxic decomposition products in the event of fire.

**Other Hazards** – Flammable materials may pose other hazards besides the risk of fire; they may also be toxic or corrosive, and many undergo dangerous chemical reactions in the event of contact with incompatibles such as oxidizing materials.

Safe work practices for flammable chemicals include:

1. Limit the quantities at any one location to those necessary, but not to exceed the limits specified above.
2. Prohibit smoking and eliminate other possible sources of ignition wherever flammable liquids are stored or used.
3. Prevent accumulation of vapors by careful handling and by providing adequate ventilation.
4. Use only approved containers (e.g. safety cans, or metal drums) for all transportation and handling of flammable liquids.
5. Avoid sparks from static charges generated by pouring; connect dispensing and receiving containers (if metal) by direct bonding or by indirect bonding through a common ground. The maximum impedance of the bond shall not exceed 6 ohms.
6. Provide fire barriers, fire alarms and fire extinguishers, as appropriate, at all locations where flammable liquids are stored or used.
7. Label every container used for flammable liquids with the name of the material and the words: "DANGER – FLAMMABLE."
8. Label all approved flammable storage cabinets with the words: "FLAMMABLE – KEEP FIRE AWAY."

## ***MAXIMUM CONTAINER SIZE FOR POINT OF USE STORAGE***

The potential fire hazard depends on the flash point and the quantity of liquid being used. The following table gives the maximum size container allowed for each class of liquid.

| | Flammables | | | Combustibles | |
|---|---|---|---|---|---|
| **Container Type** | IA | IB | IC | II | III |
| Glass | 1 pt. | 1 qt. | 1 qt. | 1 gal. | 1 gal. |
| Metal or Approved Plastic | 1 gal. | 5 gal. | 5 gal. | 5 gal. | 5 gal. |
| Safety Cans | 2 gal. | 5 gal. | 5 gal. | 5 gal. | 5 gal. |

***MAXIMUM QUANTITIES FOR POINT OF USE STORAGE***

The potential fire hazard also depends on the total quantity of flammable and combustible liquids present within a containment unit and the type of containers in which the liquids are stored. The maximum quantity allowed per unit is as follows:

| Storage Unit | Container Type | Total Quantity Stored |
|---|---|---|
| Shelf or open storage/use: | Glass, Metal or Approved Plastic | 10 gallons |
| | Safety Cans | 25 gallons |
| Approved flammable storage cabinets: | All Approved Containers | 120 gallons |

### 4.3.2 Corrosives: SOP

Corrosive chemicals can damage or destroy body tissue, depending on the type and concentration of the chemical, the physical form, the body part(s) contacted, and the speed used in applying emergency measures, such as drenching and flushing.

Potential hazards of corrosive materials include:

**Corrosive Materials**

**Contact** – Contact with corrosive chemicals can cause burns, ulceration, or other damage to skin, mucus membranes, eyes, and lungs. Acids, especially when in concentrated form, are most likely to cause immediate pain when they come into contact with the body. Contact with strong bases may go unnoticed since pain does not always occur, allowing the base time to react with the body part, and with potential for serious injury to result.

**Embrittlement** - Corrosives can etch or pit metals, such as stainless steel. Microscopic stress cracks not visible to the naked eye can form and can severely weaken or degrade the material, leading to unexpected failure (or explosions in the case of pressure vessels). Use containers designed for use with corrosive materials.

Safe work practices for corrosive chemicals include:

1. Purchase corrosives in the smallest container size practical. Where available, purchase corrosives in bottles with a safety coating, to minimize the risk of breakage and spills.
2. Wear appropriate personal protective clothing for handling corrosives (e.g., eye/face protection, buttoned lab coat or splash apron, and impervious gloves).
3. Store liquid corrosives on low shelves or in acid or caustic storage cabinets. Avoid storage of corrosives above the bench or on upper storage shelves.
4. Segregate corrosives from incompatible chemicals, using plastic storage bins as necessary to further segregate and provide secondary containment in storage. Check the MSDS/SDS for proper storage (e.g., segregate oxidizing acids from organic acids, and flammable and combustible liquids; segregate acids from bases and active metals such as sodium, potassium, magnesium, etc.).

5. Use proper pouring techniques when pouring acids into water. Always add acids to water. Use cold water; add slowly in small amounts.
6. Use caution if transferring corrosives from one container to another. Dispense from only one container at a time. Finish all dispensing of one material before starting to dispense another. Make sure containers are tightly closed.
7. If transferring corrosives to secondary containers, be sure to use the type of containers recommended by the manufacturer or supplier. Corrosives can damage or destroy containers made of improper materials.
8. Protect containers against physical damage (e.g., banging, breakage) when transferring or using them. Make sure containers are tightly closed when not in use.
9. Always handle corrosive material carefully to avoid the generation of dusts or other aerosols for solid corrosives, and mists or vapors for liquid corrosives.
10. Use bottle carriers (or carts designed for chemical transport) for transporting corrosives in glass bottles.

### 4.3.3 Cryogenic Materials: SOP

Cryogenic materials exist at temperatures of -100°F (-60°C) to -460°F (-266°C), and have a boiling point below 200°K (-73.6°C) at one atmosphere. Cryogens are extremely cold and have large liquid-to-gas expansion ratios (>700 for most). A small liquid spill produces a very large volume of gas that can displace air in a confined space. At these temperatures, tissue burns may be sustained after contact with the fluids, surfaces cooled by the fluids, or by evolving gases.

Potential hazards of cryogenic materials include:

**Cryogenic Materials**

**Contact** – Contact with exposed skin can produce a painful burn similar to thermal burns. A splash of cryogenic fluid to the eye can cause tissue damage and even loss of sight. Unprotected parts of the skin coming in contact with un-insulated items may also stick to them and the flesh may be torn on removal. Cold vapors or gases from cryogenic fluids may cause frostbite in the event of prolonged or severe exposure of unprotected parts.

**Asphyxiation** – Due to its large expansion ratio, a cryogenic liquid can displace oxygen if allowed to vent into a small closed space or other confined area. Do not use or store cryogenic fluids in a cold room or similar confined area (unless designed for such purpose and equipped with suitable controls and alarms).

**Pressure Build-up** – Since liquefied gases boil at room temperature, the resulting rapid increase in pressure can cause projectiles or container/system failure if cryogenic fluids are contained in a closed system. This is why it is critical for all personnel to wear safety glasses at a minimum (or other appropriate eye/face protection) when in a laboratory where cryogens are used. Certain cryogen handling tasks necessitate the use of a face shield by the user. Wear appropriate PPE, use properly vented containers, work behind safety shields where appropriate, and be aware of the hazards of pressure build-up.

**Embrittlement** – Ordinary materials may not be able to withstand cryogenic temperatures without failure. Use containers designed for use with cryogenic materials. Materials exposed to cryogenic temperatures for long periods or that have undergone periodic warming must be examined for cracks and deterioration.

