Oct. 2020

CHEMICAL HYGIENE PLAN

FOR

THE CHEMISTRY DEPARTMENT
HOBART AND WILLIAM SMITH COLLEGES
GENEVA, NY 14456

Adapted from PARS Environmental Services Chemical Hygiene Plan; Hamilton Square, NJ

Table of Contents

Chemical Hygiene Plan Review

Members of the Chemical Hygiene Committee should initial in the appropriate place following their review of the Chemical Hygiene Plan.

Name / Date	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
Bowyer							
de Denus							
Miller							
Pelkey							
D. Slade							
K. Slade							
Seybert							
Zuk							
Stennett							

Changes made to previous edition of CHP, effective Oct. 2020:

1. Restructured Section 8 (Standard Operating Procedures), dividing topics into categories and standardizing formatting.

2. Added section on chemical storage to 8.3.2 (Laboratory Practices)

3. Updated SOP on oxygen alarm response to be specific to the chemistry department and to reflect changes in cryogen use (original version of SOP was retained in Appendix B.)

4. Moved all forms from the body of the document to Appendix A.

5. Moved safe operating procedures for specific substances to Appendix B (please note that those documents are several years old and may not reflect current practices.)

6. Renamed Section 4 "Accident Response" (previously Medical Evaluation) to reflect the actual contents of the section. Added specific sections on responding to chemical spills, fire, and the oxygen alarm (4.1.1-4.1.3).

7. Took information on hazardous waste, which was copy-pasted in the middle of the SOP section, and turned it into Section 9.

8. Made minor changes to the language describe characteristic and listed wastes.

9. Made significant updates to the language of 2.2 (Laboratory Chemical Inventory) to reflect current practice.

10. Clarified that weekly flushing of eye was stations by faculty is recommended but not mandatory (8.2.1.)

11. Moved the summary of professors' responsibilities from the start of the document to Appendix C.

12. Added Appendix D, which has links to standards, tables, and other documents referenced in the CHP.

13. Updated maps and persons referred to in the document to reflect personnel changes.

14. Overhauled and standardized document formatting to make navigation easier, including the addition of a table of contents.

1 INTRODUCTION

1.0 Organization of the Chemical Hygiene Plan

This Chemical Hygiene Plan is a resource document which describes the OSHA Lab Standard Compliance Program. Each section addresses a specific requirement of The Standard as described below:

Section 1 - Introduction

Overview of the Chemical Hygiene Plan including assigned responsibilities.

Section 2 - Student Exposure

Permissible Exposure Limits (PELs), student exposure determination, and the laboratory chemical inventory.

Section 3 - Student Training

Student information and training program

Section 4 – Accident Response

Accident response and reporting, including medical evaluation.

Section 5 - Hazard Identification

Hazard identification program: labels and Material Safety Data Sheets (MSDS).

Section 6 - Inspection Procedures

Methods for assuring continued compliance.

Section 7 - Fume Hood Program

Fume Hood performance monitoring program.

Section 8 - Standard Operating Procedures

Standard Operating Procedures covering particularly hazardous substances, protective equipment, and safe work practices.

Section 9 – Hazardous Waste Management

Procedures for the collection, storage, labeling, and disposal of hazardous wastes.

Appendix A - Forms

Accident, spill response, and inspection forms. Sample pre-lab safety forms and quizzes.

Appendix B – Safe Operating Procedures for Specific Hazards

Safe operating procedures for specific hazards, including mercury, methylene chloride, acrylamide, corrosive liquids, flammable liquids, compressed gases, and peroxide forming chemicals.

Appendix C – Summary of Professors' Responsibilities as Described in the CHP

A compilation of sections of the CHP specifically relevant to the responsibilities of professors.

Appendix D – Referenced Standards and Lists

Hyperlinks to the following OSHA standards referenced in the CHP:

- Occupational Exposure to Hazardous Chemicals in Laboratories - 29 CFR 1910.1450
- Hazard Communication Standard - 29 CFR 1910.1200
- Access to Employee Exposure and Medical Records - 29 CFR 1910.20
- Respiratory Protection - 29 CFR 1910.134

Hyperlinks to the following lists and tables:

- Subpart Z table of air contaminants with PELs
- Subpart Z list of hazardous substances with a specific standard
- National Toxicology Program (NTP) list of carcinogens - fifth annual report summary 1989
- International Agency for Research on Cancer (IARC) list of carcinogens - summary evaluations tables, Supplement 7
- EPA characteristic and listed hazardous wastes

1.1 Purpose of the Chemical Hygiene Plan

It is the desire and intent of the Hobart and William Smith Colleges (HWS) Chemistry Department to set forth policies, procedures and work practices capable of:

Protecting students and employees from health hazards associated with hazardous chemicals in "laboratories" as defined by 29 CFR 1910.1450 - Occupational Exposures to Hazardous Chemicals in Laboratories, and

Keeping student and employee exposures below the limits prescribed in 29 CFR 1910 Subpart Z.

This document is intended to comply with the requirements of the OSHA Laboratory Standard 29 CFR 1910.1450.

1.2 Company Policy and Assigned Responsibilities

1.2.1 CHEMICAL HYGIENE RESPONSIBILITIES

The Colleges have assigned three facility **Chemical Hygiene Officers (CHO)** who will be responsible for the development and implementation of the provisions of this **Chemical Hygiene Plan (CHP)**. Certain aspects of the program may be delegated to others as indicated throughout this document. However, the overall responsibility for the execution of the **CHP** rests with the **CHOs**. The CHOs for the facility are:

Jason Woodruff
Associate Directors, Campus Safety and Security Ext. 3656

Carolee White
the Colleges' Vice-President of Finance Ext. 3337

The **Chemical Hygiene Committee** is responsible for providing technical guidance in the development and implementation of the Chemical Hygiene Plan for the Chemistry Department. The Committee is comprised of the faculty members of the Chemistry Department (excepting those on leave and not working in Lansing or Rosenberg).

Chemical Hygiene Committee:

Walter Bowyer, Christine de Denus, Justin Miller,
Erin Pelkey, David Slade, Kristin Slade, William Zuk, Elana Stennett

1.2.2 ACCESSIBILITY

This document is available to any Chemistry Department employee or student engaged in the laboratory use of hazardous chemicals. It is also available upon request to the Assistant Secretary for Occupational Safety and Health, and the Director of the National Institute for Occupational Safety and Health (NIOSH).

1.2.3 RESPONSIBILITY FOR SAFETY

The implementation of company health and safety policies and procedures is the responsibility of management and supervisory staff. However, all students and employees are expected to actively participate in the program to ensure its success.

1.2.4 REVIEW AND UPDATES

The **Chemical Hygiene Plan** will be reviewed and updated annually by the Chemical Hygiene Committee.

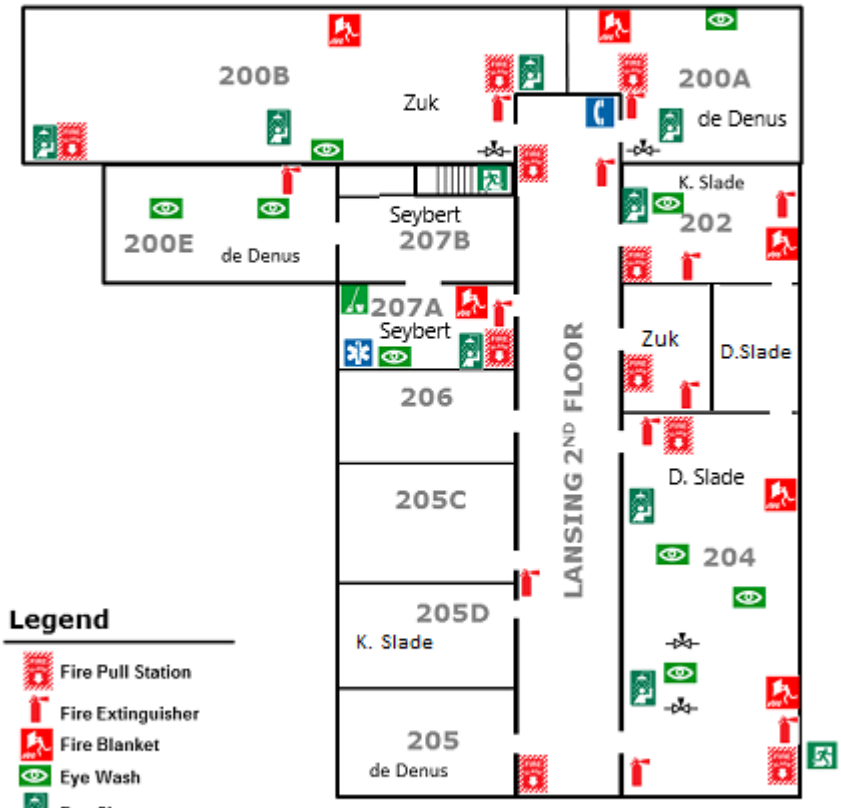
1.2.5 FACILITY DESCRIPTION

It is the policy of the Chemistry Department to identify all areas that are engaged in laboratory use of hazardous chemicals. The areas covered by this CHP are listed and illustrated in the following floor plan.

LIST OF LABORATORIES
CHEMISTRY DEPARTMENT

Laboratory Supervisor	Location	General Description of Activities
Erin Pelkey	Rosenberg 013	Biochemistry/Organic/Inorganic/NMR
Kristin Slade	Rosenberg 117	Biochemistry
Walter Bowyer	Rosenberg 119	Organic & Analytical
Justin Miller	Rosenberg 120 & 121	Organic Chemistry Research
Erin Pelkey	Rosenberg 122 & 123	Organic Chemistry Research
William Zuk	Lansing 113	Research
Walter Bowyer	Lansing 115	Research
Christine de Denus	Lansing 200A	Inorganic/ Physical Chemistry
William Zuk	Lansing 200B	General Chemistry
Christine de Denus	Lansing 200E	Inorganic Research
Kristin Slade	Lansing 202	Biochemistry Research
William Zuk	Lansing 200B	General Chemistry
David Slade	Lansing 204	Organic Chemistry
Lucas Seybert	Lansing 207	Prep Lab
Lucas Seybert	Lansing 205C	Not in active use
Elana Stennett	Rosenberg 115 & 116	Analytical Research

Laboratory Emergency Map



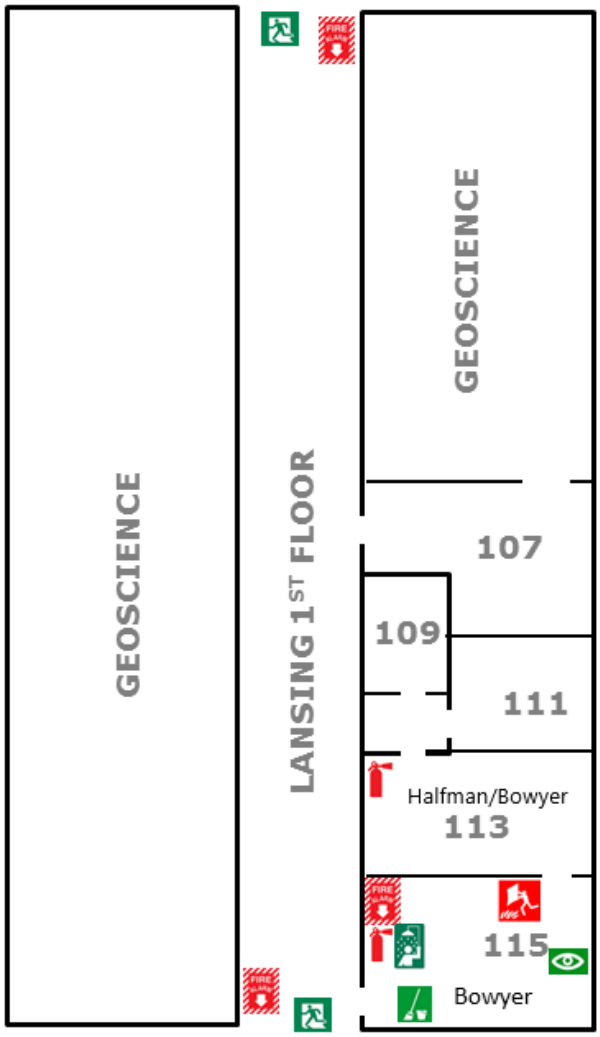
Legend

- Fire Pull Station
- Fire Extinguisher
- Fire Blanket
- Eye Wash
- Eye Shower
- First Aid
- Exit
- Spill Kit
- Gas Shut Off

Emergency Contacts

Campus Safety: Emergencies (315) 781-3333 or ext. 3333
Campus Safety: Non-emergencies (315) 781-3000
Geneva Fire Department 9-911
Geneva Police Department 9-911

Laboratory Emergency Map



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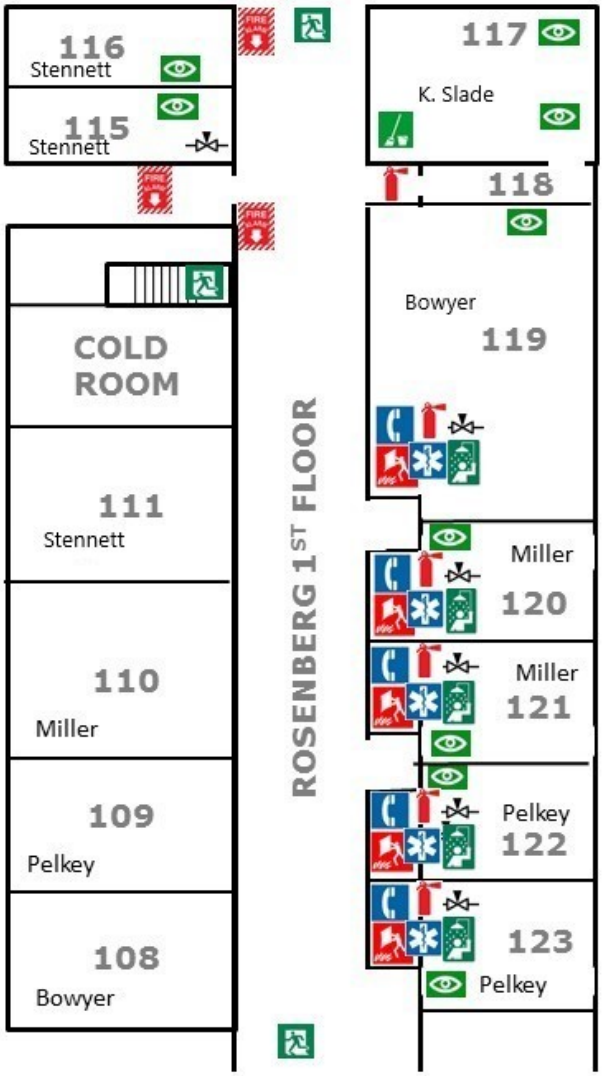

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Geneva Fire Department 9-911
Geneva Police Department 9-911

2 STUDENT EXPOSURE

2.0 Purpose of this Section

The purpose of this section is to outline the HWS Chemistry Department program for controlling student exposure to hazardous materials.

The substances regulated by OSHA fall into one of the following lists:

- List of Air Contaminants with a Permissible Exposure Limit. There are approximately 600 substances listed in the Subpart Z table.
- List of substances regulated by a specific standard (a separate standard exists for each chemical). There are twenty-seven (27) substance specific standards listed in a separate Subpart Z table; benzene being the substance in highest use in the department.

NOTE: Both lists are linked in Appendix D. Furthermore, the substances regulated by a specific standard, as well as listed as a known or suspected carcinogen are flagged in our inventory.