**Hypothermia** – Low air temperatures arising from proximity of cryogenic fluids or gases can cause hypothermia, depending on susceptibility, such as atmospheric temperature, length of exposure, and individual factors (e.g., older people are more likely to be affected).

Some types of cryogenic materials can also cause oxygen enrichment. Liquid nitrogen and liquid helium are capable of fractionally distilling air, causing liquid oxygen to collect in the cryogenic container. Liquid oxygen can increase the combustibility of many materials, and if vented into an enclosed space, can create potentially explosive conditions.

Safe work practices for cryogenic materials include:

1. Use only containers specifically designed for holding cryogenic liquids. Where appropriate, tape containers and cold traps to prevent flying glass in case of breakage.
2. Do not store cryogenic liquids in a container with a tight-fitting lid because the pressure will build-up as the cryogen boils and the container may fail.
3. Store cryogenic materials only in large and well-ventilated areas so that the rapid boil-off of fluids will not displace oxygen to create a potentially oxygen-deficient atmosphere. Never lower the head into a dry ice chest, because the oxygen content may be inadequate and suffocation can result.
4. Wear required PPE, including safety glasses with side shields and a full-face shield to protect the eyes and face from splash hazards and potential projectiles from pressure build-up. Use suitable gloves to protect hands from cryogenic materials. The gloves should be loosely fitting so that they can be quickly removed if the glove finger becomes frozen or if cryogenic liquid should spill into them.
5. Remove jewelry (or cover, if necessary), such as watches, rings, etc. to minimize the risk of cryogenic liquid being trapped beneath them, resulting in cold burns.
6. Put objects into a cryogenic liquid slowly, and pour liquids into containers slowly in order to minimize boiling and splashing. If using dry ice, add to liquid slowly and in small amounts to avoid foaming and boil over.

### 4.3.4 Compressed Gases: SOP

Compressed gases pose the potential for both physical and chemical hazards.

Potential hazards of compressed gases include.

**Compressed Gases**

**Potential Energy** - The large amount of potential energy resulting from compression of the gas makes a compressed gas cylinder a potential projectile if stored or handled improperly.

**Contact** – Compressed gases may also pose hazards based on their chemical contents (e.g., flammability, toxicity, reactivity, etc.).

**Reactivity** – Gases must be compatible with the materials used for the regulators and lines. For instance, copper should be avoided in systems with ammonia or acetylene.

Safe work practices for compressed gases include:

**Compressed Gas Cylinder Use**

1. Ensure that the cylinder content is clearly identified with the chemical name and hazard warning. Do not deface or remove cylinder markings or labels.
2. Visually inspect cylinders. Check the condition of the cylinder and fittings to ensure they are in good working order and that there is no evidence of corrosion, rust, discoloration, or other problems. Ensure that there are no leaks.
3. Keep compressed gas container valves closed at all times except when in use.

4. Do not force a cylinder valve or connections. If the cylinder cannot be opened by the wheel or small wrench provided, contact the vendor.
5. When opening cylinder valves, do not hold the regulator. Stand with the valve between you and the regulator. Open valve slowly, directed away from your face.
6. Keep removable caps and plugs on compressed gas containers at all times except when connected to dispensing equipment.
7. Do not place cylinders in any area where they:
    a. Are subject to contact with a flame or temperatures above 125° F (51.7° C)
    b. Are subject to low temperature extremes (unless approved by the supplier).
    c. May become part of an electrical circuit.
8. Keep all cylinders secured in place using chains, cages, straps, or special holding or clamping devices. Do not use wire, rope, or tubing.
9. Do not use compressed gas containers as rollers, supports, or for purposes other than containing the gas as labeled.
10. Do not attempt to transfer compressed gases from one container to another cylinder. This must only be performed by the supplier or manufacturer.
11. When a cylinder becomes empty, contact the Physical Plant to arrange for transport to the empty cylinder storage location.

**Cylinder Leaks and Other Problems**

1. Do attempt to repair or alter cylinders, valves, or pressure relief devices.
2. In the event a cylinder leaks, attempt to remedy the leak by tightening the valve gland or packing nut. If this does not stop the leak or if there are doubts:
    a. Close the valve and attach a tag indicating the cylinder is unserviceable.
    b. Contact the Physical Plant to remove the leaking cylinder to a well-ventilated location.
    c. Notify the gas supplier and follow instructions for the return of the cylinder.
3. Notify the Physical Plant, who will contact the vendor, under *any* of the following conditions:
    a. Cylinder leaks or becomes defective
    b. Cylinder is exposed to fire
    c. Harmful foreign substance enters the container or valve
    d. Cylinder or valves become severely corroded
    e. Any other damage that may impair the safety of the container.

**Cylinder Transportation and Storage Areas**

1. Before transport, ensure the cap is securely in place to protect the stem.
2. Move all cylinders using designated carts or dollies equipped with retaining straps and chains.
3. Group compressed gas containers by type of gas and arrange groups to take into account the gases contained (e.g., store flammable gases away from oxidizers).
4. Store full and empty gas containers separately in labeled and well ventilated, dry areas.

5. Keep all cylinders secured in place using chains, cages, straps, or other devices intended for that purpose.
6. Do not store compressed gas containers near readily ignitable substances or bulk combustibles, in areas subject to temperature extremes, or in wet or moist areas that could lead to rusting.

### 4.3.5 Peroxide-Forming Chemicals: SOP

Peroxide-forming chemicals react with oxygen to form peroxy compounds, with the potential to form explosive peroxide crystals. The reaction can be initiated by light, heat, contaminant, or loss of an inhibitor. The rate of peroxide formation can be affected by exposure to air, light, heat, moisture, and contamination from metals. The explosion risk increases if the peroxide crystallizes or becomes concentrated by evaporation or distillation. There are four classes of peroxide-forming chemicals, based upon the peroxide formation hazard (see Appendix G):

- Severe Peroxide Hazard
- Concentration Hazard
- Shock and Heat Sensitive
- Other Potential Peroxide-Forming Chemicals

The list of peroxide-forming chemicals included in Appendix G is not intended to be all-inclusive; always consult the MSDS/SDS and/or label for a specific chemical.

Potential hazards of peroxide-forming chemicals include:

**Peroxide-Forming Chemicals**

**Ignition/Explosion** - Peroxides may be sensitive to shock, sparks, or other forms of accidental ignition, and in some circumstances, can become low power explosives with the potential to cause serious accidents.

**Other Hazards** - Some peroxide-forming compounds (e.g., diethyl ether, tetrahydrofuran) are also extremely flammable. Some also have high vapor densities, which means that explosive airborne concentrations can accumulate in low spots.