2.1 Requirements of the Standard

2.1.1 PERMISSIBLE EXPSOURE LIMITS - 29 CFR 1910.1450 (c)

For laboratory uses of OSHA regulated substances, the professor of a course shall assure that students' exposure to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z. If the professor cannot be confident that engineering controls (e.g. fume hoods) and personal protective equipment will be effective, the procedure should be discontinued.

2.1.2 STUDENT EXPOSURE DETERMINATION

It is the policy of the department that all hazardous materials will be handled only in fume hoods. Containers outside of fume hoods must be closed and clean. On the advice of the security officer at the time of the preparation of the CHP, and consultants from Blasland, Bouck and Lee, this obviates the need for monitoring.

It is the responsibility of each faculty member to guarantee that hazardous materials are handled in fume hoods with appropriate personal protection in his/her courses and research.

2.1.3 OSHA REGULATED SUBSTANCES

It is the HWS Chemistry Department policy to keep student exposures to chemical substances below the OSHA exposure limits established in 29 CFR 1910 subpart Z (see Appendix D), through the use of engineering controls and personal protective equipment. The exposure limits include Permissible Exposure Limits (PELs), Short Term Exposure Limits (STELs) and Ceiling Values (C).

2.2 Laboratory Chemical Inventory

It is the HWS Chemistry Department policy to develop and maintain a list of all hazardous chemicals present in the department, including the location where each container is stored. The most up-to-date chemical inventory is saved in N:\ChemDept\Chem Inv, but a copy will be saved to N:\Campus Chemical Inventory\Chemistry at least once per quarter. The date on which the copy was saved will be given in the file name. Older copies of the chemical inventory will be moved to a sub-folder within the Chemistry folder. Safety Data Sheets (SDS) are available in Lansing 207. Links to digital SDS are available in the chemical inventory.

Due to the nature of teaching laboratories, chemicals may temporarily be moved to a new location before being returned to their regular storage location. The supervisor of each laboratory (see Section 1.2.5) is responsible for knowing which chemicals are present in their lab on a temporary basis, and for providing this information to emergency response personnel as necessary.

In addition to the location of each chemical container, the chemical inventory lists hazard information for every chemical in the department. This inventory is cross-referenced with OSHA standards and particularly hazardous substances (Section 8.1.1) are flagged.

Lucas Seybert is responsible for maintaining the chemical inventory. Each faculty member is responsible for assisting Lucas in this by informing him when chemicals are moved or exhausted. Each faculty member is responsible for maintaining the inventory of his/her research lab(s). When a reagent is completely exhausted, the empty bottle should be placed in the chemical disposal bin so that Lucas can update the inventory. Every two years, a complete inventory of the chemistry department should be performed to correct any discrepancies in the digital inventory.

3 STUDENT TRAINING

3.0 Purpose of this Section

The purpose of this section is to outline the HWS Chemistry Department program of student education and training on hazardous chemicals. A description of how students are to be trained and the content of the training program is provided. In spite of repeated requests by the Department, the Colleges provide no training for faculty.

3.1 Training

3.1.1 INFORMATION AND TRAINING - 29 CFR 1910.1450 (f)

The faculty shall provide students with information and training to ensure that they are apprised of the hazards of chemicals present in their laboratory work. Such information shall be provided at the time of a student's first chemistry course. The frequency of refresher information and training shall be determined by the faculty. Normally this will occur each new chemistry course the student takes. Review as well as discussion of hazards specific to the new course will be covered. Additional training will be provided immediately prior to an experiment when deemed necessary by the professor. Faculty also must provide safety training and information to their research students.

3.1.2 INFORMATION REQUIREMENTS

Students shall be informed of:

15. The contents of this standard and its appendices, which shall be made available to employees;

16. The location and availability of the employer's Chemical Hygiene Plan and how to use it;

17. The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

18. Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory;

19. The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the chemical supplier; and

20. The location and proper use of appropriate safety equipment such as eye washes, safety showers, and fire blankets.

3.1.3 TRAINING REQUIREMENTS

Student training shall include:

1. Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as visual appearance or odor of hazardous chemicals when being released, etc.);

2. The physical and health hazards of chemicals in the work area;

3. The measures students can take to protect themselves from these hazards, including specific procedures the faculty has implemented to protect students from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and

4. The appropriate response to exposure to hazardous chemicals, including the location and use of eye washes and safety washes.

Training varies according to the professor's estimation of need. Typically, the students are recommended to obtain a book, *Working Safely with Chemicals in the Laboratory,* and do a worksheet to supplement the reading lecture. A quiz may be given in the second lab meeting. The worksheet must be completed accurately; the results of the worksheet and/or the quiz are included in the course grade. The results (quiz and worksheet) will be filed in Lansing 207 for at least three years. A sample worksheet as well as safety handouts for several example courses may be found in Appendix A.

Whenever a new hazard is introduced into a course, students will be informed of the new hazard and receive the appropriate training. Students will receive refresher training as well as additional training every time they take a course. Additional training is provided immediately prior to every experiment when deemed advisable by the professor. Safety training for employees (e.g. maintenance, housekeeping) is the responsibility of Howard Simmons, Buildings & Grounds.

4 ACCIDENT RESPONSE

4.0 Introduction

This section describes the actions that should be taken in the advent of a laboratory accident, fire, or chemical spill. The Colleges' Emergency Action Plans describe the appropriate responses to various emergencies in more detail and can be found at https://www.hws.edu/studentlife/planning/.

4.1 Accident Response Protocol

Campus Safety must be alerted immediately at (either by calling x3333 or by activating the fire alarm) if any of the following apply:

1. a fire not immediately and thoroughly extinguished
2. a spill of more than 50 mL of any chemical that is rated 3 or 4 in any category
3. a spill in which students or faculty may be exposed to levels that may exceed the STEL, for example spills of volatile hazardous materials outside of the fume hood
4. a student or faculty needs medical attention
5. the professor or student feels it is appropriate to call Campus Safety.

In addition, the Provost Office must be alerted immediately at x3304 if any of the following apply:

6. a student or faculty needs medical attention
7. the professor or student feels it is appropriate to call the Provost Office.

4.1.1 CHEMICAL SPILLS

In the event of a chemical spill that does not meet any of the criteria established in Section 4.1, the spill may be cleaned up by a trained individual using a spill kit. The locations of spill kits are marked on the maps in Section 1.2.5. Refer to the SDS of the spilled material prior to cleaning up a spill and disposing of the resulting material. Follow all relevant requirements for labeling, storage, and disposal of hazardous waste (see Section 9.)

4.1.2 FIRE

Wherever possible, measures should be taken to reduce or eliminate risk of fire. Guidelines for handling flammable materials may be found in Section 8.3.5. In case of a small fire, a trained individual may attempt to extinguish the fire. If the fire is not immediately extinguished, or if there is any doubt to whether it can be easily contained, **pull the fire extinguisher and evacuate the building**.

4.1.3 OXYGEN ALARM

An oxygen alarm is installed in Rosenberg 013 due to the presence of large quantities of liquid nitrogen and liquid helium. The alarm will sound at oxygen concentrations below 19.5% and above 23.5%. **It is not safe to enter or remain in the room when the alarm is sounding.** If the oxygen sensor is alarming or flashing, evacuate immediately and call Campus Safety (x3333) once in a safe location. Notify Lucas Seybert as soon as possible. See 8.3.9 for the complete SOP regarding oxygen alarm response.

4.2 Accident Reporting Protocol

There are three forms for reporting accidents: Initial Investigation of Possible Overexposure, Physician's Written Opinion for Medical Consultation, and Accident Report Form. The first is required for accidents in which employees or students have been exposed to sufficient quantities of hazardous materials that there may be significant damage. The second form is required if the exposure merits medical attention (see Section 4.1). The third form is required whenever the first two forms are required as well as any time there is a significant accident that may not involve chemical exposure. Minor accidents involving restricted spills, broken glassware, or small cuts, burns, or abrasions require completion of the forms only at the professor's discretion. When necessary, form(s) should be completed as promptly as possible without hindering rapid response to the problem. In any event, the form(s) should be completed before the end of the next working day. The hard copy should be filed in the department's CHP. A hard copy or electronic version should be sent to the Provost Office. Faculty may also want to retain a hard or electronic copy. When accidents involve particularly hazardous materials (see section 8.2.1), a copy of the Hazardous Chemical Procedure Form (which will have been completed before the particularly hazardous materials were handled) should be attached to the other forms.

The purpose of these forms is to provide critical information in the event of an accident, to help the chemical hygiene committee formulate improvements in our practices to avoid accidents in the future, and to inform appropriate administrators. The Hazardous Chemical Procedure Form contains information that will be useful in evaluating any incidents involving particularly hazardous chemicals. Copies of these forms may be found in Appendix A.

4.3 Policy for Medical Evaluation Following Exposure to Hazardous Chemicals

The Colleges provide employees and students who work with hazardous chemicals an opportunity to receive free medical attention when:

8. The student complains of symptoms resulting from an exposure.

9. The professor or lab supervisor is advised of an abnormal exposure (e.g. spillage on skin) of a hazardous substance and deems a medical examination

desirable. Utilize Emergency Shower or Eye Wash if needed.

In either event, with an exposure, Campus Safety is to be called, x3333 or 315- 781-3333 and they will respond and call Finger Lakes Ambulance and the Geneva Fire Department for on scene medical treatment, with the patient being transported to Geneva General Hospital. Hubbs does not have the capability to treat an exposed (contaminated) student and GGH Emergency Department does. It is important to provide the physician with the following information:

10. The identity of the substance(s) to which the patient has been exposed. An SDS sheet for each substance should be included.

11. A description of the conditions, time, and date of the exposure. This should include all pertinent information including quantity of hazardous substance, duration of exposure, location of injuries or sites of contact.

12. A description of the symptoms the student is experiencing. This should include an indication of the time elapsed from exposure for the first appearance of the symptoms.

This information should be provided by completing the Initial Investigation of Possible Overexposure form (Appendix A.) A copy of this form should remain on file in Lansing 207 for at least three years.

The physician will be requested to provide a written report to the student/employee as well as to the Director of Campus Security. The student should be provided with the Physician's Written Opinion for Medical Consultation form (Appendix A.)

5 HAZARD IDENTIFICATION

5.0 Introduction

This section outlines the Chemistry Department policies and the assigned responsibilities for labeling containers, for obtaining and maintaining SDSs, and for implementing procedures for hazard determination of chemicals developed in the laboratory.
The requirements for hazard identification as described in the standard are also included.

5.1 Requirements of the Standard

5.1.1 HAZARD IDENTIFICATION 29 CFR 1910.1450 (h)

Labeling of Containers

Lucas Seybert shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced. When anyone transfers chemicals to a new container, she/he must label the new container with name of chemical, date, and appropriate hazard warning(s).

Material Safety Data Sheets
Hard copies of material safety data sheets are located in Lansing 207A. Links to digital copies of MSDSs may be found in the chemical inventory.

Chemicals Developed in the Laboratory

The following provisions shall apply to chemical substances developed in the laboratory:

1. If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the professor shall determine if it is a hazardous chemical as defined by the OSHA Hazard Communication Standard. If the chemical is determined to be hazardous, the professor shall provide appropriate training as required by this standard (Section 3.1).

2. If the chemical produced is a byproduct whose composition is not known, the professor shall assume that the substance is hazardous and shall implement the Chemical Hygiene Plan.

3. Proper labeling is the responsibility of the professor in whose lab the substance is stored, used, or generated.

Labeling of laboratories

All laboratories will have a sign posted indicating the person responsible for the area, that hazardous chemicals are present, and what PPE is required.

NOTE: The complete text of the OSHA Hazard Communication Standard, 29 CFR 1910.1450 is linked in Appendix D.

6 INSPECTION PROCEDURES

Regular inspections of laboratories are necessary to identify hazardous conditions that may endanger both students and faculty. It is the responsibility of the professor whose students are working in the lab to assure the lab has passed inspection within the past six months. Inspections of all teaching and research labs are to be performed in March and September. It is the responsibility of the Chair (or designee) to verify the inspection by the end of the month. Inspection is done using the Laboratory Safety inspection form located in Appendix A. A digital copy of this form is also available in If the laboratory does not pass inspection in every category, it may not be used until the problem is corrected.

7 FUME HOOD PROGRAM

7.0 Introduction

This section describes the HWS Chemistry Department Fume Hood Program. General principles for proper fume hood use and guidelines for establishing a chemical fume hood monitoring program are also included.

7.1 Requirement of the Standard

7.1.1 EQUIPMENT MAINTENANCE 29 CFR 1910.1450 (e) (3) (iii)

The Chemical Hygiene Plan requires that fume hoods and other protective equipment are functioning properly and that specific measures shall be taken to ensure proper and adequate performance of such equipment.

Howard Simmons, Director of Buildings and Grounds, and his staff are responsible for maintenance and repair of fume hoods. All fume hoods have been inventoried and are inspected annually. The procedure for testing is as follows:

ANNUAL FUME HOOD INSPECTION AND FLOW TESTING PROCEDURES

1. Perform inventory of fume hoods. Confirm status and locations.

2. Schedule flow test and certification of fume hoods for proper exhaust airflow. This should be done yearly by a certified testing and balancing contractor.

   A. Take air flow readings at every ten square inches of hood face.

   B. Measuring probe held by ring stand in plane of sash perpendicular to opening, taking care not to stand in front of opening.

   C. Each reading averaged over a period of at least five seconds or a minimum of four readings taken at each point.

   D. Readings averaged and no reading should deviate +/-20% from average.

   E. Acceptable average: 90 to 120 Feet Per Minute.

   F. Sash position is adjusted until acceptable average is achieved. The final sash position is marked. For laboratory purposes, the hood sash must be lowered to marked position, while in use, for safe function.

   G. Fume hood labeled with test date, name of tester, sash position, & average.

   H. Reports submitted and kept on file.

   I. More important factors:

      a. Cross drafts need to be avoided. Air currents may draw contaminants

from hood. Check supply air diffusers, open windows or doors, or rapid movements in front of hood.

b. Work inside should be at least six inches behind the hood face.

c. Fan should be on high speed while in use.

d. Make sure there are no unnecessary objects inside the hood that can cause turbulence and outflow of contaminants.

3. Document results in proper file.

4. Notify BUILDINGS AND GROUNDS of completion.

The history of the results of these inspections is maintained by Buildings and Grounds.

FUME HOOD MAINTENANCE PROCEDURES

- To provide proper air flow across the fume hood face, adjust the internal slots until flow is distributed evenly.

- Preventive maintenance should be performed on exhaust fans and controls.

NOTE:
Visual inspections by hood users and/or laboratory staff should be performed periodically using smoke or plastic ribbons.

EXHAUST FAN SCHEDULED MAINTENANCE:

1. Replace cracked/frayed belt.

2. Tighten motor fan, shaft, bearing lock devices.

3. Tighten vacuum fan, blade, housing.

4. Check vibration elimination springs and bearings.

5. Tighten all bolts/fan housing/bearings.

6. Dry lube damper bearing/actuator shaft.

7. Check damper for proper closure.

8. Measure motor currents design amps.

9. Check vacuum motor cooling vents.

10. Check motor starter contracts.

11. Lube motor bearing if required.

12. Perform a visual inspection.

7.2 SAFE OPERATING PROCEDURES FOR USE OF CHEMICAL FUME HOOD

Personnel who are required to conduct procedures within a fume hood should follow the practices outlined below.

1. Familiarize yourself with the physical and chemical properties of the materials you plan to work with by consulting the Material Safety Data Sheets and other available references.

2. Do not assume that a fume hood is operating properly. Always review the results of the most recent fume hood survey by consulting the hood sticker or the survey report.

3. Check the continuous flow monitoring device on the hood face (e.g. static pressure gauge), and compare the current reading with the number recorded on the hood sticker or the survey report to confirm that the hood operation is consistent with the results of the latest survey. If there are questions about proper performance, resolve them before using the hood.

4. Based upon the hazards posed by the substances being manipulated and the results of the most recent hood survey, determine whether the hood is adequate for the work contemplated.

5. Perform all chemical manipulations at least six (6) inches inside the hood face. A line drawn on the work surface six inches inside the face can be an effective reminder.

6. Locate all laboratory equipment as far back in the hood as practicable and make certain that hood exhaust slots are not blocked.

7. Elevate large pieces of equipment off the work surface to reduce turbulence and improve airflow characteristics, thus optimizing hood performance.

8. Avoid cross drafts in front of the hood from supply air ducts or pedestrian traffic in the vicinity of the hood. Rapid movements by the user also tend to disrupt the airflow into the hood and reduce the containment provided.

9. Minimize chemical storage in the fume hood to avoid impairing its effectiveness. This will also simplify spill cleanups and reduce any complications from a fire, minor explosion, or other incident.

10. Do not allow paper, disposable gloves, or other debris to be drawn into the slots at the rear of the hood. They can become trapped in the exhaust ductwork and adversely affect hood performance.

11. Avoid placing your head inside hood while performing chemical manipulations. Lowering the hood sash will provide some protection to the user in the event of splashes or a minor explosion.

12. It is the responsibility of the faculty to assure that his/her students use hoods properly.

13. Nonfunctional hoods should be reported immediately to Buildings and Grounds (ext. 3660) and not used until repaired.

14. In case of a power outage pull hood sash completely down until power is restored.

8 STANDARD OPERATING PROCEDURES

8.0 Introduction

The purpose of this section is to outline the HWS Chemistry Department practices and procedures for handling particularly hazardous substances; for selecting, using, and maintaining protective equipment; for laboratory hygiene; and for handling liquid nitrogen. Additional guidelines for handling physical and chemical hazards may be found in Appendix B.

8.1 Particularly Hazardous Substances

8.1.1 REQUIREMENTS OF THE STANDARD 29 CFR 1910.1450 (e) (3) (v)

The Chemical Hygiene Plan shall include the circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the professor before implementation.

Definition of Particularly Hazardous Substances:

1. Any substance with the NFPA hazard code of 4 for health, reactivity, flammability, or other.

2. Any select carcinogen, cancer suspect agent, or reproductive toxin. Any chemical rated as highly toxic (acute or chronic).

3. Any explosive chemical.

4. Any chemical deemed particularly hazardous by the professor.

In order to use particularly hazardous substances, the student must have written permission including a completed and signed Hazardous Chemical and Procedure Form (Appendix A) and an MSDS must be in the laboratory.

It is the responsibility of the professor to identify particularly hazardous substances used in coursework. The professor should make every effort to substitute a less hazardous substance or experiment whenever possible. For work done as independent study or Honors research, it is the responsibility of both the professor and student to identify particularly hazardous substances.

The Hazardous Chemical Procedure Form is designed not only to provide written permission but also the necessary training/information for use of the particularly hazardous substance.

8.1.2 DEFINITIONS

Select Carcinogen

means any substance which meets one of the following criteria:

1. It is regulated by OSHA as a carcinogen; or

2. It is listed under the category, "known to be carcinogen," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or

3. It is listed under Group 1 ("carcinogen to humans") by the International Agency for Research on Cancer (IARC) (latest edition); or

4. It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP.

NOTE: The NTP and IARC lists of carcinogens are linked in Appendix D.

Reproductive Toxin

means chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

NOTE: Embryotoxins, which are substances that act during pregnancy to cause adverse effects on the fetus, are also included in this category.

Designated Area

means an area which may be used to work with select carcinogens, reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

All designated areas should be clearly marked with sign describing the category of hazards contained within and any restrictions placed on the area. An example of such a sign would be:

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

Wastes and other contaminated materials should be collected and either decontaminated or disposed of as hazardous waste (see Section 9.0, Hazardous Waste Management.

8.1.3 DEPARTMENT POLICY AND ASSIGNED RESPONSIBILITY

It is Hobart and William Smith Colleges' Chemistry Department policy to follow the safe work practices whenever particularly hazardous substances are used.

The person responsible for identifying those procedures involving particularly hazardous substances is the professor of the course or research project.

The person responsible for establishing the designated areas to be used for each procedure involving a particularly hazardous substance is the professor of the course or research project.

8.2 Protective Equipment

8.2.1 REQUIREMENTS OF THE STANDARD 29 CFR 1910.1450 (e) (3) (iii)

The Chemical Hygiene Plan requires that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment. All hazardous materials must be handled inside fume hoods to assure the PEL is not exceeded.

All students, professors, visitors and employees are required to wear eye protection when in any chemistry laboratory. Professors are responsible for assessing the need for any additional protective equipment. Training on the availability and proper use of the protective equipment is to be conducted by the professor of the course.

The location of the protective equipment found in each department is indicated on the floor plans in Section 1.2.5.

Fire extinguishers are visually inspected for broken seals, damage and low gauge pressure (depending on type of extinguisher) monthly. Proper mounting of the extinguisher and its ready accessibility should also be checked. The monthly inspections and annual maintenance checks of fire extinguishers as per 29 CFR 1910.157, is to be done by Bill Hastings, Associate Director of Security.

Fire drills are to be performed at least twice each year. Martin Corbett contracts the annual inspection and cylinder tests of fire extinguishers to Rochester Fire Equipment, Rochester, NY. Fire inspections of the buildings are performed annually by the Geneva Fire Department.

Safety showers and eyewash fountains should be examined visually and their mechanical function tested. Buildings and Grounds is responsible for testing safety showers and eyewash fountains on a monthly basis. If possible, faculty should flush the eyewash fountains in their labs for at least 30 seconds once per week. See Section

8.2.6 for eyewash testing procedures.

8.2.2 PROTECTIVE EQUIPMENT - GENERAL PRINCIPLES

Personal protective equipment includes all clothing and other work accessories designed to create a barrier against workplace hazards. The basis of any personal protective equipment management program should be an in-depth evaluation of the equipment needed to protect against the hazards in the workplace.

The need for specific types of safety equipment is dependent upon the types of operations and the nature and quantity of the materials in use and must be assessed on a case by case basis.

The protection afforded by this equipment depends upon its proper selection, maintenance and use.

All laboratories in which chemicals are used should have available fire extinguishers, safety showers, and eyewash fountains in addition to personal protective equipment such as eye and face protection, gloves, respiratory protection, and other protective clothing as appropriate.

Laboratory workers must be aware that the equipment does not eliminate the hazard. The proper use of these items will minimize or eliminate **exposure** to the hazards associated with many laboratory operations.

8.2.3 EYE AND FACE PROTECTION

Eye and face protection must be worn in the laboratory whenever there is reasonable probability of an injury that could be prevented by their use. Suitable eye and face protection is made conveniently available by The Company whenever machines or operations present the hazard of flying objects, glare, liquids, injurious radiation or a combination of these hazards. Employees must use the protectors. These stipulations apply also to supervisors, management, and should apply to visitors while they are in hazardous areas.

Minimum Requirements
Eye and face protectors must meet the following minimum requirements:

1. Provide adequate protection against particular hazards for which they are designed;

2. Be reasonably comfortable when worn under the designated conditions;

3. Fit snugly without interfering with the movements or vision of the wearer;

4. Be durable;

5. Be capable of being disinfected;

6. Be easily cleanable; and

7. Be kept clean and in good repair.

Selection
Each eye, face, or eye and face protector is designed for a particular hazard. In selecting the protector, consideration should be given to the kind and degree of hazard, and the protector should be selected on that basis. Where a choice of protectors is given, and the degree of protection required is not an important issue, worker comfort may be a deciding factor.

Corrective Lenses
Persons using corrective lenses in spectacles that are required to wear eye protection must wear face shield, goggles, or spectacles of one of the following types:

1. Spectacles with protective lenses providing optical correction;

2. Goggles worn over corrective spectacles without disturbing the adjustment of the spectacles; or

3. Goggles that incorporate corrective lenses mounted behind the protective lenses.

Contact Lenses
Contact lenses do not provide eye protection. Gases and vapors can concentrate under such lenses and cause permanent eye damage. Furthermore, in the event of a chemical splash into the eye, it is often nearly impossible to remove the contact lenses to irrigate the eye because of an unconscious spasm of the eyelid. Their use in the laboratory is prohibited.

8.2.4 GLOVES

When working in the laboratory environment, the hands are often the most likely point of contact with hazardous chemicals. Skin or hand contact can occur in several circumstances such as direct immersion, splashing, spills, contact with solvent-coated objects, or the selection of improper gloves.

The most effective means of preventing skin exposure are by substituting a less hazardous substance or re-designing the experiment. If these methods are not feasible or successful in eliminating potential exposure completely, gloves may be necessary.

Glove Selection
Glove selection is the responsibility of the professor. The most important thing to remember in selecting gloves is that there is no one glove material that is impervious to all chemicals. The glove selection process should include:

1. Review of the MSDS for the material. This reference or chemical permeation and degradation guides available from glove manufacturers may provide information on the type of glove that should be used with the chemicals you plan to handle.

2. Evaluation of the additive or synergistic effects of a mixture of materials. All chemicals in the mixture must be considered when selecting an appropriate glove.

3. Determination of the potential consequences of skin contact by the chemical. Be aware of the symptoms of overexposure and the health effects the material is capable of producing.

4. Establishment of a decontamination procedure for gloves that will be used more than once. The decontamination process must be effective in removing contamination and suitable for the glove chosen (not cause degradation of the glove material).

5. Determination of dexterity and sizing requirements. Gloves come in all shapes and sizes. A glove that is too large, thick or stiff may not be satisfactory for precise laboratory work. A glove that is too small will cause the hand to fatigue easily.

6. Determination of the physical resistance properties required of the glove, e.g. puncture resistance, temperature insulation, etc.

7. Consideration of any additional factors, such as selection of a contrasting color to highlight contamination, glove length, cuffs to catch drips, and the use of liners to absorb moisture and reduce irritation.

8. When limitations or precautions are indicated by the manufacturer, they should be transmitted to the user and strictly observed.

Glove Use

1. Before donning gloves they should be checked for imperfections, cracks or pinholes.

2. Avoid touching anything except work materials. Remove gloves before touching door knobs, light switches, hood sashes or lab notebooks.

3. Decontaminate the gloves with a suitable solvent before removing.

4. Wash hands immediately after removing the gloves.

8.2.5 FIRE EXTINGUISHERS

The use of fire extinguishers in a laboratory should conform with the following guidelines:

1. Portable fire extinguishers suitable to the conditions and hazards involved shall be provided and maintained in an effective operating condition.

2. Portable fire extinguishers shall be conspicuously located and mounted where they will be readily accessible. Extinguishers shall not be obstructed or obscured

from view.

3. Portable fire extinguishers shall be given maintenance service at least once a year and a written record kept to show the maintenance or recharge date. A record shall be maintained of the service.

4. Where the employer has provided portable fire extinguishers for employee use in the workplace, the employer shall also provide an educational program to familiarize employees with the general principles of fire extinguisher use and the hazards involved with initial stage fire fighting.

5. The portable fire extinguisher program instituted at the facility must conform with the OSHA Fire Protection standard - 29 CFR 1910.157.

8.2.6 EYEWASH AND SAFETY SHOWERS

Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.

Safety Showers
The shower should be capable of drenching the subject immediately and should be large enough to accommodate more than one person if necessary. It should have a quick-opening valve requiring manual closing. A downward-pull delta bar is satisfactory if long enough. Chain pulls are not advisable because of the potential for persons to be hit by them and the difficulty of grasping them in an emergency.

Eyewash Fountains
An eyewash fountain should provide a soft stream or spray of aerated water for an extended period (at least 15 minutes). These fountains should be located close to the safety showers so that, if necessary, the eyes can be washed while the body is showered. Eyewash fountains and safety shower locations should be clearly marked and employees should be familiar with their locations and functioning. Access to eyewash and safety fountains must be free of clutter at all times.

Safety Shower and Emergency Eyewash Testing Procedures

Safety Shower

1. Flush systems and check valves for proper operation.

2. Check entire unit for leaks.

3. Verify proper flow rates and adjustment of shower heads.

4. Recommended ANSI flow rates are minimum 30 gallons per minute at 30 PSI.

5. Report results to supervisor.

Emergency Eyewash (Fresh Water Type)

1. Flush systems and check valves for proper operation.

2. Check entire unit for leaks.

3. Verify proper flow rates and adjustment of spray heads.

    - Recommended ANSI flow rates are minimum 0.4 gallons per minute for at least 15 minutes.

4. Report results to supervisor.

Emergency Eyewash (Portable)

1. Make sure the units are properly stocked with fresh wash solution. If expiration date has passed, replace bottles.

2. Check bottles for physical damage, which can lead to contamination.

3. Check mounting backboard for damage.

4. Report results to Jason Woodruff.

8.3 Safe Work Practices and Assigned Responsibilities

It is the Chemistry Department policy for all students and employees to follow the safe work practices and standard operating procedures described in the preceding sections of this Chemical Hygiene Plan and any additional practices deemed necessary by the professor of the course.

The person responsible for ensuring that students follow the established procedures is the professor of the course or research project.

General Guidelines

1. Know the safety rules and procedures that apply to the work that is being done. Review the potential hazards (e.g., physical, chemical, biological) and appropriate safety precautions before beginning any new operation.

2. Know the location of and how to use the emergency equipment in your area, as well as how to obtain additional help in an emergency. Familiarize yourself with emergency response procedures, facility alarm systems, the location of emergency equipment (e.g. fire extinguishers, safety showers and eyewash fountains), and building evacuation routes.

3. Know the types of protective equipment available and use the proper type for each job.

4. Be alert to unsafe conditions and actions and bring them to the attention of your supervisor immediately so that corrections can be made as soon as possible. Someone else's accident can be as dangerous to you as any you might have.

5. Do not consume or store food or beverages in areas where chemicals are being used or stored.

6. Avoid hazards to the environment by following accepted waste disposal procedures. Chemical reactions may require traps or scrubbing devices to prevent the escape of toxic substances to the laboratory and the environment.

7. Be certain all chemicals are correctly and clearly labeled. Post warnings signs when unusual hazards, such as radiation, laser operations, flammable materials, biological hazards, or other special problems exist.

8. Remain out of the area of a fire or personal injury unless it is your responsibility to help meet the emergency. Curious bystanders interfere with rescue and emergency personnel and endanger themselves.

9. Avoid distracting or startling any other worker. Practical jokes or horseplay cannot be tolerated at any time.

10. Use equipment only for its designed purpose.

11. Position and clamp reaction apparatus thoughtfully in order to permit manipulation without the need to move the apparatus until the entire reaction is completed.

12. Combine reagents in the appropriate order (e.g. adding acid to water) and avoid adding solids to hot liquids.

13. Prioritize safety until it becomes a habit.

8.3.1 HOUSEKEEPING AND HYGIENE

Health and Hygiene
Laboratory workers should observe the following health practices:

1. Wear appropriate eye and face protection at all times.

2. Use protective apparel, including face shields, gloves, and other special clothing or footwear as needed.

3. Confine long hair and loose clothing when in the laboratory. Wear shoes at all times in buildings where chemicals are stored or used. Open toe shoes or sandals are not acceptable.