Safe work practices for peroxide-forming chemicals include:

1. Purchase only the quantity that will be used in a short time and in the smallest size of container that is practical. Purchase chemicals that have a peroxide formation inhibitor, where possible.
2. Upon receipt, use a permanent marker to label the container with the date received and initials.
3. Upon opening a new container of a peroxide-forming material, use a permanent marker to label the container with the date opened and initials. The length of time a peroxide-forming chemical can be safely stored depends on the particular material; some form peroxides on aging, others upon concentration. Refer to Appendix G, read the MSDS/SDS and other sources of hazard information, or contact the CHO for assistance.
4. Do not open containers if the date of receipt indicates that it is past the recommended shelf life (or more than twelve months old), or if it is past the manufacturer's expiration date.
5. Inspect containers for peroxide formation before opening or moving the containers. Do not open, touch, or otherwise disturb any container if crystalline solids are observed in liquid peroxide-forming chemicals. From a safe location, immediately contact the CHO.
6. Store peroxide-forming chemicals in airtight amber glass containers. The amber glass container protects the substance from excess light exposure and allows the user visual access to the substance without opening

the container. Once material is removed from the source container it must not be returned to the reagent container.

7. Before storing, ensure that bottles and caps are free of chemical residue. Keep containers tightly capped to minimize peroxide formation.
8. Store peroxide-forming chemicals away from heat sources, sparks, direct light, flammables, and combustibles. Check the MSDS/SDS for any additional incompatibilities of the specific material.
9. Avoid the use of metal implements, since metals contamination can lead to explosive decomposition. Use implements made of alternative materials such as wood, ceramics, or Teflon®.
10. Use extra caution when handling near-empty or empty containers of peroxide-forming materials because the air space above the liquid can accelerate the formation of peroxides.
11. If antioxidant inhibitors are used, be aware that the inhibitor may be consumed with time, making the compound again sensitive to peroxidation.
12. Consider the need for additional controls, such as shielding of reactions. [*Note: Fume hood sashes may provide some level of physical protection against minor explosions; however, most sashes are not explosion-proof.]*

### 4.3.6 Work with Particularly Hazardous Chemicals: SOP

Where tasks will involve work with particularly hazardous substances, including select carcinogens, reproductive toxins, and/or substances with high acute toxicity, certain provisions for additional employee protection may also be necessary, such as:

- Specification of designated area(s);
- Provide additional chemical-specific hazard training for employees who will work in designated areas;
- Use of containment equipment such as fume hoods, glove boxes, or biological safety cabinets (BSCs);
- Procedures for safe removal of contaminated waste; and
- Decontamination procedures.

Types of substances that OSHA considers to be particularly hazardous are listed below, with additional details provided in Appendix H. Examples of reproductive toxins used in Regis College laboratories include formamide and analiphatic amide, which are included in some of the kits. The volume, concentration and risks of exposure from handling kit components may not warrant specification of designated areas.

**Select Carcinogens** – Substances regulated as select carcinogens by OSHA include any substance that is listed on:

1. Compounds regulated by 29 C.F.R. Part 1910, Subpart Z - Toxic and Hazardous Substances
2. Compounds considered to be "Known Carcinogens" by the National Toxicology Program, (NTP) in their Annual Report on Carcinogens as well as some substances listed as "reasonably anticipated to be carcinogens."
3. Compounds designated as "carcinogens to humans" (Group 1) and some "reasonably anticipated to be carcinogens" (Group 2A or 2B) by the International Agency for Research on Cancer, (IARC).

**Reproductive Toxins** – Reproductive toxin includes any chemical that may affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis). Examples of chemicals with reproductive toxicity include dibromochloropropane (DBCP), lead, and ethylene oxide.

**Substances with a High Degree of Acute Toxicity** – Although the OSHA Laboratory Standard does not define substances with a high degree of acute toxicity, the rule's preamble describes them as those substances that are "fatal or cause damage to target organs as a result of a single exposure or exposures of short duration." Hydrogen cyanide, hydrogen sulfide, and nitrogen dioxide are given as examples. Specifically, high acute toxicity includes any chemical that falls within any of the following categories:

1. A chemical with a median lethal dose ($LD_{50}$) of 50 milligrams (mg) or less per kilogram (kg) of body weight when administered orally to certain test populations.
2. A chemical with an $LD_{50}$ of 200 mg or less per kg of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) to certain test populations.
3. 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.

Safe work practices for particularly hazardous substances include:

1. Evaluate whether a safer chemical alternative is feasible. If not, ensure the CHO has reviewed and approved work with particularly hazardous substances.
2. Wherever feasible, conduct procedures in a fume hood. Otherwise, use equivalent engineering or combinations of other controls.
3. Use the smallest amount of chemical that is consistent with the requirements of the work to be done.
4. Wear appropriate personal protective equipment to prevent exposure.
5. Where work with carcinogens, mutagens, or reproductive hazards is to be conducted on a routine basis, establish designated areas (e.g., benches or hoods) for work with these materials, clearly label the designated area with a sign, restrict access, and implement special decontamination procedures.
6. Use care when weighing solids to avoid creation of aerosols. Where possible, use fume hoods or other vented enclosures for weighing highly hazardous chemicals. Where applicable, use high-efficiency particulate air (HEPA) filters or high-efficiency scrubber systems to protect vacuum lines and pumps.
7. Establish a schedule and procedure for decontamination of work surfaces and equipment (e.g., at the completion of the operation or at the end of the day). The decontamination solution must be compatible with the materials with which it is being used, and should be selected based on the properties of the materials it is being used to decontaminate.
8. Establish proper housekeeping procedures. Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance is a dry powder.
9. Carefully handle waste generated from procedures involving particularly hazardous chemicals. Follow all waste procedures (e.g., labeling of containers, keeping waste collection containers tightly closed when not in use, providing secondary containment for liquid waste containers, etc.) while waste is in storage prior to transfer to the central storage room.
10. For *embryotoxins* (e.g., organomercurials, lead compounds, formamide), if you are a woman of childbearing age, handle these substances only in a hood whose satisfactory performance has been confirmed, using appropriate protective apparel (especially gloves) to prevent skin contact.
11. Store these chemicals in appropriately labeled, unbreakable, chemically resistant, secondary containers.
12. Review each use of these materials with the CHO and review continuing uses annually or whenever a procedural change is made.

13. Notify the CHO of all incidents of exposure or spills. Call the CHO from a safe location for any emergency situations.

**Know the hazards and safe work practices for the specific material and conditions of use. Ensure the CHO has reviewed and approved procedures involving carcinogens, reproductive toxins, highly acute toxins, and other particularly hazardous substances.**

## 4.4 PERSONAL PROTECTIVE EQUIPMENT

PPE hazard assessments are performed by the CHO or Instructors for each laboratory and specific job task to determine if hazards are present that necessitate the use of PPE. Where such hazards are present, or likely to be present, the appropriate PPE has been identified and communicated to laboratory personnel. In addition to the hazard assessments, the following safe work practices should be followed in regards to PPE:

- Wear laboratory coats and safety glasses when in the laboratory.
- Do not wear laboratory coats in public areas/outside the laboratory.
- Wear gloves when handling chemicals and remove gloves before touching common objects (e.g., telephone, doorknob, etc.) and before leaving the laboratory.
- Whenever a hazardous chemical is used in the laboratory, the Instructor assures the appropriate types/sizes of gloves are readily available and that staff wears the appropriate gloves.
- Inspect all gloves before use.
- If the respirators may be needed, the CHO should be contacted for an exposure assessment. Voluntary use of filtering facepieces/dust masks is permissible where relief from nuisance odors or dust is desirable. A copy of OSHA's statement, "Information for Personnel Using Respirators When Not Required Under the Standard," must be given to those individuals using filtering facepieces/dust masks voluntarily.

## 4.5 EQUIPMENT AND GLASSWARE

The following safe work practices for equipment and glassware should be followed when working in the laboratories at Regis College:

- Handle glassware with care to avoid damage; do not use damaged glassware.
- Dewar flasks and other glassware under pressure or vacuum should be shielded or wrapped to contain chemicals and glass shards should implosion occur.
- Use plastic instead of glass whenever possible.
- Dispose of damaged glassware in containers approved for broken glass.

## 4.6 LABORATORY DRESS CODE

The following dress code should be followed in the laboratory:

- Wear safety glasses with side shields or goggles in the laboratory.
- Wear laboratory coats or aprons when working with corrosive chemicals and/or particularly hazardous substances.
- Do not wear sandals or other open-toed shoes that do not protect the feet.
- Wear long pants or skirts in the laboratory.

## 4.7 HYGIENE

Personal hygiene is essential for keeping employees healthy and can aid in the reduction of employee exposure. The hygiene safe work practices listed below should be followed when working in Regis College laboratories:

- Do not eat, drink, smoke, apply cosmetics, chew gum/tobacco, or insert contact lenses in the laboratory.
- Do not store, handle, or consume food or beverages in storage areas, refrigerators, or glassware or use utensils that are designated and used for laboratory operations or procedures.
- Wash hands before leaving the laboratory; never use solvents for hand washing.
- Never smell or taste chemicals to determine the chemical's identity.

## 4.8 HOUSEKEEPING

It is essential for both safety and efficiency that the facilities be kept neat and orderly. The bullets below provide housekeeping practices that should be followed in the laboratory:

- Floors, shelves, and benches should be free from dirt and unnecessary apparatus and tools.
- Equipment should not obstruct exits, passages, or access to eyewashes, safety showers, and other safety equipment.
- Care should be taken with what is put into waste containers. Do not dispose of hazardous waste into regular trash bins.
- Small incidental spills should be cleaned up promptly.

## 4.9 CHEMICAL STORAGE

It is important to store chemicals in ways that eliminate or diminish the risk of accidents that might cause exposure to toxic chemicals or byproducts of the mixing of incompatible chemicals. Appendix I provides some information about potentially incompatible materials. There are a few general rules to follow when storing chemicals:

- Incompatible chemicals must be segregated. Lists of incompatible chemicals can be found in the MSDS/SDS.
- Glass bottles must not be stored on high shelves or on the floor.
- Chemicals should be stored in containers with which they are compatible.
- All bottles must be labeled with the product identifier and words, pictures, symbols, or combination thereof, which provide at least general information regarding the hazards of the chemicals, and which, in conjunction with the other information immediately available to employees will provide specific information regarding the physical and health hazards of the hazardous chemical.

## 4.10 WASTE DISPOSAL

All chemicals shall be managed and disposed of in accordance with the procedures in the Regis College Hazardous Waste Management Plan. General rules for the accumulation and storage of waste in the laboratory include:

- Do not dispose of chemical waste in the trash, down drains, or evaporate in fume hoods.
- Provide a secondary container for waste collection containers.

- Keep waste containers closed at all times except when adding or removing waste. Do not leave funnels in containers.
- Label all chemical containers. Include contents, your name, phone number, and department on the label. Position containers so that waste labels are visible.
- Segregate waste containers by hazardous class. (i.e., flammable, corrosive, reactive, etc.) Do not mix waste streams.
- Maintain ten percent free space in waste containers to allow for expansion.
- Conduct weekly inspections of chemical waste collection area.
- Post the name and phone numbers for responsible persons to contact 24 hours a day in case of an emergency.

# 5. EMPLOYEE INFORMATION AND TRAINING

The CHO will provide information and training about the handling of hazardous chemicals in the laboratory. New employees receive training on general laboratory and chemical safety before they begin their work in Regis College laboratories. Required information and initial training include:

1. The contents of the OSHA lab standard, Occupational Exposure to Hazardous Chemicals in Laboratories, and its appendices 29 C.F.R. § 1910.1450.
2. The location, availability, and applicable details of the CHP and SOPs.
3. Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.
4. The location and availability of references, such as MSDSs/SDSs, the on-line links provided in Appendix J and hard copy references available from the CHO.
5. Methods and observations that may be used to detect the presence or release of a hazardous chemical (e.g., monitoring, visual appearance, odor, etc.).
6. Physical and health hazards of chemicals.
7. Measures employees can take to protect themselves from chemical hazards, including specific procedures implemented at the Regis College.

Employees shall be informed by the Instructor of the presence of hazardous chemicals when assigned to a work area and prior to new exposure situations.

Appendix D contains a training program that the CHO presents to laboratory personnel to explain this CHP. Regis College provides initial training and annual refresher training for all subject employees. An employee will be retrained if their job responsibilities change, if there is a change to the CHP, or if they have shown deficiencies in training they have received. Records of chemical hygiene training done by Regis College are kept by EHSC.

# 6. MEDICAL CONSULTATION AND EXAMINATIONS

The purpose of medical surveillance is, as a secondary means of prevention, to detect early failures of primary means of workplace protection that may result in work place illness. All employees needing medical attention use the medical services at Newton-Wellesley Hospital. Medical consultation is offered to employees under the following circumstances:

- Whenever a staff member develops signs or symptoms associated with a hazardous chemical to which the staff member may have been exposed in the laboratory.
- Where exposure monitoring reveals an exposure level routinely above OSHA's Action Level or PEL for an OSHA regulated substance which requires such monitoring or medical surveillance.
- Whenever an event occurs such as a chemical spill, leak, explosion, etc. that results in a potential hazardous exposure.

## 6.1 MEDICAL EXAMINATIONS AND CONSULTATIONS

All medical examinations and consultations are performed by or under the direct supervision of a licensed physician or healthcare professional and are provided to the employee free of charge, without loss of pay, and at a reasonable time and place.