4. Do not use mouth suction to pipet chemicals or to start a siphon; a pipet bulb or an aspirator should be used to provide vacuum.

5. Avoid exposure to gases, vapors, and aerosols. Use appropriate safety equipment and work in a fume hood whenever such exposure is likely.

6. Wash well before leaving the laboratory area. However, avoid the use of solvents for washing the skin. They remove the natural protective oils from the skin and can cause irritation and inflammation. In some cases, washing with a solvent may facilitate absorption of a toxic chemical.

Food Handling

Contamination of food, drink, and smoking materials is a potential route for exposure to toxic substances. Food should be stored, handled, and consumed in an area free of hazardous substances.

1. Well-defined areas should be established for storage and consumption of food and beverages. No food should be stored or consumed outside of this area.

2. Areas where food is permitted should be prominently marked and a warning sign (e.g., EATING AREA - NO CHEMICALS) posted. No chemicals or chemical equipment should be allowed in such areas.

3. Consumption of food or beverages and smoking should not be permitted in areas where laboratory operations are being carried out.

4. Glassware or utensils that have been used for laboratory operations should never be used to prepare or consume food or beverages. Laboratory refrigerators, freezers, ice chests, or cold rooms, should not be used for food storage. Separate equipment should be dedicated to that use and prominently labeled.

Housekeeping

There is a definite relationship between safety performance and orderliness in the laboratory. When housekeeping standards fall, safety performance inevitably deteriorates. The work area should be kept clean, and chemicals and equipment should be properly labeled and stored.

1. Work areas should be kept clean and free from obstructions. Cleanup should follow the completion of any operation or at the end of each day.

2. Wastes should be deposited in appropriate receptacles.

3. Spilled chemicals should be cleaned up immediately and disposed of properly. All laboratory personnel should be informed of proper cleanup and disposal procedures for laboratory accidents.

4. Unlabeled containers and chemical wastes should be disposed of promptly, by using appropriate procedures. Such materials, as well as chemicals that are no longer needed, should not accumulate in the laboratory.

5. Floors should be cleaned regularly.

6. Stairways and hallways should not be used as storage areas.

7. Access to exits, emergency equipment, controls, and such should never be blocked.

8. Equipment and chemicals should be stored properly; clutter should be minimized.

8.3.2 LABORATORY PRACTICES

Chemical Storage
Containers should be tightly closed when not in active use, and broken or damaged containers should be immediately replaced. Wherever possible, chemicals should be stored in closed cabinets or on shelves with a lip preventing containers from falling off. Minimize chemical storage on benchtops and fume hoods. Do not store hazardous chemicals above eye level.

Incompatible chemicals are chemicals which react violently with each other under ambient conditions. Incompatible chemicals **must not** be stored together. If insufficient space is available to store incompatible chemicals in separate cabinets, chemicals should be segregated using trays or tubs. The following are examples of incompatible categories of chemicals, but this is not a complete list.

1. Acids and bases

2. Acids and metals

3. Oxidizing agents and reducing agents

4. Oxidizing agents and flammable materials

5. Water reactives and aqueous solutions

Certain chemicals should be segregated from all other chemicals due to their reactivity with a wide range of substances; examples of this include nitric acid and ammonium nitrate. Always refer to the MSDS for the storage requirements of a specific chemical.

In addition to separating incompatible chemicals, it is good practice to store toxic chemicals, reproductive hazards, and other particularly hazardous substances away from other chemicals in designated, clearly labeled areas. See Section 8.1.2 for more information on particularly hazardous substances, and Sections 8.3.5-8.3.8 for storage guidelines for specific categories of hazardous substances.

Empty reagent bottles which are to be disposed of should not be rinsed out. Solid residue is allowed to remain in the bottles marked for disposal. Solvent bottles should be allowed to dry in a fume hood. To minimize waste, the Chemistry Department reuses many reagent bottles. If a bottle is to be reused, it may be rinsed out and the used rinse solvent treated like any other waste (see Section 9.)

Warning Signs and Labels
Laboratory areas that have special or unusual hazards should be posted with warning signs. Standard signs and symbols have been established for a number of special situations, such as radioactivity hazards, biological hazards, fire hazards, and laser operations. Other signs should be posted to show the locations of safety showers, eyewash stations, exits, and fire extinguishers. Extinguishers should be labeled to show the type of fire for which they are intended. Waste containers should be labeled for the type of waste that can be safely deposited.

The safety and hazard signage systems in the laboratory should enable a person unfamiliar with the usual routine of the laboratory to escape in an emergency (or help combat it, if appropriate).

When possible, labels on containers of chemicals should contain information on the hazards associated with use of the chemical. Unlabeled bottles of chemicals should not be opened; such materials should be disposed of promptly and will require special handling procedures.

Waste Disposal Procedures
Laboratory management has the responsibility for establishing waste disposal procedures for routine and emergency situations and communicating these to laboratory workers. Workers should follow these procedures with care, to avoid any safety hazards or damage to the environment. Hazardous waste disposal procedures are discussed in detail in Section 9.

Working Alone
Generally, it is prudent to avoid working in a laboratory building alone. Under normal working conditions, arrangements should be made between individuals working in separate laboratories to crosscheck periodically. Experiments known to be hazardous should not be undertaken by a worker who is alone in a laboratory.

Under unusual conditions, special rules may be necessary. The professor of the laboratory has the responsibility for determining whether the work requires special safety precautions. In any case, working alone is not permitted in any lab work associated with a chemistry course.

Independent Study and research students may work in a lab alone during normal business hours (8:00 A.M. - 5:00 P.M., Monday through Friday) but must inform the advisor of their schedule. Outside of this time, they must have a second person according to the recommendation of the professor. Work on particularly hazardous procedures must be done Monday through Friday, 8:00 A.M. - 5:00 P. M. and the advisor must be alerted.

Procedures deemed non-hazardous by the professor may be done by research students working alone at any time.

Unattended Operations
Frequently, laboratory operations are carried out continuously or overnight. It is

essential to plan for interruptions in utility services such as electricity, water, and inert gas. Operations should be designed to be safe, and plans should be made to avoid hazards in case of failure. Wherever possible, arrangements for routine inspection of the operation should be made and, in all cases, the laboratory lights should be left on and an appropriate sign should be posted on the door.

One particular hazard frequently encountered is failure of cooling water supplies. A variety of commercial or homemade devices can be used that:

1. Automatically regulate water pressure to avoid surges that might rupture the water lines or

2. Monitor the water flow so that its failure will automatically turn off electrical connections and water supply valves.

If these devices are not available, **clamp** all connections to cooling water supply hoses.

Accident Reporting
Emergency telephone numbers to be called in the event of fire, accident, flood, or hazardous chemical spill should be posted prominently in each laboratory. The professor should be notified immediately in the event of an accident or emergency, and the form in Section 4 should be completed and filed in the CHP in Lansing 201B.

8.3.3 EQUIPMENT

Equipment Maintenance
Good equipment maintenance is important for safe, efficient operations. Equipment should be inspected and maintained regularly. Servicing schedules will depend on both the possibilities and the consequences of failure. Maintenance plans should include a procedure to ensure that a device that is out of service cannot be restarted.

Safety Guards
All mechanical equipment should be adequately furnished with guards that prevent access to electrical connections or moving parts (such as the belts and pulleys of a vacuum pump). Each laboratory worker should inspect equipment before using it to ensure that the guards are in place and functioning.

Careful design of guards is vital. An ineffective guard can be worse than none at all, because it can give a false sense of security. Emergency shutoff devices may be needed, in addition to electrical and mechanical guarding.

8.3.4 PHYSICAL HAZARDS

Handling Liquid Nitrogen

Contact with liquid nitrogen may cause severe harm including frostbite, eye damage, and asphyxiation, and must be handled using appropriate containers, tools, and personal protective equipment.

1. Do not allow untrained individuals to handle liquid nitrogen.

2. Wear safety goggles and insulated gloves when handling liquid nitrogen or any objects that have been submerged in liquid. Do not allow liquid nitrogen to contact any unprotected part of your body.

3. Use tweezers to handle superconductors, magnets, or other small, cold objects. Plastic tweezers should be tested for embrittlement prior to use.

4. Use liquid nitrogen only in well ventilated places.

5. Do not store liquid nitrogen in any container with a tight fitting lid. A tightly sealed container will build up pressure as the liquid boils and may **explode** after a short time.

6. Many substances become brittle and may shatter when cold, sending pieces of the material flying. Avoid letting common glass and large, solid plastics come into contact with liquid nitrogen, and handle objects that have been submerged in liquid nitrogen with care.

Safety Shielding and Explosions
Safety shielding should be used for any operation having the potential for explosion, including

1. Any reaction being attempted for the first time. (Use small quantities of reactants to minimize hazards).

2. Reactions being carried out at a significantly larger scale than usual (e.g., 5-10 times more material).

3. Reactions being carried out at non-ambient conditions.

Shields must be placed so that all personnel in the area are protected from hazard.

Glassware
Accidents involving glassware are a leading cause of laboratory injuries.

1. Careful handling and storage procedures should be used to avoid damaging glassware. Damaged items should be discarded or repaired.

2. Adequate hand protection should be used when inserting glass tubing into rubber stoppers or corks or when placing rubber tubing on glass hose connections. Tubing should be fire polished or rounded and lubricated, and hands should be held close together to limit movement if glass should fracture occur. The use of plastic or metal connectors should be considered.

3. Glass-blowing operations should not be attempted unless proper annealing facilities are available.

4. Vacuum-jacketed glass apparatus should be handled with extreme care to prevent implosions. Equipment such as Dewar flasks should be externally taped or metal shielded. Only glassware designed for vacuum work should be used for that purpose.

5. Hand protection should be used when picking up broken glass (Small pieces should be swept up with a brush into a dustpan.)

6. Proper instruction should be provided in the use of glass equipment designed for specialized tasks, which can represent unusual risks for the first-time user. (For example, separatory funnels containing volatile solvents can develop considerable pressure during use.)

Cold Traps and Cryogenic Hazards

The primary hazard of cryogenic materials is their extreme coldness. They, and surfaces they cool, can cause burns if allowed to contact the skin. Gloves and a face shield may be needed when preparing or using some cold baths.

Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture in the presence of air because oxygen can condense from the air, which leads to an explosion hazard. Insulated dry gloves should be used when handling dry ice, which should be added slowly to the liquid portion of the cooling bath to avoid foaming over. Workers should avoid lowering their head into a dry ice chest: carbon dioxide is heavier than air, and suffocation can result.

Systems Under Pressure

Reactions should never be carried out in, nor heat applied to, an apparatus that is a closed system unless it is designed and tested to withstand pressure. Pressurized apparatus should be equipped with relief devices. If the reaction cannot be opened directly to the air, an inert gas purge and bubbler system should be used to avoid pressure buildup.

8.3.5 FLAMMABLE MATERIALS

There is a fire risk in many laboratories because of the storage and handling of flammable substances, which may be in solid, liquid or gaseous form. Particular attention should be paid to fire prevention in both design and operation of laboratories. A significant general hazard that is often disregarded is a tendency to obstruct the means of escape from the workplace. It is essential that steps are taken to ensure that this does not occur.

The magnitude of the hazard from flammable substances depends both on their physico- chemical properties and the quantities involved. For a liquid, the flash point, auto-ignition temperature, explosive limits, vapor density and ability to accumulate an electrostatic charge are all important factors. The possibility of such hazards being accentuated through oxygen enrichment should also be considered. Consult the MSDS before working with these materials.

Almost all flammable vapors can be ignited by common ignition sources such as flames or incandescent surfaces. However substances (e.g. certain ethers, aldehydes and carbon disulfide) can be ignited at even lower temperatures such as those produced by hot plates, ovens and heating mantles. Carbon disulfide is particularly dangerous in this respect because its auto-ignition temperature is only just above 100° C.

Fire or explosion can occur when flammable vapors are mixed with oxygen in proportions within critical values known as the Lower and Upper Explosive limits (LEL and UEL, respectively). For most solvents the LEL lies in the range of 1.5% in air and therefore good ventilation is essential in order to eliminate the risk of forming a flammable or explosive atmosphere when such substances are used.

In addition to observing all the safe work practices described in section 8.5.2, the following must be considered.

1. Vapors from flammable liquids are denser than air and thus tend to sink to ground level where they can spread over a large area. Care should be taken to minimize the production of such vapors and the associated risk of ignition by flashback from a remote source.

2. Flammable vapors may also be ignited by sparks caused by the discharge of static electricity. (Static charges may be generated in liquids flowing through pipes or by their agitation or stirring.) When large quantities of flammable solvents are dispensed it is good practice to ensure that all vessels used are of metal and are electrically connected and grounded.

3. Quantities of flammable substances in laboratories should be kept to a minimum. When not in use, solvents are best kept in suitable fire-resistant cabinets. Larger quantities of solvents should be stored in special flammable liquid cabinets.

4. When flammable liquids are transported within the laboratory appropriate carriers should be used for other than small glass bottles.

5. The dispensing of flammable liquids from bulk containers should be carried out by trained staff in a safe area.

6. All containers must be labelled with the names of the contents.

7. Flammable solvents should not be poured down sinks.

8. Use a fume hood whenever possible to control flammable vapor concentrations.

9. Do not store flammable liquids in standard refrigerators. Use only refrigerators designed for this purpose.

10. Provide fire extinguishers rated for Class B fires.

11. Flammable solids often encountered in laboratories include the alkali metals, magnesium metal, metallic hydrides, some organometallic compounds,

phosphorus and sulfur. Such substances must be stored safely in correctly labeled containers and staff must be made aware of the hazards associated with their use. Class D extinguishing agents may be necessary for some of these materials.

8.3.6 CORROSIVE MATERIALS

Many chemicals in common laboratory use are corrosive or irritating to body tissue. They present a hazard to the eyes and skin by direct contact, to the respiratory tract by inhalation or to the gastrointestinal system by ingestion. Consult the MSDS before working with these materials.

Corrosive chemical liquids (e.g. mineral acids, alkali solutions and some oxidizers) represent a very significant hazard because skin or eye contact can readily occur from splashes. The following considerations should be taken when handling and storing corrosive liquids.

1. The eyes are particularly vulnerable. It is therefore essential that approved eye and face protection be worn in all laboratories where corrosive chemicals are handled.

2. Gloves and other chemically resistant protective clothing should be worn to protect against skin contact.

3. To avoid a flash steam explosion due to the large amount of heat evolved, always add acids or bases to water (and not the reverse).

4. Acids and bases should be segregated for storage. Nitric acid should be segregated from all other acids.

5. Liquid corrosives should be stored below eye level.

6. Adequate quantities of spill control materials should be readily available.

Corrosive and irritant **gases and vapors** are hazardous to all parts of the body; certain organs (e.g. the eyes and the respiratory tract) are particularly sensitive. The magnitude of the effect is related to the solubility of the material in the body fluids. Highly soluble gases (e.g. ammonia, hydrogen chloride) cause severe nose and throat irritation, while substances of lower solubility (e.g. nitrogen dioxide, phosgene, sulfur dioxide) can penetrate deep into the lungs.

1. Warning properties such as odor or eye, nose or respiratory tract irritation may be inadequate with some substances. Therefore, they should not be relied upon as a warning of overexposure.

2. Perform manipulations of materials that pose an inhalation hazard in a chemical fume hood to control exposure or wear appropriate respiratory protection.

3. Protect all exposed skin surfaces from contact with corrosive or irritating gases

and vapors.