Regis College must provide the following information to the physician:

- The identity of the hazardous chemical(s) to which the employee may have been exposed;
- A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and
- A description of the signs and symptoms of exposure that the employee is experiencing, if any.

For employee medical examination or consultation, the employee shall obtain a written opinion from the examining physician, which includes:

- Recommendations for follow-up, if needed;
- Results of the medical examination and associated tests;
- Any medical condition revealed in the course of the examination that may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace; and
- A statement that the employee has been informed by the physician of the results of the consultation or examination, as well as any follow-up which needs to be done.

## 6.2 EXPOSURE REPORTING

Any staff member who believes they have had an exposure should verbally report the incident to the CHO. An incident report form must be completed and submitted to the Human Resources, who will communicate and coordinate with the CHO and the responsible supervisor who will arrange for a medical consultation.

# 7. EMERGENCY PROCEDURES

Emergencies that may occur in a laboratory include: fire, explosion, chemical spill or release, medical, or other health threatening accidents. All emergencies should be reported to the CHO and may require additional reporting to outside agencies. The CHO will be responsible for notifications to Campus Police and outside agencies for emergencies involving chemicals. Refer to Appendix A for the Emergency Contact List. General procedures to be followed in any emergency are:

- Render assistance to person(s) involved and remove them from exposure to further injury, if necessary, and if this can be done safely.
- Notify nearby persons who may be affected and call the CHO to report the emergency and seek assistance.
- Evacuate the area until help arrives. If necessary, pull the fire alarm to evacuate the entire building.
- Wait for emergency responders and assist them in handling the emergency.
- Assist in the follow-up investigation of the emergency.

Refer to the sections below for additional information about emergency procedures.

## 7.1 CHEMICAL CONTACT

Newton-Wellesley Hospital is equipped and staffed to handle industrial injuries. If deemed necessary by the CHO, an injured employee will be transported to Newton-Wellesley Hospital, unless specifically requested otherwise by the employee or by emergency medical services (EMS) due to the nature of the incident. In cases of chemical exposure the CHO will provide a copy of the chemical MSDS/SDS and other appropriate information resources. Ambulance service is provided by EMS.

## 7.2 EYE CONTACT

If chemical contact with the eye or eyes occurs follow the steps below:

- Promptly flush the eye(s) with water for 15 minutes.
- Incidents and near misses should be verbally reported to the CHO or Lab Safety Committee.
- The CHO will coordinate with Campus Police to provide medical help, as necessary.
- An incident report form must be completed and submitted to the CHO who will communicate and coordinate with the Office of Human Resources and the responsible supervisor.

## 7.3 SKIN CONTACT

If chemical contact with the skin occurs, use the following steps:

1. Remove contaminated clothing as quickly as possible.
2. Flush the affected area with water.
3. Incidents and near misses should be verbally reported to the CHO or Lab Safety Committee.
4. The CHO will coordinate with Campus Police to provide medical help, as necessary.
5. An incident report form must be completed and submitted to the CHO who will communicate and coordinate with the Office of Human Resources and the responsible supervisor.

## 7.4 SPILL CLEAN UP

Laboratory personnel are responsible for cleaning up incidental spills in their areas. An incidental spill is a release in which the substance(s) can be absorbed, neutralized, or otherwise controlled at the time of release by personnel in the immediate release area and where there is no significant risk of chemical exposure, fire or explosion. Appropriate protective apparel must always be worn and spill materials disposed of as hazardous waste.

Releases that require an emergency response pose a serious threat to employees' health and safety and, by their very nature, require an emergency response. Regis College personnel are not trained to clean-up releases that require emergency response.

An incidental release becomes an emergency when:

- The release requires evacuation of employees in the area;
- The release creates, or has the potential to create, and immediate danger to life and health;
- The release creates, or has the potential to create, a serious fire or explosion;
- The release requires immediate attention because of imminent danger;
- The release may cause high levels of exposure to toxics;
- It is not known whether employees in the immediate area can handle the situation with the equipment and the personal protective gear provided; and
- The situation is unclear or information about the important factors is unknown.

In the event of a non-incidental chemical spill, the following steps must be taken:

1. Cease operations, evacuate from the immediate danger zone, and contact the CHO.
2. If safe to do so, determine the:
    a. Sources of the leak or spill;
    b. Type of material spilled; and
    c. Amount of material spilled.
3. Classify the characteristics of the material spilled and determine the affected areas.
4. Until the CHO arrives, the Instructor is responsible for control of the area and should ensure employees are not exposed to hazardous materials.
5. Upon arrival, the CHO assumes incident command and determines if evacuation is necessary.
6. If necessary, the CHO contacts Campus Police and the Weston Fire Department to contain the spill and stabilize the situation and arranges for a spill response coordinator to clean-up the spill.
7. Campus Police arranges for emergency services for any injured personnel.
8. If the spill response does not put employee life or health in danger, disperse absorbent materials and/or booms to prevent the spill from spreading.
9. Restrict sources of ignition.

# APPENDIX A: EMERGENCY CONTACT LIST

# EMERGENCY CONTACT LIST

| CONTACT | PHONE | WHEN TO CALL |
|---|---|---|
| **INTERNAL CONTACTS AND RESPONDERS** | | |
| Ashley J. Bielawski<br>Environmental Health and Safety Compliance | Office: (781) 768-7867<br>Cell: (781) 795-2493 | All spills, fires, explosions, or other emergencies |
| Campus Police | (781) 768-7777 | All spills, fires, explosions, or other emergencies if the primary emergency coordinator is not available |
| Joseph Shaughnessy<br>Director of Physical Plant | Office: (781) 768-7133<br>Cell: (781) 820-1571 | All fires during work hours |
| **EXTERNAL AGENCIES AND RESPONDERS** | | |
| Weston Fire Department (Emergency)<br>(Non-Emergency) | 911<br>(413) 893-2372 | All non-incidental spills, fires, or explosions that present an imminent or threatened hazard to human health or the environment, as appropriate and as required by applicable regulations |
| Emergency Response Contractor –<br>Clean Harbors | (800) 645-8265 | |
| MassDEP – 24 Hour Spill Hotline | (888) 304-1133 | Spills exceeding the reportable quantities in the Massachusetts Oil and Hazardous Material List |
| Massachusetts Water Resources Authority | (617) 305-5940 | Spills that discharge to the sanitary sewer |
| Weston Police Department (Emergency)<br>(Non-Emergency) | 911<br>(413) 893-4803 | If security support is required |
| Newton-Wellesley Hospital (Emergency)<br>(Non-Emergency) | 911<br>(617) 243-6000 | Medical emergencies |
| Poison Control Center | 800.222.1222 (24 hours) | In case of accidental poisoning |

# APPENDIX B: REGULATORY CROSS REFERENCE TABLE

# Regulatory Cross Reference Table

| Regulation (29 C.F.R. § 1910....) | Plan Component | Plan Location |
|---|---|---|
| 1450(a) | Applicability to all employers engaged in the laboratory use of chemicals. | Sections 1.1 and 1.2 |
| 1450(c) | Assure that laboratory employees' exposures to OSHA regulated substances do not exceed permissible exposure limits specified in Subpart Z. | Section 2.3 |
| 1450(d) | Employee exposure determination. | Section 2.2 |
| 1450(e)(1) | Develop and carry out the provisions of a written Chemical Hygiene Plan (CHP) | Section 1.1 |
| 1450(e)(2) | The CHP shall be readily available to employees, employee representatives, and upon request to the Assistant Secretary. | Section 1.4 |
| 1450(e)(3)(i) | Standard operating procedures relevant to safety and health considerations. | Chapter 4 |
| 1450(e)(3)(ii) | Criteria to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices. | Section 2.3 |
| 1450(e)(3)(iii) | A requirement that fume hoods and other protective equipment are functioning properly and procedures to ensure adequate performance. | Sections 2.4 and 2.5 |
| 1450(e)(3)(iv) | Provisions for employee information and training. | Section 5 |
| 1450(e)(3)(v) | Circumstances under which a particular laboratory operation, procedure or activity shall require prior approval before implementation. | Sections 1.3, 2.1, 4.2, and 4.3.6 |
| 1450(e)(3)(vi) | Provisions for medical consultation and medical examinations. | Section 6.1 |
| 1450(e)(3)(vii) | Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer and, if appropriate, establishment of a Chemical Hygiene Committee. | Section 1.3 |
| 1450(e)(3)(viii) | Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins ad substances which have a high degree of acute toxicity. | Section 4.3.6 |
| 1450(e)(4) | Review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update as necessary. | Section 1.4 and Appendix C |
| 1450(f) | Provide employees with information and training to ensure they are apprised of the hazardous chemicals present in their work areas. Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher training shall be determined by the employer. | Section 5 |
| 1450(g) | Provide all employees who work with hazardous chemicals with an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary. | Section 6.1 |
| 1450(h) | Hazard identification: ensure that labels on incoming containers of hazardous chemicals are not removed or defaced. Maintain material safety data sheets and ensure they are readily accessible to laboratory employees. | Section 2.6 |
| 1450(i) | Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide at no cost to the employee proper respiratory equipment. | Section 4.4 |
| 1450(j) | Establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions. | Section 2.2 |

# APPENDIX C: ANNUAL REVIEW LOG

## CHP Annual Review Log

| Date of Review | Person Completing Review | Description of Amendments |
|---|---|---|
| | Printed Name:<br>Printed Title:<br>Signature: | |
| | Printed Name:<br>Printed Title:<br>Signature: | |
| | Printed Name:<br>Printed Title:<br>Signature: | |
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| | Printed Name:<br>Printed Title:<br>Signature: | |

# APPENDIX D: CHEMICAL HYGIENE TRAINING PROGRAM AND TRAINING RECORDS

# Regis College Chemical Hygiene Training

| | |
|---|---|
| **Date of Training:** | |
| **Conducted by:** | |

| **Attendees:** | | |
|---|---|---|
| **Name** | **Laboratory** | **Affiliation** |
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# APPENDIX E: STUDENT LABORATORY SAFETY AGREEMENT

# APPENDIX F: NEW CHEMICAL REQUEST FORM

# New Chemical Request Form

This form is to be filled out for chemicals that are ordered for the "FIRST TIME" by a laboratory. It is meant to insure that MSDSs/SDSs are available, and that all safety equipment and regulatory issues are in place prior to the chemical arriving at Regis College. It is not intended to prohibit the ordering of any chemical by employees, but rather to assure that Regis College is complying with all pertinent legislation regarding the acquisition of chemicals and to help ensure the safety of all personnel in the building. Thank you for your cooperation in filling out this form. Should you have any questions regarding your approval, please contact EHSC.

Responsible Individual _____ Laboratory _____

Name of Chemical Substance _____

Amount to be ordered _____ CAS # _____ Vendor/Catalog# _____

**Hazard Classification:**

Health Hazard Criteria:

- ☐ Acute Toxicity
- ☐ Skin Corrosion/Irritation
- ☐ Serious Eye Damage/Eye Irritation
- ☐ Respiratory or Skin Sensitizer
- ☐ Carcinogenicity
- ☐ Reproductive Toxicity
- ☐ Specific Target Organ Toxicity
- ☐ Aspiration Hazard

Physical Hazard Criteria:

- ☐ Explosive
- ☐ Flammable Gasses/Aerosols
- ☐ Oxidizing Gasses
- ☐ Gasses Under Pressure
- ☐ Flammable Liquids/Solids
- ☐ Self-Reactive
- ☐ Pyrophoric Liquids/Solids
- ☐ Self-Heating Chemicals
- ☐ Self-Heating Chemicals
- ☐ Water-Reactive Chemicals
- ☐ Oxidizing Liquids/Solids
- ☐ Organic Peroxides
- ☐ Corrosive To Metals

**Storage Requirements:**

- ☐ General Chemical Storage
- ☐ Refrigerator
- ☐ Freezer
- ☐ Explosion-Proof Refrigerator
- ☐ Flammable Cabinet
- ☐ Corrosive Cabinet
- ☐ Other (describe) _____

**Engineering Controls Needed:**

- ☐ Chemical Fume Hood
- ☐ Biosafety Cabinet
- ☐ Distillation Hood
- ☐ Laminar Flow Hood
- ☐ Glove Box
- ☐ Local Exhaust
- ☐ Other (describe) _____

**Personal Protective Equipment:**

- ☐ Protective Eyewear (ANSI Z87.1)
- ☐ Face Shield
- ☐ Gloves
- ☐ Lab Coat
- ☐ Respirator (contact EHSC)
- ☐ Other (describe) _____

Is employee exposure anticipated? ☐ No ☐ Yes (describe) _____

_____

Are workplace exposure levels anticipated? ☐ No ☐ Yes (describe) _____

_____

Brief description of the procedure: _____

| Signature of Responsible Individual | Date | EHSC Manager | Date |
|---|---|---|---|