8.3.7 REACTIVES AND EXPLOSIVES

The risk of explosions from mixtures of flammable vapors with air has been referred to above. Explosions can also occur when flammable substances are mixed with solid or liquid oxidants and the need for such combinations should always be assessed before proceeding. Consult the MSDS before working with these materials.
In addition to observing all the safe work practices described in section 8.5.2, the following must be considered.

Some substances can detonate as a result of friction, shock, heat (e.g. organic peroxides) or contamination (e.g. mixtures of perchloric acid with a wide variety of materials can be highly unstable). Attention must be given to the storage instructions which are provided with such materials. In addition to hazards associated with the handling of these materials, it should be remembered that unstable substances may be formed during chemical operations or prolonged storage. Appropriate measures should be taken to avoid this from occurring. For example, certain ethers, alcohols and aldehydes can form peroxides which may detonate during distillation. For this reason bottles of materials prone to peroxidation should be dated upon receipt and not kept for prolonged periods once they have been opened.
Some substances are inherently unstable and can detonate under certain conditions of pressure and temperature (e.g. acetylene, carbon disulfide and substances prone to autopolymerization).

8.3.8 COMPRESSED GASES

Compressed gases are stored at very high pressures and, as such, pose a significant risk in the laboratory. Heating, shock, or damage to the valve can cause explosive decompression and turn the cylinder into a projectile, and the release of non-breathable gases into an enclosed space may cause asphyxiation. In addition to these physical risks, many common compressed gases are flammable or toxic. Care should be used when transporting and storing compressed gas cylinders.

Standard cylinder-valve outlet connections have been devised by the Compressed Gas Association (CGA) to prevent the mixing of incompatible gases due to an interchange of connections. The outlet threads used vary in diameter; some are internal and some are external; some are right-handed and some are left-handed. In general, right-handed threads are used for fuel and oil-pumped gases. Information on the standard equipment assemblies for use with specific compressed gases are available from the supplier. To minimize undesirable connections that may result in a hazard, only CGA standard combinations of valves and fittings should be used in compressed gas installations; the assembly of miscellaneous parts (even of standard approved types) should be avoided. The threads on cylinder valves, regulators, and other fittings should be examined to ensure that they correspond to one another and are undamaged.

General Handling Precautions

1. Position cylinders so that the cylinder valve is accessible at all times. The main cylinder valve should be closed as soon as it is no longer necessary that it be open (i.e., it should never be left open when the equipment is unattended or not operating).

2. Store full and empty cylinders separately. Serious cylinder contamination can occur when an empty cylinder is attached to a pressurized system causing reverse gas flow.

3. Avoid dragging, rolling, or sliding cylinders. Move cylinders by using a suitable hand truck with a strap, chain, or other device for securing the cylinder.

4. Never drop cylinders or permit them to strike each other violently.

5. Leave the valve-protection cap on each cylinder until it has been secured against a wall or bench, or placed in a cylinder stand, and is ready to be used.

6. Never tamper with safety devices in valves or cylinders.

7. Place cylinders where they will not become part of an electric circuit.

8. Bond and ground all cylinders, lines, and equipment used with flammable compressed gases.

9. Check for leaks with a water and soap solution. Never use a flame.

10. Use compressed gases only in a well-ventilated area. Toxic, flammable, and corrosive gases should be used in a hood. Only small cylinders of toxic gases should be used. Consider the use of flow restrictors in the cylinder valve to limit the rate of flow during an accidental release.

11. Use a trap or suitable check valve when discharging gas into a liquid to prevent liquid from getting back into the cylinder or regulator.

12. Use appropriate safety equipment such as safety goggles, face shield, and rubber gloves when using corrosive gases.

13. Do not force a cylinder valve that is stuck or frozen. Seek advice from the vendor.

Pressure Regulators

A regulator should be attached to a cylinder without lubrication and without forcing the threads. A poor fit may indicate that the regulator is not intended for use on the gas chosen. Clean the connecting surfaces with a clean, dry cloth. Oxygen valves, however, should be blown out before attaching regulators rather than using a cloth to avoid contamination with lint or other organic matter. The following procedure should be used to obtain the required delivery pressure:

1. After the regulator has been attached to the cylinder valve outlet, turn the delivery pressure adjusting screw counter-clockwise until it turns freely. This will prevent unintended gas flow through the regulator.

2. Open the cylinder valve slowly until the inlet gauge on the regulator registers the cylinder pressure. If the cylinder pressure reading is lower than expected, this may indicate that the cylinder valve is leaking.

3. With the flow control valve at the regulator outlet closed, turn the delivery pressure adjusting screw clockwise until the required delivery pressure is reached. The regulator itself should not be used as a flow control by adjusting the pressure to obtain different flow rates.

4. When done using the gas, close the cylinder valve and release the regulator pressure.

8.3.9 OXYGEN ALARM RESPONSE

A large dewar of liquid nitrogen is stored in Rosenberg 013, and the NMR contains large reservoirs of both liquid nitrogen and liquid helium. In the event of a spill or catastrophic failure of these containment systems / tanks, the inert gases could displace the air (oxygen) in the room and cause asphyxiation.

Oxygen alarms will sound when concentrations are less than 19.5% or greater than 23.5%. Outside of these concentrations, it is NOT SAFE to enter the room. If the oxygen sensor is alarming or flashing, immediately evacuate the area and keep the door to the room open. Immediately call Campus Safety (x3333 on campus), and then notify Lucas Seybert.
In case of inhalation of nitrogen or helium, immediately leave the area and remain in fresh air. Refer to section 8.3.4 regarding cryogenic hazards and seek medical attention if necessary.

Once the area has been evacuated, proceed as follows:

1. Determine the concentration of oxygen in the room from exterior monitors or hand held sensors. If less than 19.5%, DO NOT ENTER, and keep all other personnel from entering the area.

2. Open doors, windows (from exterior if possible), and ensure that the ventilation systems are providing as much fresh air as possible.

3. Emergency services (Fire Department) has appropriate equipment to enter into an area with too little oxygen. HWS personnel do not.

4. If it is safe to enter, (Oxygen concentration greater than 19.5%), only enter if you have a portable detector as well as the wall mount system.

5. Ensure all valves are closed on the tank if it is safe to do so.

This section was adapted from the multi-department Oxygen Alarm Response SOP (Appendix B) and updated to reflect personnel changes.

9 HAZARDOUS WASTE MANAGEMENT

9.0 Introduction

Hazardous wastes are generated by the Hobart & William Smith Colleges (HWS) Chemistry Department through laboratory exercises completed as part of the curriculum for certain chemistry courses as well as through research projects. Courses in which hazardous wastes are generated as part of laboratory exercises include but are not limited to; General Chemistry, Intermediate Chemistry, Organic Chemistry (I & II), Analytical Chemistry, Biochemistry and Physical Chemistry. The purpose of this section is to outline the procedures for handling, storage and disposal of these wastes.

9.1 Defining Hazardous Waste

Hazardous waste is a waste that is dangerous or capable of having a harmful effect on human health or the environment. A discarded material will be deemed a hazardous waste if it exhibits any of the four hazardous waste characteristics identified below, or if it is on one of four lists of specific hazardous wastes compiled by the EPA.

Characteristic Hazardous Waste (All D□Codes):

1. Ignitability: liquids with a flash point of 140°F or below, oxidizers, or spontaneously combustible materials (D□Codes)

2. Corrosivity: pH≤2 or ≥12.5, (D□Codes)

3. Reactivity: materials that readily explode or undergo violent reactions (D□ Codes)

4. Toxicity: wastes likely to leach dangerous concentrations of toxic chemicals into groundwater (D□ Codes)

There are also four types of "listed hazardous wastes." These are divided into two categories: F and K list wastes, which are generated by specific industrial processes, and U and P list wastes, which are unused commercial chemicals. See Appendix D for a link to the EPA guidelines for hazardous waste classification.

Hazardous wastes that are typically generated by the Chemistry Department include but are not limited to: chlorinated and non□chlorinated organic solvents (e.g. acetone, hexane, methylene chloride, etc.); water containing inorganic salts, acetone, trace amounts of organic chemicals, acids and bases; and silica gels.

9.2 Accumulating, Handling, and Storing Hazardous Wastes

Appropriate personal protective equipment should be worn at all times when handling hazardous waste. Hazardous wastes generated in the Chemistry Department are to be collected into leak□proof, sealed containers made of compatible materials (e.g. acids should not be stored in a metal container) and do not contain any residual material that may be incompatible with the waste. Hazardous Waste labels are to be affixed to the containers clearly identifying the chemical name(s) of the substance(s) stored in the containers. To the extent known, the concentration of the various chemical components of the hazardous waste should be listed on the label. An example hazardous waste label may be found in Appendix A.

Containers are to be closed at all times except when waste is being transferred into the container. The waste container is to be stored beneath the fume hood in the room where the waste is generated until the jar is full or the waste generation activity is complete. When the waste generation activity is complete or the container is full, a laboratory technician will transfer the container of waste to the Satellite Accumulation Area (SAA) in the Lansing basement. Prior to placing the container in a cabinet, the technician will enter the waste information on the hazardous waste entry log affixed to the storage cabinet and evaluate whether the waste is compatible with the other wastes stored in that cabinet. Information on chemical compatibilities can be found on the Material Safety Data Sheets (MSDSs) for the chemicals in question. In addition, the following are general guidelines with respect to compatibility:

1. Store acids and bases separately.

2. Keep acids apart from cyanides or sulfides

3. Acids should never be put into steel containers.

4. Water□reactive, strong acids such as organic acid halides, organic acid anhydrides, inorganic acid anhydrides, and strong acidic salts must be kept apart from both alkalis and water.

5. Oxidizing agents must be kept apart from reducing agents and organic compounds.

6. Water□reactive agents must be stored apart from water, aqueous solutions, and acids.

7. Air□reactive materials must be packed in containers that are sealed off from the atmosphere.

9.2.1 UNIDENTIFIED WASTES

The responsibility for establishing the identity of an unknown substance rests with the Chemistry Department. Jason Woodruff at the Office of Campus Safety (315□781□ 3171) should be contacted to obtain the names of certified analytical laboratories who

can identify/characterize the waste.

9.3 Offsite Disposal

An outside vendor manages the packaging, shipping and offsite disposal of the hazardous wastes generated by the Chemistry Department and stored in the SAA in the Lansing Basement. The disposal events occur twice per year, typically in July or August and December or January. If the cabinets become full prior to these disposal times, please contact Bill Hastings at the Office of Campus Safety (315□781□3171) who will arrange to move some of the wastes to the Hazardous Waste Storage Shed next to the Buildings and Grounds building.

Appendix A: Forms

INVESTIGATION OF POSSIBLE OVEREXPOSURE
(Page 1 of 2)

NITIAL

Date of incident:_____ Date of interview: ___

Name of Student:_____Telephone No.: _____

Course:_____Faculty: _____

Name of chemical(s) in use: _____
MSDS attached to this report:
Time of incident: _____
Duration of exposure: _____

Amount of chemical involved: _____

Control measures used at time of incident: _____

Fume hood or other control devices: _____

Personal protective equipment: _____

Description of incident:

_____
_____
_____
_____
_____

Witnesses: ____

Location of injuries or sites of contact, e.g. eyes, skin:

_____
_____

INITIAL INVESTIGATION OF POSSIBLE OVEREXPOSURE
(Page 2 of 2)

Signs and symptoms developed, if any:

_____
_____

Elapsed time for signs and symptoms to develop:

_____
_____

Are signs and symptoms same as indicated on MSDS?

_____
_____

Conclusions of investigation: _

_____
_____
_____

Medical examination recommended: _

_____

_____ _____ _____
Name of Investigator Signature Date

NOTE: This information should be provided to the examining physician and returned to the Chemistry Department CHP.

PHYSICIAN'S WRTTEN OPINION FOR MEDICAL CONSULTATION*

Physician's Name: _____

Student's Name: _____

Date of Visit: _____

Description of incident: _____
_____
_____

Results of medical examination and any associated tests: _____
_____
_____

Medical conditions revealed upon examination that may place the employee at increased risk as a result of exposure to a hazardous chemical in their workplace:
_____
_____
_____

Additional recommended follow-up: _____
_____

Comments: _____
_____

The above referenced student has been informed by me of the results of this consultation and any medical condition that may require further examination or treatment.

_____
Date Physician's Signature

*This written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

Return to the Chemistry Department, Hobart and William Smith Colleges, Geneva, NY 14456.

ACCIDENT REPORT FORM

Student NAME		**Date & Time**	
Professor NAME		**Course**	

TYPE OF ACCIDENT (CHECK ALL THE BOXES THAT APPLY)

	Chemical Spill
	Explosion
	Fire
	Chemical Exposure
	Injury – Eye
	Injury – Skin
	Other _____

Further description of incident:

CORRECTIVE MEASURES (CHECK ALL THE BOXES THAT APPLY)

	Security called (x 3333)
	Provost office called (x 3304)
	Fire extinguisher or fire smothered
	Eye wash
	Emergency room visit
	First aid kit
	Other _____

Further description of corrective measures:

PROCEDURE FORM

IAZARDOUS
CHEMICAL

(Page 1 of 2)

User:__ Substance and procedure used:

Signature: ____ _____

Advisor/instructor:___ Amount of material to be used: _____

Signature:_____ How long will the substance be used:

Building/room number: _____ _____

Location in room:____Material Safety Data Sheet reviewed and

Is location properly posted as on file: ( ) yes ( ) no

designated area You must print out a MSDS data sheet

( ) yes ( ) no for the substance and attach it to this form.

Fill in the hazard ratings for substance:

DISPOSAL

Describe waste disposal procedures, include inactivation of compound and proper labeling of waste containers

_____

_____

_____

Storage requirements: _____

Special hazards: _____

HEALTH

What is the target organ(s) for the substance:

_____

Describe spill control and cleanup procedures, including special protective equipment:

_____

_____

_____

_____

_____

_____

How is the substance taken into the body (e.g. absorbed through skin):

_____

_____

_____

List the symptoms of overexposure to substance:

_____

_____

_____

PROCEDURES

List of required safety precautions and equipment for use of substance (e.g. type of gloves):

_____

_____

_____

_____

Make two copies of this form. Give one of these forms plus the MSDS sheets to your advisor and keep the other for your own personal reference.

MICROTOME SAFETY TRAINING

Students must receive training before using any microtome!!

If ever uncertain about safety, discontinue experiment and consult your professor!!

Blades are extremely sharp!! Microtomes can present a hazard, especially when the sharp blades are left uncovered and appropriate safety controls are not employed. For example, in 2008 a health care lab worker in San Diego lost a fingertip while preparing and cutting tissue samples on a microtome. Microtomes must be used, operated, and maintained by qualified, trained persons in accordance with the manufacturer's recommendations.

During operation, utilize the following safety procedures:

- The blade lock should always be engaged unless actively manipulating the blade (the blade lock secures the blade on the holder)
- Whenever a blade is present on the holder the blade guard must be used.
- Whenever the rotary arm is not in active use, the brake lock must be engaged. When applying the brake, ensure that it is tight. Most accidents occur when the brake slips and the operator's hand is drawn into the blade. For example, a researcher at the University of California went to the emergency room for a finger laceration after not locking the wheel in place.
- The blade should be installed and removed with the aid of a clamping tool such as needle nose pliers. This is only done by the professor, who will handle blades very carefully when installing or removing. They will follow the manufacturer's installation/removal instructions explicitly and never leave blades on countertops.
- When placing or retrieving materials near the blade, use appropriate tools (such as forceps or fine- tipped paint brush) so that hands remain in the clear of the blade.
- A minimum clearance of 1 inch must be maintained between the operator's hands and the blade (point of operation) at all times.
- Blades must be stored in their transport box. For disposal, place blades in sharps container.
- Keep microtome clean of wax and properly lubricated for safe operation.
- Always wear a lab coat and goggles during use. Keep long hair tied back.
- Students may not open the top cover of the microtome (pinch hazard).
- When preparing a paraffin sample for the Microtome, remember to clamp the sample down tight. The movement allowed by a loose clamp increases your risk of cuts.
- Use forceps or small brush to retrieve slices from the boat and to retrieve ribbons, thereby keeping your hands free from the moving parts of the microtome.
- The microtome weighs 80 lbs and should not be moved.
- Make sure all clamps are tightly in place.

I understand the safety rules and will observe them whenever using the microtome.

_____

Signature Date

Sign one copy and return to professor; keep the other copy.

Safety training adapted from ThermoShandon manual, University of California, and Boston University.

Student Safety Training Outline

Hobart and William Smith Colleges

Federal regulations require training for all lab workers and retraining for any reassigned lab workers. These regulations give you the right to receive training and at the same time assign you the responsibility for learning and putting in practice the training you receive.

It is recommended to read and understand *Working Safely with Chemicals in the Laboratory*. This will describe safe laboratory practices. Pay particular attention to Chapters II, III, IV, and VI-IX. Additional sections will be emphasized depending on your course.

A chemical hygiene plan (CHP) reviews your rights and responsibilities and can be found in Lucas Seybert's office in Lansing 207. The Plan documents safe lab practices, lists hazardous chemicals including their permissible exposure levels, includes an inventory of all hazardous chemicals in the Chemistry Department, and outlines student safety training.

Chemicals can be hazardous by being flammable, corrosive, explosive, at high pressures, toxic, or carcinogenic. Toxic chemicals can enter your body through inhalation, skin contact, eye contact or ingestion. Toxicity may be acute or chronic. Although symptoms of exposure are highly variable, they may include skin irritation or burning, respiratory tract irritation, nausea, impaired vision, and/or loss of consciousness. Symptoms specific to each chemical can be found in the MSDS sheet (see below). If there is reason to believe that you have been exposed to dangerous levels of a hazardous substance, you have the right to a free medical examination. Please alert your instructor immediately. It is your responsibility to learn about these hazards as well as to learn safe laboratory practices which minimize the hazards.

All chemicals should be labeled with a summary of their hazards. Read the labels. Further information can be found in the Manufacturer Safety Data Sheets including toxicity, disposal practices, necessary personal protective gear, and proper storage. An SDS sheet for every hazardous chemical in the department is available on the chemical inventory.

Toxic or hazardous chemicals have maximum exposure levels mandated by the federal government. Safe lab practice will present you from being exposed to higher levels. Avoid skin contact with all chemicals in the laboratory, especially those which are corrosive or can be absorbed through skin. All hazardous organic chemicals should be handled in the ventilation hoods only.

Upon arriving in the laboratory, review the laboratory for the location of eyewashes, showers, fire extinguishers, and emergency exits. Locate each of these in any lab which you will be working. Your professor will also review these with you the first day of lab.

Your presence in the laboratory requires wearing approved eye protection. Some experiments will require other personal protective equipment (gloves are the most common example). You will be alerted to the need for additional protection by the labels and/or by your instructor.

Ultimately, informing yourself is necessary for safety in the lab. Come to lab understanding the experiment you will be doing. Common sense will usually allow you to recognize if you are being exposed to a hazardous chemical. Typically, you will smell it; feel symptoms (burning eyes or skin, dizziness, etc.); see it in a puddle, on your hands or on your clothes. However, some chemicals have no smell and have a latency period of years. Wash your hands after every experiment.

Dispose of all chemicals properly. While many substances are perfectly natural and can go down the drain, many must be put into labeled waste containers. Inform yourself before disposing of anything.

Appended to this list of general rules, you will find a list provided by your professor for the specific class.

Rules for Chemistry 110, 120, and 210

Walter Bowyer

1. Understand the general rules provided by OSHA mandates (previous page).

2. No eating or drinking in labs. You must always wear safety glasses and may not wear contact lenses in lab.

3. Wear shoes (no sandals). Keep long hair tied back.

4. Never work in lab alone. Never do unauthorized experiments.

5. If you spill chemicals on you, wash with a lot of water. Inform me immediately.

6. Never smell any chemicals.

7. Do not put anything in your mouth (pipettes, pencils, fingers) in lab. Do not rub your eyes. Wash hands before leaving lab.

8. Add acid to water, not vice versa. In fact this is a good rule when diluting any solution.

9. When heating in test tubes, do not point them at yourself or at neighbors. Turn off Bunsen burners when not in use. Do not put Bunsen burners under anything.

10. Dispose of chemicals properly. Many can go down the drain with a lot of water. Others must be put in labeled waste jars. If you are unsure, ask.

11. Do not store or use volatile solutions out of the hood (e.g. acetone, Br_2).

12. Additional rules specific to individual experiments may be given in the lectures preceding the experiment.

I have read the safety rules and will observe them in all chemistry courses.

Signature Date

Sign one copy and return to professor; keep the other copy.

Rules for Independent Study, Honors, Summer Research for Students Working with Walter Bowyer

Safety during research is particularly important because in many situations no one can predict when an experiment or substance is hazardous. Also, during research you will encounter a wider range of hazardous chemicals than you will in course work. Research poses a larger hazard since exposures can occur over longer time periods than is possible during course work. The following rules are in addition to the practices and policies you have learned in your chemistry courses. If you are or might be pregnant, discuss lab safety with your physician.

1. Understand the general rules provided by OSHA mandates. The Chemical Hygiene Plan available in Lansing 207 describes many safety practices and policies.

2. No eating or drinking in labs.

3. Wear shoes (no sandals). Keep long hair tied back.

4. Dispose of chemicals properly. It is particularly important to keep track of the type and amounts of chemicals which you put into the waste jars.

5. Personal protection is critical. Handle all substances in the hood and always wear protective eyewear.

6. When using a new chemical, read the label carefully. The use of particularly hazardous compounds requires written permission from your instructor. Also a copy of the MSDS must be in the lab where you are handling the particularly hazardous compound.

7. Glove selection is a difficult but important task. For every new chemical, consult the SDS sheets for glove selection and consult with your professor.

8. In the event of an accident, alert your professor, campus security (3333) and the fire department (9-911).

9. For small spills, clean up chemicals immediately. For larger spills, get help (see 8).

10. When handling compressed gasses, explosives, corrosives, carcinogens, mutagens, any substance with a 4 in the NFPA Fire Diamond or other special hazards, inform yourself and obtain written permission before doing the experiment.

11. Wash hands frequently.

12. Identify the locations of the eyewash, showers, fire extinguishers, and emergency telephones in and near your lab.

13. Independent study/research students may work alone in the lab only 8:00 A.M. - 5:00

    P.M. Monday through Friday, but must notify their instructor of their schedule. Outside of this time, they must have a second person (not necessarily a scientist) in the room with them whenever doing any lab work. Any procedure deemed

particularly hazardous, including any use of particularly hazardous substances (all cancer suspect agent or carcinogen, any compound with a rating of 4 in the NFPA Fire Diamond), must be done 8:00 A.M. - 5:00 P.M. Monday through Friday and the faculty member must be advised of the specific times.

I have read the safety rules and will observe them while doing research.

_____

Signature Date

Sign one copy and return to professor; keep the other copy.

SAFETY GUIDELINES FOR CHEM 240/241 (Erin Pelkey)

(1) Understand the general rules provide by OSHA mandates (previous page).

(2) No eating or drinking in labs.

(3) Wear shoes (no sandals). Keep long hair tied back.

(4) Never work in lab alone. Never do unauthorized experiments.

(5) If you spill chemicals on you, wash with a lot of water. Inform the instructor immediately.

(6) Never smell chemicals.

(7) Do not put anything in your mouth (pipets, pencils, fingers) in lab. Do not rub your eyes. Wash your hands before leaving the lab.

(8) Add acid to water, not vice versa (remember AAA: always add acid).

(9) No flames are allowed in lab at any time (no bunsen burners, lighters, etc)

(10) Dispose of chemicals properly. Some can go down the drain with lots of water. Others must be put in labeled waste jars. If you are unsure, ask. Usually, your instructor will let you know the proper waste disposal procedures at the beginning of the lab period.

(11) Do not store volatile solutions out of the hood (e.g., solvents).

(12) Additional rules specific to individual experiments may be given in the lectures preceding the experiment.

(13) Consult a physician if you are pregnant or have any other medical condition which might render you susceptible to exposure to the chemicals used in the laboratory.

I have read the safety rules and will observe them in all chemistry courses.

Signature Date

Sign one copy and return to professor, keep the other copy for your records.

Safety Rules for Physical Chemistry and Instrumental Analysis; Chem 320, 322, 437
Hobart & William Smith Colleges

1. **SAFETY GLASSES: Safety glasses must be worn at all times in the laboratory.** Corrective eyeglasses may not be substituted. Wearing of contact lenses is forbidden.

2. **ACCIDENTS:** Please alert the laboratory instructor immediately in the event of an accident. The following safety precautions must be followed:

   a. Be aware at all times.

   b. Make sure you understand the potential dangers associated with any chemicals, instrumentation or other facilities used in the lab.

   c. Don't panic. If an accident occurs involving yourself or a lab partner, a controlled response to the situation is the best response. Contact the instructor immediately.

   d. Report all injuries regardless of how small, at once, to the instructor.

3. **FIRE HAZARDS:** . Solvents are to be handled in the hood. Many solvents are extremely flammable. Never use a flame near a solvent container.

   a. Never use an open flame in the lab without prior approval from the instructor.

4. SAFETY PRECAUTIONS

   a. Know the locations of and how to use the fire extinguishers, fire blankets and eye-wash stations in the laboratory.

   b. Never work in a lab alone.

   c. Be sure gas cylinders are securely attached to the wall.

   d. Be sure that gas cylinders are topped off with regulators or steel caps. Gases in the cylinder are under extremely high pressure, never try to remove a regulator or steel cap.

e. Be sure rubber tubing on all equipment and experimental set-up is securely attached.

f. Do not pour water on a flaming laboratory chemical.

g. No food or beverages in lab. Never drink lab water.

h. Don't clean up shards of broken glass with your hands.

i. No open-toe shoes.

j. Long hair must be tied back.

k. Be alert to potential fire hazards.

5. **TOXIC MATERIALS:** Every chemical substance should be treated as a potential hazard. Many compounds are toxic. Lethal exposure may occur by swallowing the substance, inhaling its vapors, or absorption through the skin.

a. If any material is spilled on the skin, immediately wash it with large amounts of water.

c. Laboratory chemicals should never be tasted.

d. Immediately replace tops or stoppers on containers.

e Unless directed to do so, do not remove chemicals from the areas designated for their storage and measurement.

f. When disposing of liquids in the sink, pour directly into the drain and flush with large quantities of water. Put water-insoluble solids in the waste crocks, not in the sink.

g. When any substance is spilled in the laboratory clean it up immediately.

6. MECHANICAL HAZARDS:

a. Tubing, thermometers, etc. when pushed into stoppers tend to break and the broken ends tend to become lodged in one's hand or arm. Take short holds on tubing, use lubricants, and keep the torque to a minimum.

b. Safety shields must be used with any operation involving an explosion hazard.

7. GENERAL:

a. Unauthorized experiments are forbidden.If you need to work “over-time” in the laboratory, please see me to arrange a time.

Please complete the following tasks in your laboratory notebook:
1.) Please sketch a diagram of the laboratory. Make sure to note on your map the location of:
eye wash station safety shower fire extinguisher first aid kit
exit doors (2) safety shield fire alarm accident reports

2.) Please obtain an SDS sheet from Lucas Seybert (1 copy for the group you’re working with is enough)

Please answer the following questions:

Where can the SDS sheets be found?

Name four types of information that must be included on a SDS? Name and define three types of physical data given on a SDS.
3.) Please answer the following questions based on your previous experience in chemistry laboratory environments:

Name four basic types of personal protective gear used in a chemistry laboratory?

What types of clothing should not be worn in the laboratory? Please explain why these items cannot be worn in the lab.

4.) Please answer the following questions based on your previous experience in chemistry laboratory environments or by refreshing your memory by consulting the Hugh B. Careful safety book:

Name four ways that hazardous substances can enter the body. Describe measures or equipment used to reduce exposure for each.

Describe the procedure one should follow in the event of a spill.

Safety Worksheet (must be completed before doing lab work)

Name (print) _____

Signature _____

1. Name four ways that hazardous substances can enter the body. Describe measures to reduce exposure for each.

2. What is the difference between acute and chronic exposure?

3. Give 12 examples of types of hazardous warning labels.

4. What is a Material Safety Data Sheet and where can you find it in the chemistry department?

5. Name four types of information that must be included on an MSDS.

6. What are four basic types of personal protective equipment used in a chemistry lab?

7. What types of clothing should **NOT** be worn in lab?

8. List the ten steps to follow in case of a spill.

9. Briefly summarize the first three G's of lab protocol: general, glassware, disposal. For the fourth G, gear, describe the fume hood use.

HWS - Laboratory Safety Inspections

Lab/Room#:_____ **Professor:**_____
Date:_____ **Inspector(s):**_____

Safety Equipment	Eye wash/drench hose tested monthly?	YES	NO	N/A
	Safety shower tested quarterly?	YES	NO	N/A
	First aid kit?	YES	NO	N/A
	Fire extinguisher in area or hallway?	YES	NO	N/A
	Chemical spill kit?	YES	NO	N/A

Lab Hoods	Hood clean?	YES	NO	N/A
	Hood free of stored chemicals?	YES	NO	N/A
	Hood currently (w/in 1 year) inspected?	YES	NO	N/A
	Velometer reads 80-120 fpm when open?	YES	NO	N/A
	Lab hood filters current?	YES	NO	N/A

Chemical Safety	MSDS/SDSs available (on-line or paper)?	YES	NO	N/A
	Chemical containers labeled? Including those in lab hoods (chemical, preparer and date)?	YES	NO	N/A
	Chemical cabinets organized?	YES	NO	N/A
	"Expired" chemicals removed/rotated?	YES	NO	N/A
	Gas cylinders secured?	YES	NO	N/A

General Safety	Emergency exits accessible?	YES	NO	N/A
	Emergency procedures posted?	YES	NO	N/A
	Lab contact person posted?	YES	NO	N/A
	Space around oven/furnace free of combustibles?	YES	NO	N/A
	Areas organized/Good housekeeping?	YES	NO	N/A
	Food/Drink prohibited, if chemicals present?	YES	NO	N/A