# APPENDIX G: GUIDANCE ON PEROXIDE-FORMING CHEMICALS

# GUIDANCE ON PEROXIDE FORMING CHEMICALS

| | |
|---|---|
| **Severe Peroxide Hazard Substances: Form Peroxides on Exposure to Air** | |
| *The following chemicals present severe peroxide hazards on storage with exposure to air and should typically be discarded within **3 months** of opening.* | |
| Butadiene (liquid monomer) | Potassium Amide |
| Diisopropyl Ether (Isopropyl Ether) | Sodium Amide (Sodamide) |
| Divinylacetylene (DVA) | Tetrafluoroethylene (liquid monomer) |
| Potassium Metal | Vinylidene Chloride(1,1-DiChloroethylene) |
| **Concentration Hazard** | |
| *The following chemicals present peroxide hazards on concentration. Do not distill or evaporate these chemicals without first testing for the presence of peroxides. These chemicals should typically be discarded or tested for peroxides within **6 months** of opening.* | |
| Acetaldehyde Diethyl Acetal (Acetal) | Ethylene Glycol Dimethyl (Glyme) |
| Cumene (Isopropyl Benzene) | Ethylene Glycol Ether Acetates |
| Cyclohexene | Ethylene Glycol Monoethers (Cellosolves) |
| Cyclopentene | Furan |
| Decalin (Decahydronaphthalene) | Methylacetylene |
| Diacetylene (Butadiene) | Methylcyclopentane |
| Diethyl Ether (Ether) | Tetrahydrofuran (THF) |
| Dioxanes | Vinyl Ethers |
| **Shock or Heat Sensitive** | |
| *The following chemicals present hazards of rapid polymerization initiated by internally formed peroxides. These chemicals should typically be discarded or tested for peroxides **within 6 months** of opening (gases should be discarded or tested for peroxides **within 12 months**).* | |
| Chloroprene (2-Chloro-1,3-Butadiene) | Vinyl Acetate |
| Styrene | Vinylpryidine |
| Butadiene | Vinylacetylene (MVA) |
| Tetrafluoroethylene (TFE) | Vinyl Chloride |
| **Other Potential Peroxide-Forming Chemicals: Form Peroxides Under the Right Conditions** | |
| *There are a number of other compounds with the potential to form peroxide under the right conditions. For instance, compounds containing aldehyde or amide groups are easily peroxidizable, but may not necessarily accumulate peroxide at dangerous levels. Chemicals in this class should typically be discarded or tested for peroxides within 1 year of opening.* | |
| Diethoxymethane | 2-Methoxyethanol |
| 1-Pentene | n-Propyl ether |

# APPENDIX H: GUIDANCE ON PARTICULARLY HAZARDOUS CHEMICALS

# GUIDANCE ON PARTICULARLY HAZARDOUS CHEMICALS

This appendix has been developed as a supplement to the information on Particularly Hazardous Chemicals contained in Section 4.3.6 of this CHP.

## Carcinogens

Carcinogens are agents that can cause cancer. There are a number of chemicals that are known or suspected carcinogens due to their ability to cause neoplasms (tumors) in humans and/or animals. Some carcinogens react directly with a cell's genetic information (DNA), causing changes (mutations) that are incorporated into subsequent generations of that cell.

OSHA defines a potential occupational carcinogen as: any substance, or combination or mixture of substances, which causes an increased incidence of benign and/or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasms in humans or in one or more experimental mammalian species as the result of any oral, respiratory or dermal exposure, or any other exposure which results in the induction of tumors at a site other than the site of administration. This definition also includes any substance which is metabolized into one or more potential occupational carcinogens by mammals. [29 C.F.R. Part 1990, Identification, Classification and Regulation of Carcinogens]

Carcinogen lists include:

1. Compounds regulated by 29 C.F.R. Part 1910, Subpart Z - Toxic and Hazardous Substances (see the text box on OSHA Regulations on the following page).
2. Compounds considered to be "Known Carcinogens" by the National Toxicology Program, (NTP) in their Annual Report on Carcinogens as well as some substances listed as "reasonably anticipated to be carcinogens."
3. Compounds designated as "carcinogens to humans" (Group 1) and some "reasonably anticipated to be carcinogens" (Group 2A or 2B) by the International Agency for Research on Cancer (IARC).

Examples of carcinogens include: acrylamide, acrylonitrile, benzene, ethylene oxide and formaldehyde.

## Reproductive Toxins

Reproductive hazards are substances or agents that may affect the reproductive health of women or men or the ability of couples to have healthy children. These hazards may cause problems such as infertility, miscarriage, decreased physical or mental health of the baby and birth defects. The effects may include chromosomal damage (mutations) and effects on developing fetuses (teratogenesis). Reproductive toxins can affect both men and women.

Examples of reproductive toxins include carbon disulfide, lead (inorganic), and 2-methoxyethanol.

## Highly Acute Toxins

Highly acute toxins are materials that may be fatal or cause damage to target organs from a single exposure or exposures of short duration. The specific effects depend on the material but may include: intense irritation that can result in pulmonary edema (fluid and swelling in the lungs), chemical asphyxia, and systemic (body-wide) poisoning.

Highly acute toxins include any chemical that falls within one or more of the following categories:

1. 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.
2. A chemical with an $LD_{50}$ of 200 mg or less per kg of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) to certain test populations.

3. 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.

Examples of highly acute toxins include: hydrogen cyanide, dimethyl mercury, chlorine gas, phosgene gas, and sodium azide.

**OSHA Regulations**

There are a number of OSHA health standards [29 C.F.R. 1910 Subpart Z] with specific requirements for certain carcinogens and particularly hazardous chemicals, including:

- Asbestos
- 13 Carcinogens: 4-Nitrobiphenyl, 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-Dimethylaminoazo-benzene, N-Nitrosodimethylamine
- Vinyl Chloride
- Inorganic Arsenic
- Lead
- Hexavalent Chromium
- Cadmium
- Benzene
- 1,2-Dibromo-3-chloropropane
- Acrylonitrile
- Ethylene Oxide
- Formaldehyde
- Methylenedianiline
- 1,3-Butadiene
- Methylene Chloride

However, where applicable, the OSHA Lab Standard supersedes the requirements of all other OSHA health standards in 29 C.F.R. 1910 Subpart Z, except as follows:

1. For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions listed in 3 below apply.
2. Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.
3. Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements paragraphs (d) and (g)(1)(ii) of the OSHA Lab Standard shall apply.