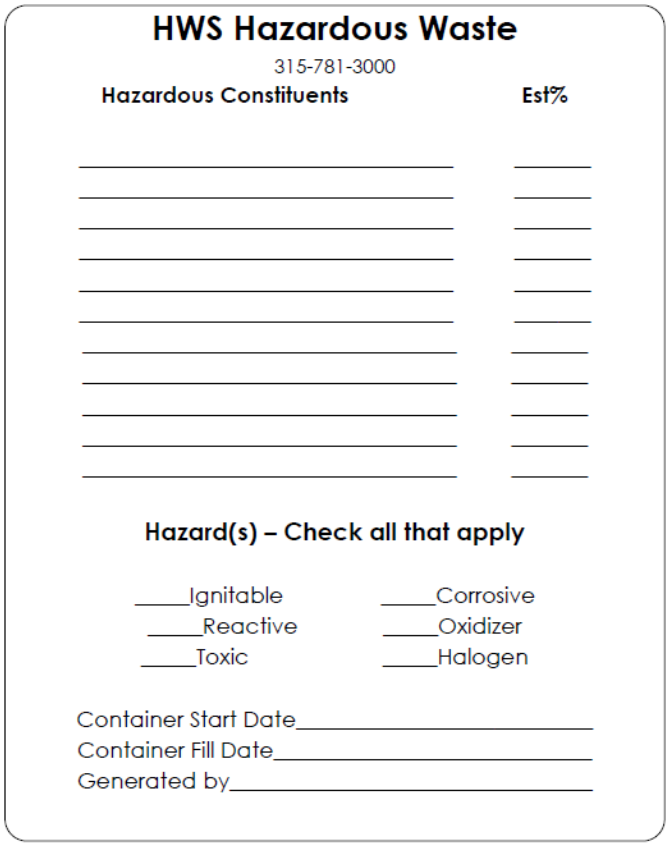
PPE	Safety glasses (available)?	YES	NO	N/A
	Chemical gloves (available)?	YES	NO	N/A
	Lab coats (available)?	YES	NO	N/A
	Open toe shoes prohibited?	YES	NO	N/A

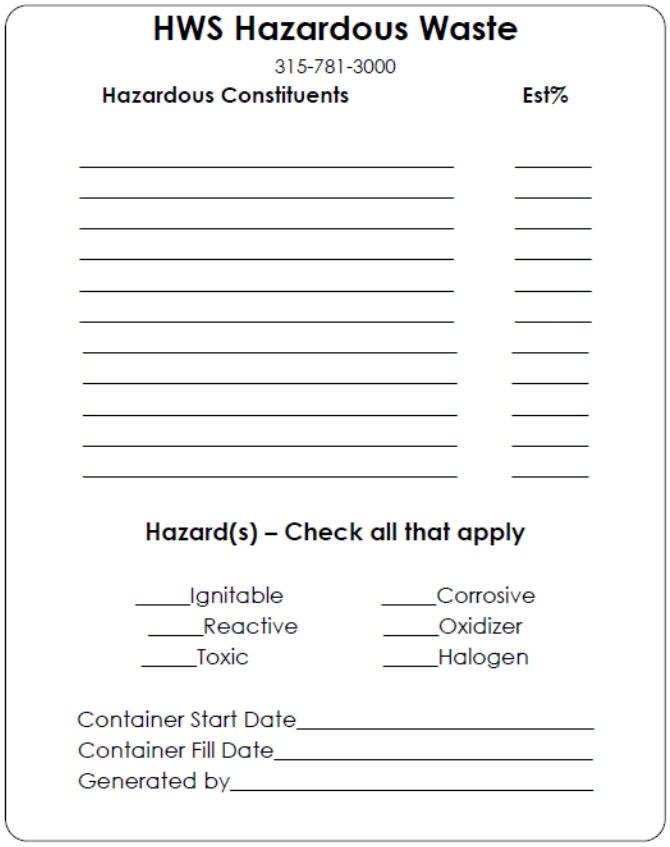
Environmental	Hazardous waste labeled?	YES	NO	N/A
	Hazardous waste in designated area?	YES	NO	N/A

For any "NO" responses, please list action(s) taken or to be taken:_____

Comments:_____

Example Hazardous Waste Labels





Appendix B: Hazardous Material Handling Guides

HOBART AND WILLIAM SMITH COLLEGES

Mercury Safe Operating Procedures

Date Updated: 6/22/12 **Area:** Physics Department

Hazards associated with mercury:
The main hazards associated with elemental (liquid) mercury exposure are its toxicity. Exposure is primarily through inhalation of vapors, ingestion due to improper personal hygiene (washing hands after exposure or removing gloves), or skin absorbtion.

The following personal protective equipment must be worn when working near mercury:

- Nitrile or other chemical resistant gloves
- Safety goggles
- Lab coat

If you have had, or are concerned that you have had an exposure to mercury, immediately:

1. Notify your supervisor.
2. Wash hands, face, and other affected areas.
3. Get medical treatment as needed.
    a. It may be necessary to have treatment based on absorbed mercury levels. These can be tested for via blood sample or urinalysis

Mercury must be stored in secure locations in durable containers away from unauthorized personnel.

For spills less than approximately 25 mL

1. Use spill cleanup procedure developed for cleaning mercury thermometers.
2. Contact department manager/supervisor/professor of the area to notify about the spill.
3. Gather cleanup materials.
4. Clean the spill.
5. Dispose of mercury and contaminated materials per HWS procedures for hazardous waste.

For spills greater than approximately 25 mL

1. Notify the department manager/supervisor/professor of the area.
2. Contact the NYSDEC spill response team at 1800□457□7362
3. Put on gloves and other PPE.
4. Use spill kit contents to contain the spill.
5. Cover all floor or other drains to prevent mercury from entering.
6. Block off the area to keep unauthorized people away.
7. Open windows to allow ventilation into the room.

When working with liquid mercury, NEVER:

1. Heat the mercury

2. Leave uncovered

3. Pour down drains or dispose in unauthorized manner

4. Handle mercury with bare skin.

5. Allow untrained personnel to work with mercury

HOBART AND WILLIAM SMITH COLLEGES

Mercury Thermometer Cleanup Procedure

Date Updated: 6/22/12 **Area:** Campus

The following personal protective equipment must be worn when working near mercury:

- Nitrile or other chemical resistant gloves
- Safety goggles
- Lab coat

Steps to clean up mercury thermometer spill

1. Put on gloves and other PPE.
2. Use cardboard or other disposable item to sweep broken glass into a disposable container (Ziplock bag or other).
3. Using slow sweeping motions, gather all mercury beads with a squeegee or other sweeping method.
4. Use an eye dropper to pick up loose beads of mercury.
5. Use duct tape to lift very small beads of mercury.
6. If the spill occurred on carpet, cut out the section of carpet for disposal.
7. Place all mercury contaminated wastes into a sealable bag.
8. Use a flashlight at low angle to see if any mercury beads remain, and clean as listed above.
9. Label all wastes as mercury containing.
10. Wash hands and face immediately after working near spill. Launder lab coat separately from other clothing.

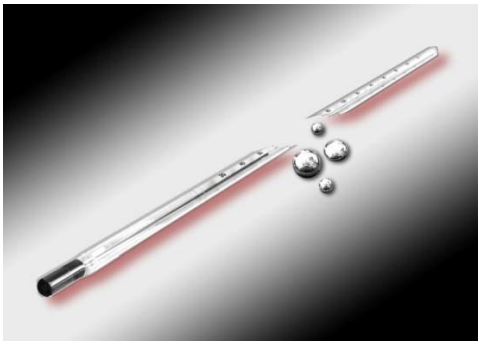
When cleaning a mercury thermometer spill NEVER:

1. Use a vacuum.

2. Handle mercury with bare skin.

3. Allow untrained personnel to help with the cleanup.

4. Dispose of mercury down a drain or in the normal trash.



HOBART AND WILLIAM SMITH COLLEGES

Methylene Chloride Safe Operating Procedures

Date Updated: 3/3/14 **Area:** Chemistry

Hazards associated with Methylene Chloride (Dichloromethane):
Methylene Chloride is a chlorinated solvent. It is considered by the National Institute of Occupational Safety and Health (NIOSH) a potential occupational carcinogen. Methylene Chloride affects the central and peripheral nervous systems and is also considered a mutagen.

The following personal protective equipment must be worn when working with Methylene Chloride:

- Double Nitrile or laminated film gloves. NOTE: Nitrile gloves subject to a splash should be changed immediately.
- Safety goggles
- Lab coat

When working with Methylene Chloride:

1. **Always use chemicals inside of lab hoods.** Verify appropriate flow rate of the hood (80-120 Feet per minute).
2. Prevent direct contact with Methylene Chloride (to gloves or skin).
3. Keep oxidizers and other reactives away from Methylene Chloride.
4. Practice good personal hygiene to prevent exposure. Wash hands following chemical use.

For small spills:

1. Contact department manager/supervisor/professor of the area to notify about the spill.
2. Use spill cleanup procedure in the spill kit.
3. Clean the spill.
4. Dispose of contaminated materials per HWS procedures for hazardous waste if necessary.

In case of large spills, or skin / inhalation exposure:

1. Exit the area immediately.
2. Wash hands, face, and other exposed skin immediately, if needed.
3. Remove any clothing contaminated with Methylene Chloride.

5. Seek medical attention, as needed.

HOBART AND WILLIAM SMITH COLLEGES

Acrylamide Safe Operating Procedures

Date Updated: 3/4/14 **Area:** Chemistry

Hazards associated with Acrylamide:

Acrylamide is a combustible solid powder. It is soluble in water and other chemicals. Acrylamide affect the central and peripheral nervous systems, and has also been shown to be a carcinogen in animals.

The following personal protective equipment must be worn when working with acrylamide:

- Nitrile or other chemical resistant gloves
- Safety goggles
- Lab coat

If working with acrylamide:

1. Always use chemicals inside of lab hoods.
2. Verify all sources of spark, unprotected electrical connections, or other fire producing materials are removed from the immediate area.
3. Keep oxidizers and other reactives away from acrylamide powder.
4. Practice good personal hygiene to prevent exposure. Wash hands after using acrylamide.

If you start to feel numb, tingling, drowsiness or weakness when working with acrylomide, immediately discontinue use, leave the area, and notify a faculty member, professor, or other staff.

For *small spills:*

1. Contact department manager/supervisor/professor of the area to notify about the spill.
2. Use spill cleanup procedure in the spill kit.
3. Clean the spill.
4. Dispose of contaminated materials per HWS procedures for hazardous waste if necessary.

In case of large spill or inhalation/skin exposure:

1. Exit the area immediately.
2. Wash hands, face, and other exposed skin immediately if needed

3. Remove contaminated clothing.
4. Notify your department manager, professor, or supervisor.
5. Seek medical attention, as needed.

HOBART AND WILLIAM SMITH COLLEGES

Corrosives Safe Operating Procedures

Date Updated: 3/3/14 **Area:** All Departments

Hazards associated with Corrosive liquids:

The main hazards associated with corrosive liquids are burns, exposure to skin and eyes, and reactions with organic solvents, metals and other materials which can create heat, hydrogen gas, and other byproducts.

The following personal protective equipment must be worn when working with corrosive liquids:

- Nitrile or other chemical resistant gloves
- Safety goggles or safety glasses with side shields.
- Lab coat

If **working with corrosives:**

1. Use chemicals inside of lab hoods. Verify appropriate flow in the hood (80-120 feet per minute).
2. Ensure eye wash and safety showers are operational nearby.
3. Keep spill kits stocked with neutralizing chemicals.
4. Use good personal hygiene when working with chemicals. Wash hands after using chemicals.
5. Remember "AAA - Always Add Acid to water, never water to acid/II

Corrosives must be stored In secure locations in durable containers away from organic solvents or reactives. Corrosive storage cabinets are present In al/ labs.

For spills less than approximately 50 ml

1. Clean the spill using the spill cleanup procedure in the spill kit.
2. Contact department manager/supervisor/professor of the area to notify about the spill.
3. Dispose of contaminated materials per HWS procedures for hazardous waste if necessary.

For spills greater than approximately 50mL

1. Exit the area immediately.
2. Notify the department manager/supervisor/professor of the area.
3. Block off the area to keep unauthorized people away.

HOBART AND WILLIAM SMITH COLLEGES

Flammables Safe Operating Procedures

Date Updated: 3/3/14 **Area:** All Departments

Hazards associated with Flammable liquids:

The main hazards associated with flammable liquids are fire, explosion, and supporting combustion. Many flammable liquids are also solvents and can cause inhalation hazard, skin absorbtion hazards, and other target organ effects.

The following personal protective equipment must be worn when working with flammable liquids:

- Nitrite or other chemical resistant gloves
- Safety goggles or safety glasses with side shields
- Lab coat

If working with flammables:

1. Use chemicals (solvents) inside of lab hoods. Verify appropriate flow rate of lab hoods (80-120 feet per minute).
2. Verify all of the sources of spark, unprotected electrical connections, or other fire producing materials are removed from the immediate work area.
3. Keep oxidizers and other reactives away from flammables.
4. Always bond and ground flammable containers when transferring liquids to prevent static spark ignition/II

Flammables must be stored In secure locations In durablf! containers away from sources of Ignition or oxidizers/reactives. Flammable storage cabinets are present In all labs.

For spills less than approximately 50 mL

1. Clean the spill using the spill cleanup procedure in the spill kit.
2. Contact department manager/supervisor/professor of the area to notify about the spill.
3. Dispose of contaminated materials per HWS procedures for hazardous waste.

For spills greater than approximately 50mL

1. Exit the area immediately.
2. Notify the department manager/supervisor/professor of the area.
3. Block off the area to keep unauthorized people away.

4. Await campus safety or other emergency services to control the spill.

HOBART AND WILLIAM SMITH COLLEGES

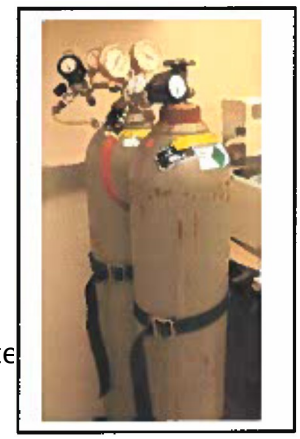
Cylinders Safe Operating Procedures

Date Updated: 2/11/14 **Area:** All Departments

Hazards associated with Compressed Gases:

The hazards associated with compressed gas cylinders relate to both the specific gas inside (i.e., flammable, oxidizer, toxic, etc) and the physical hazard associated with damage to the cylinder (act like a projectile).

Safe handling of cylinders:



- Label cylinder storage areas.
- Ensure cylinders are capped when not in use or being transported.
- Ensure cylinders are chained up at all times to a load bearing structure.
- Separate empty cylinders from full cylinders.
- Ensure incompatible (i.e., flammables and oxidizers) are stored separate (5 or 20 feet) .

When transporting compressed gas cylinders:

1. Remove the regulator and place the cap on the cylinder.
2. Use a cart (with straps to secure in place).

When opening a cylinder:

1. Verify the contents of the cylinder.
2. Ensure to leak test with a soap and water solution.
3. Do not connect incompatible gases in a manifold.
4. Never force connections that don't fit correctly. Regulators are threaded differently for different gases.

When closing cylinders

1. Keep in mind residual gas is still present in the tank.
2. Relieve pressure on the regulator by closing the main valve and opening the regulator valve.
3. Separate from full cylinders.

Remember: Compressed gas cylinders can fire off like a rocket if the valve is damaged and

HOBART AND WILLIAM SMITH COLLEGES

Peroxide Forming Chemicals Operating Procedures

Date Updated: 2/11/14 **Area:** Science Departments

Hazards associated with Peroxide forming chemicals:

Certain organic chemicals become unstable after long periods of storage or under certain chemical manipulations (i.e., evaporation, concentration, distillation, etc.). These chemicals may form peroxides (an oxidizer) which when mixed with a flammable liquid can cause significant fire / explosion hazards.

Certain peroxide salts can also be shock sensitive/ touch sensitive and not require a spark to ignite.

The following personal protective equipment must be worn when working with peroxide forming chemicals:

- Chemical resistant gloves (i.e., Nitrile).
- Safety glasses/goggles.
- Lab coat.

Specific procedures for peroxides:

1. Only purchase these chemicals when they have inhibitors combined in them.
2. Purchase limited quantities which will be used.
3. Work with these chemicals only in an operational fume hood.
4. Store these chemicals in flammable storage cabinets.
5. Peroxide contamination should be tested prior to chemical manipulations.