# APPENDIX I: GUIDANCE FOR THE STORAGE OF INCOMPATIBLE CHEMICALS

# GUIDANCE FOR THE STORAGE OF INCOMPATIBLE CHEMICALS

This list is provided to illustrative incompatibilities for common laboratory chemicals and is not a complete list; always consult the MSDS/SDS for the chemical or other chemical hazard reference. The material on the left should be stored and handled so that it does not come in contact with the incompatible chemical(s) on the right.

| Chemical Compound | | Should Be Kept Out Of Contact With |
|---|---|---|
| A | Acetic Acid | Acetaldehyde, ammonium nitrate, chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates |
| | Acetaldehyde | Acetic acid, acetic anhydride, ammonia (anhydrous) |
| | Acetylene | Chlorine, bromine, copper, fluorine, silver, mercury |
| | Acetone | Concentrated nitric and sulfuric acid mixtures |
| | Alkali and Alkaline Earth (e.g., Powdered Aluminum or Magnesium, Calcium, Lithium, Sodium, Potassium) | Water, carbon tetrachloride or other chlorinated metals hydrocarbons, carbon dioxide, halogens |
| | Aluminum | Ammonium nitrate, bromates, chlorates, iodates, bromine vapor, carbon disulfide vapor |
| | Ammonia (Anhydrous) | Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous) |
| | Ammonium Nitrate | Acids, powdered metals, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials |
| | Aniline | Nitric acid, hydrogen peroxide |
| | Arsenic | Any bromate, chlorate, or iodate |
| | Azides | Acids |
| B | Bromine | See chlorine |
| | Barium | Carbon tetrachloride |
| C | Calcium Oxide | Water |
| | Carbon (Activated) | Calcium hyperchlorite, all oxidizing agents |
| | Carbon Tetrachloride | Sodium |
| | Chlorates | Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials, sulfides |
| | Chromic Acid | Acetic acid, naphthalene, camphor, glycerin, turpentine, alcohol |
| | Chlorine | Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine |
| | Chlorine Dioxide | Ammonia, methane, phosphine, hydrogen sulfide |
| | Copper | Acetylene, hydrogen peroxide |
| | Cumene Hydroperoxide | Acids (organic or inorganic) |
| | Cyanides | Acids |
| F | Flammable Liquids | Ammonium nitrate, chromatic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens |
| | Fluorine | Isolate from everything |

| Chemical Compound | | Should Be Kept Out Of Contact With |
|---|---|---|
| H | Hydrocarbons (e.g. Butane, Benzene) | Fluorine, chlorine, bromine, chromic acid, sodium peroxide |
| | Hydrocyanic Acid | Nitric acid, alkali |
| | Hydrofluoric Acid (Anhydrous) | Ammonia (aqueous or anhydrous) |
| | Hydrogen Peroxide | Copper, chromium, iron, most metals or their salts, alcohols, acetone, ferrous sulfide, lead IV oxide, lead II oxide, lead sulfide, organic materials, aniline, nitromethane, combustible materials, flammable liquids, oxidizing gases |
| | Hydrogen Sulfide | Fuming nitric acid, oxidizing gases |
| | Hypochlorites | Acids, activated carbon |
| I | Iodine | Acetylene, ammonia (aqueous or anhydrous), hydrogen |
| M | Maleic Anhydride | Magnesium hydroxide, lithium metal |
| | Magnesium Metal | Mercury II oxide, nitric acid |
| | Mercury | Acetylene, fulminic acid, ammonia |
| | Methanol | Lead perchlorate, mercury II nitrate |
| N | Nitrates | Sulfuric acid |
| | Nitric Acid | Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, powdered magnesium metal, phosphorus, phthalic acid |
| | Nitroparaffins | Inorganic bases, amines |
| O | Oxalic Acid | Silver, mercury |
| | Oxygen | Oils, grease, hydrogen, flammable liquids, solids |
| P | Perchloric Acid | Acetic anhydride, aluminum, Bakelite, bismuth and its alloys, alcohol, paper, wood, plastics, nylon (polyamide), modacrylic ester (35-85% acrylonitrile), polyester, Lucite, cellulose-based lacquers, metals, copper and copper alloys, high nickel alloys, cotton, wool, glycerin-lead oxide, grease, oils |
| | Peroxides, Organic | Acids (organic or mineral), avoid friction, store cold |
| | Phosphorus (White) | Air, oxygen, alkalis, reducing agents |
| | Phosphorus Pentoxide | Water |
| | Potassium | Carbon tetrachloride, carbon dioxide, water |
| | Potassium Chlorate | Sulfuric and other acids |
| | Potassium Perchlorate (See Also Chlorates) | Sulfuric and other acids |
| | Potassium Permanganate | Glycerol, ethylene glycol, benzaldehyde, sulfuric acid |
| S | Silver | Acetylene, oxalic acid, tartaric acid, ammonium compounds |
| | Selenides | Reducing agents |
| | Sodium | Carbon tetrachloride, carbon dioxide, water |
| | Sodium Nitrate | Ammonium nitrate and other ammonium salts |
| | Sodium Peroxide | Ethanol, methanol, glacial acetic acid, acetic anahydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural |
| | Sulfides | Acids |
| | Sulfuric Acid | Potassium chlorate, potassium perchlorate, potassium permanganate (or similar compounds of light metals, such as sodium, lithium) |

# APPENDIX J: ON-LINE CHEMICAL SAFETY RESOURCES

# GENERAL CHEMICAL HAZARD AND SAFETY INFORMATION

1. NIOSH Pocket Guide to Chemical Hazards. Reference document that concisely summarizes key safety information (physical properties, potential routes of exposure, health effects, exposure limits, etc.) for thousands of chemicals.

   In addition to the information included in the body of the NIOSH Pocket Guide, the appendices also include information that may be useful: http://www.cdc.gov/niosh/npg/nengapdx.html (or control + click on appendix below)
   **APPENDIX A** - NIOSH Potential Occupational Carcinogens
   **APPENDIX B** - Thirteen OSHA-Regulated Carcinogens
   **APPENDIX C** - Supplementary Exposure Limits
   **APPENDIX D** - Substances with No Established RELs
   **APPENDIX E** - OSHA Respirator Requirements for Selected Chemicals
   **APPENDIX F** - Miscellaneous Notes
   **APPENDIX G** - 1989 Air Contaminants Update Project: Exposure Limits NOT in Effect

2. OSHA Safety and Health Topics page: Carcinogens.

3. OSHA Safety and Health Topics page: Chemical Reactivity Hazards.

4. OSHA Safety and Health Topics page: Laboratories.

5. OSHA Safety and Health Topics page: Reproductive Hazards.

6. OSHA/EPA Occupational Chemical Database. Database compiling information from several government agencies and organizations, that includes a list of PELs and Carcinogens, with available reports that include: "Physical Properties," "Exposure Guidelines," "NIOSH Pocket Guide," and "Emergency Response Information."

7. NYP 12th Report on Carcinogens. This includes a list of known carcinogens and reasonably anticipated to be carcinogens, as well as specific substance profiles.

8. Prudent Practices in the Laboratory: Handling and Disposal of Chemicals In the early 1980s, the National Research Council (NRC) produced two major reports on laboratory safety and laboratory waste disposal: Prudent Practices for Handling Hazardous Chemicals in Laboratories (1981) and Prudent Practices for Disposal of Chemicals from Laboratories (1983). The NRC's Board on Chemical Sciences and Technology issued an update and revision of the earlier studies in 1995 and most recently in 2011.

**OSHA Lab Standard and Interpretive Guidance**

1. OSHA "Occupational Exposure to Hazardous Chemicals in Laboratories" Standard [29 C.F.R. 1910.1450]

2. OSHA Standard Interpretations for the Lab Standard