If you have had, or are concerned that you have chemicals which are very old or have formed peroxides,:

1. Notify your supervisor.
2. Do not handle the container until determined safe by the supervising professor.
3. Dispose of the chemical as special hazardous waste.

If you see salt crystals formed around the lid of a container of these chemicals, NEVER:

1. Unscrew the lid.
2. Shake the bottle

3. Work near an ignition source.

4. Work outside of a lab hood.

5. Allow untrained personnel to work with thechemicals.

Chemicals which are known to be potential peroxide formers:

- lsopropyl Ether- Forms peroxides with no chemical manipulations. This chemical is especially hazardous. It's use should be limited as possible.

The following chemicals may form peroxides when chemically manipulated.

- Acetal
- Acetaldehyde
- Benzyl Alcohol
- 2-Butanol Dioxanes
- Chlorofluoroethylene
- Cumene{isopropylbenzene)
- Cyclohexene
- 2-Cyclohexen-1-ol
- Cyclopentene
- Decahydronapthalene(decalin)
- Diacetylene(butadiyne)
- Dicyclopentadiene
- Oiglyme
- Oiethylether
- Ethylene glycol ether acetates
- Furan
- 4-Heptanol
- 2-Hexanol

- 3-Methyl-1-butanol
- Methyl-isobutyl ketone
- 4-Methyl-2-pentanol
- 2-Pentanol
- 4-Penten-1-ol
- 1-Phenylethanol
- Tetrahydrofuran
- Tetrahydronapthalene
- Vinyl Ethers

Dry Ice Procedures

Date Updated: 2/11/14 **Area:** Chemistry Department

The following personal protective equipment must be worn when making dry ice:

- Cryo gloves (cold resistant gloves).
- Safety glasses/goggles.
- Lab coat (or long sleeve shirt).
- Long pants.

Operating Instructions for Thermosa/e Dry-Ice Machine:

1. Always use the Dry-Ice maker in a well ventilated area - never allow it to hang by the feed hose before, during, or after use.

2. Assemble the Dry-Ice box using the hinged snap locks and make sure they are all locked down.

3. Connect feed hose to liquid CO_2 cylinder.

4. Ensure that the other end of the feed hose is firmly attached to the fitting on top of the Dry-Ice box.

5. Carefully open the valve of liquid CO_2 - approximately ¼ to ½ a turn should be sufficient. Adjust valve smoothly and in small increments. Be careful of cold metal surfaces, which may form ice.

6. Observe the process and watch for vapor discharging through the vents in the box. Do not be alarmed at the discharge - it is perfectly normal. Depending on the surrounding temperature, it may take up to two minutes for the block to form. When the block is formed the vapor will turn to a "snow".

7. Turn CO_2 cylinder valve off.

8. The Dry-Ice Block can now be removed from the box. Carefully release the snap locks on the

HOBART AND WILLIAM SMITH COLLEGES

Trifluoroacetic Acid Safe Operating Procedures

Date Updated: 3/3/14 **Area:** Chemistry

Hazards associated with TFA:
The main hazards associated with exposure to TFA are skin/eye burns, exposure to mucous membranes, and reactions with metals and other materials which can create heat, hydrogen **gas,** and other byproducts.

The following personal protective equipment must be worn when working with corrosive llquids:

- Nitrite or other chemical resistant gloves
- Safety goggles
- Lab coat/ long sleeves
- Contact lenses should be avoided when working near acids of any kind

If working with TFA:

1. **Always use chemicals Inside of lab hoods.** Verify correct flow rates on the lab hood (80-120 feet-:pe·t - .

   minute).
2. Ensure eye wash and safety showers are operational nearby.
3. Always keep spill kits stocked with neutralizing chemicals.
4. Always use good personal hygiene when working with chemicals. Wash hands after using chemicals.
5. Remember "'AAA" - Always Add Add to water, never water to acid/II

'Corrosives must be stored In secure locations In durable containers away from organic solvents or reactlves. Corrosive storage cabinets are present In all labs.

In Case of exposure to skin:

1. Immediately flush the affected area with water.
2. Notify the department manager, supervisor, or professor.
3. Neutralize acid as needed.
4. Remove clothes that have been contaminated by chemicals.
5. Follow up with medical treatment as needed. NOTE: TFA burns can appear hours after exposure.

In Case of exposure toface I eyes:

2. Secure transportation to medical services (do not drive yourself).

3. Remove any contact lenses and reflush the face/eyes

4. 00 NOT RUB YOUR EYESIII

For spills less than approximately 50 mL

1. Clean the spill using the spill cleanup procedure in the spill kit.

2. Contact department manager/supervisor/professor of the area to notify about the spill.

3. Dispose of contaminated materials per HWS procedures for hazardous waste if necessary.

For larger spills

1. Exit the immediately.

2. Notify the department manager/supervisor/professor of the area.

HOBART AND WILLIAM SMITH COLLEGES

STANDARD OPERATING PROCEDURE

Oxygen Alarm Response

Date Updated: 9/28/18 **Area:** Eaton B-15, Rosenberg 013, Lansing 205C

Background Information:
Liquid nitrogen is used in bulk containers in the above rooms, and a liquid helium source is present in Rosenberg 013 in addition to the nitrogen. In the event of a spill or catastrophic failure of these containment systems / tanks, the inert gases could displace the air (oxygen) in the room and cause asphyxiation.

Oxygen Alarms:

1. **Oxygen alarms will sound when concentrations are less than 19.5% or greater than 23.5%.**
2. ***Outside of these concentrations, it is NOT SAFE to enter the room.***
3. If the oxygen sensor is alarming or flashing, immediately evacuate the area and keep the door to the room open.
   - Immediately call Campus Safety (x3333 on campus).
   - Immediately notify Kathy Slentz (Rosenberg) or Peter Spacher (Physics/ Eaton) or Josh Newby (Lansing).

In Case of inhalation exposure:

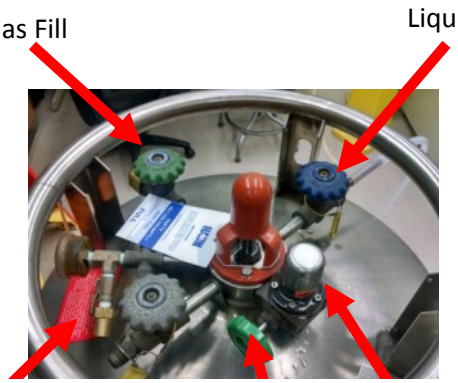
1. Immediately leave the area.
2. Remain in fresh air.

In Case of Skin Contact with Liquid

1. Seek medical attention if needed.
2. Protect any blisters from rupturing.

Response Procedures

1. Determine the concentration of oxygen in the room from exterior monitors or hand held sensors.
   a. If less than 19.5%, DO NOT ENTER
   b. Keep other personnel from entering the area if a hazardous concentration of nitrogen.
2. Open doors, windows (from exterior if possible), and ensure that the ventilation systems are providing as much fresh air as possible.
3. Emergency services (Fire Department) has appropriate equipment to enter into an area with too little oxygen. HWS personnel do not.
4. If it is safe to enter, (Oxygen concentration greater than 19.5%), only enter if you have a portable detector as well as the wall mount system.
5. Ensure all valves are closed on the tank if it is safe to do so.



Appendix C: Summary of Professors' Responsibilities as Described in the CHP

Highlights of Professors' Responsibilities as Described in this CHP. This is a summary and does not replace or substitute for the complete CHP.

It is the policy of the department that all hazardous materials will be handled only in fume hoods. Containers outside of fume hoods must be closed and clean. On the advice of the security officer at the time of the preparation of the CHP, and consultants from Blasland, Bouck and Lee, this obviates the need for monitoring.

It is the responsibility of each faculty member to guarantee that hazardous materials are handled in fume hoods with appropriate personal protection in his/her courses and research.

It is the HWS Chemistry Department policy to develop and maintain a list of hazardous chemicals used in each laboratory area. This list is provided in the CHP, is on the computer in Lansing 207, and is located at N:\Campus Chemical inventory\ChemInv20XX.accdb (Microsoft Access file). Each faculty member is responsible for assisting Lucas in maintaining the inventory by informing him when chemicals are moved. When a reagent is completely exhausted, the bottle is to be placed in a chemical disposal bin so that Lucas can update the inventory. Do not rinse out empty reagent bottles prior to disposal. Each faculty member is responsible for maintaining the inventory of his/her research lab(s).

The faculty shall provide students with information and training to ensure that they are apprised of the hazards of chemicals present in their laboratory work. Such information shall be provided at the time of a student's first chemistry course. The frequency of refresher information and training shall be determined by the faculty. Normally this will occur at the start of each new chemistry course the student takes. Review as well as discussion of hazards specific to the new course will be covered. Additional training will be provided immediately prior to an experiment when deemed necessary by the professor. Faculty also must provide safety training and information to their research students.

The Colleges provide employees and students who work with hazardous chemicals an opportunity to receive free medical attention when:

1) The student complains of symptoms resulting from an exposure.

2) The professor or lab supervisor is advised of an abnormal exposure (e.g. spillage on skin) of a hazardous substance and deems a medical examination desirable. With any exposure, Campus Safety is to be called, and we will respond and call Finger Lakes Ambulance and The Geneva Fire Department for on scene medical treatment, with the patient being transported to Geneva General Hospital.

Hubbs does not have the capability to treat an exposed (contaminated) student and GGH ED does. It is important to provide the physician with the information on the appropriate forms.

Lucas Seybert shall ensure that labels on incoming containers of hazardous chemicals

she/he must label the new container with name of chemicals, date, and appropriate hazard warning(s).

The following provisions shall apply to chemical substances developed in the laboratory:
If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the professor shall determine if it is a hazardous chemical as defined by the OSHA Hazard Communication Standard. If the chemical is determined to be hazardous, the professor shall provide appropriate training as required by this standard (see section 3 - Student Training). If the chemical produced is a byproduct whose composition is not known, the professor shall assume that the substance is hazardous and shall implement the Chemical Hygiene Plan. Proper labeling is the responsibility of the professor.

It is the responsibility of the professor whose students are working in a lab to inspect the lab every six months for safety concerns. Inspections of research and teaching labs should take place in March and September. The Chair (or other designated person) shall review the inspections by the end of the month. In addition, every lab must pass a biannual Fire Inspection. Inspection is done using a form posted in every laboratory (If no form is posted, the professor should obtain a copy of the form from this CHP and post it.). If the laboratory does not pass inspection in every category, it may not be used until the problem is corrected.

Personnel who are required to conduct procedures within a fume hood should follow the practices described in the CHP.

In order to use particularly hazardous substances, the student must have written permission including a completed and signed Hazardous Chemical and Procedure Form and an MSDS must be in the laboratory. It is the responsibility of the professor to identify particularly hazardous substances used in coursework. The professor should make every effort to substitute a less hazardous substance or experiment whenever possible. For work done as independent study or Honors research, it is the responsibility of both the professor and student to identify particularly hazardous substances. The form is designed not only to provide written permission but also the necessary training/information for use of the particularly hazardous substance.

Designated Area means an area which may be used to work with select carcinogens, reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood. All designated areas should be clearly marked.

The Chemical Hygiene Plan requires that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment. Students are required to wear lab coats when determined by the professor of the course. All students, professors, visitors and employees are required to wear eye protection when in any chemistry laboratory. All hazardous materials must be handled inside fume hoods to assure the PEL is not exceeded. The person responsible for assessing the need for protective equipment is the professor of the course. The professor of the course is also responsible for a weekly flush of eyewashes in his/her lab(s). Buildings and Grounds (Howard

eyewashes.

Generally, it is prudent to avoid working in a laboratory building alone. Under normal working conditions, arrangements should be made between individuals working in separate laboratories to crosscheck periodically. Experiments known to be hazardous should not be undertaken by a worker who is alone in a laboratory. Under unusual conditions, special rules may be necessary.
The professor of the laboratory has the responsibility for determining whether the work requires special safety precautions. In any case, working alone is not permitted in any lab work associated with a chemistry course.

Independent Study and research students may work in a lab alone during normal business hours (8:00 A.M. - 5:00 P.M., Monday through Friday) but must inform the advisor of their schedule. Outside of this time, they must have a second person according to the recommendations of the professor. Work on particularly hazardous procedures must be done Monday through Friday, 8:00 A.M. - 5:00 P. M. and the advisor must be alerted. Procedures deemed non-hazardous by the professor may be done by research students working alone at any time.

Accident Response Protocol

Campus Safety must be alerted immediately (either by calling x3333 or 315-781-3333 or by activating the fire alarm) if any of the following apply:

a. a fire not immediately and fully extinguished

b. a spill of more than 50 mL of any chemical that is rated 3 or 4 in any category

c. a spill in which students or faculty may be exposed to levels that may exceed the STEL, for example spills of volatile hazardous materials outside of the fume hood

d. a student or faculty needs medical attention

e. the professor or student feels it is appropriate to call security.

In addition, the Provost Office must be alerted immediately at x3304 if any of the following apply:

a. a student or faculty needs medical attention

b. the professor or student feels it is appropriate to call the Provost Office.

Accident Reporting Protocol

There are three forms for reporting accidents: Initial Investigation of Possible Overexposure, Physician's Written Opinion for Medical Consultation, and Accident Report Form (Appendix A). The first is required for accidents in which employees or students have been exposed to sufficient quantities of hazardous materials that there may be significant damage. The second form is required if the exposure merits medical attention (see Section 4.3). The third form is required whenever the first two forms are required as well as any time there is a significant accident that may not involve chemical exposure. Minor accidents involving restricted spills, broken glassware, or small cuts, burns, or abrasions require completion of the forms only at the professor's discretion. When necessary, form(s) should be completed as promptly

should be completed before the end of the next working day. The hard copy should be filed in the department's CHP. A hard copy or electronic version should be sent to the Associate Dean responsible for Sciences in the Provost's Office. Faculty may also want to retain a hard or electronic copy. When accidents involve particularly hazardous materials (see section 8.1), a copy of the Hazardous Chemical Procedure Form (Appendix A) should be attached to the other forms. The purpose of these forms is to provide critical information in the event of an accident, to help the chemical hygiene committee formulate improvements in our practices to avoid accidents in the future, and to inform appropriate administrators. The Hazardous Chemical Procedure Form contains information that will be useful in in the chemical hygiene committee's evaluation of any accidents involving particularly hazardous compounds.

Appendix D: Referenced Standards and Lists

This index contains links to regulatory standards and chemical lists referenced in the CHP.

Occupational Exposure to Hazardous Chemicals in Laboratories - 29 CFR 1910.1450
https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1450

Hazard Communication Standard - 29 CFR 1910.1200
https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1200

Access to Employee Exposure and Medical Records - 29 CFR 1910.1020
https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1020

Respiratory Protection - 29 CFR 1910.134
https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134

OSHA Standard 1910—see Subpart Z for hazardous substances with a specific standard
https://www.osha.gov/laws-regs/regulations/standardnumber/1910

Subpart Z table of air contaminants with PELs
https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1000TABLEZ1

National Toxicology Program (NTP) list of carcinogens – 14th annual summary report, 2016
https://ntp.niehs.nih.gov/ntp/roc/content/listed_substances_508.pdf

International Agency for Research on Cancer (IARC) list of carcinogens
https://monographs.iarc.fr/list-of-classifications/

EPA characteristic and listed wastes
https://www.epa.gov/hw/defining-hazardous-waste-listed-characteristic-and-mixed-radiological-wastes