

Chemical Hygiene Plan: Laboratory Standard Operating Procedures

A. Laboratory Specific Information and Signatures

The **Chemical Hygiene Plan: Laboratory Standard Operating Procedures** (section 3 only), after being reviewed and signed by the Laboratory Supervisor, Departmental Chemical Hygiene Officer and affected personnel, will be sent to Risk Management Attn. University Chemical Hygiene Officer Box 1914.

Please send section 3 only to the Office of Environmental Health and Safety.

Updates are due at least annually.

Do not change/alter other sections of the plan. If you have any questions, please contact the University Chemical Hygiene Officer at X3-1737.

This plan is for the **Department of Chemistry**

Building: "GeoChem" Building

Rooms covered by plan: **401, 403, 404, 405, 406, 407, 412, 455**

The **Departmental Chemical Hygiene Officer** for this laboratory is;

Print Name: Peter G. Weber

Signature _____

Date _____

The **Laboratory Supervisor** for this laboratory is;

Print Name: **David E. Cane**

Signature _____

Date _____

Signature and Title of persons covered by this plan (including students and staff);

Print Name	Signature	Title
David E. Cane		Professor
Wayne Chou		Postdoc Res. Assoc.
Myung-Ji Seo		Postdoc Res. Assoc.
Young-Ok You		Postdoc Res. Assoc.
Dongqing Zhu		Postdoc Res. Assoc.
Xun Guo		Grad. Res. Assistant
Chiara Valenzano		Grad. Res. Assistant
Chieh-Mei Wang		Grad. Res. Assistant
Charles Frohman		Undergrad. Res. Asst
Helen Segal		Undergrad. Res. Asst
Jeremie Blum		Visiting Researcher

B. Preparation, Approval, Annual Review and Update

1. The Departmental Chemical Hygiene Officer will oversee the preparation of the Chemical Hygiene Plans by the Laboratory Supervisor for *his/her department*;
2. He/she is responsible for seeing that the plan meets requirements set forth in 29 CFR 1910.1450.
 - a. Assistance in creating the Chemical Hygiene Plan will be provided by the University Chemical Hygiene Officer in Risk Management (x3-1737).
3. The Departmental Chemical Hygiene Officer is responsible for seeing that the Chemical Hygiene Plan is reviewed on an annual basis and updated to accommodate changes in the 29 CFR 1910.1450, departmental procedures, personnel Brown policies and other pertinent materials.
 - a. The Departmental Chemical Hygiene Officer and the Laboratory Supervisor will also see that the Chemical Hygiene Plan is updated to include procedures regarding new hazards and processes as they are introduced.
4. The Laboratory Supervisor will see that the Chemical Hygiene Plan and updates are distributed to or made available to those who are affected by it during all working hours.
5. The **Chemical Hygiene Plan: Laboratory Standard Operating Procedures** and updates, after being reviewed and signed by the Laboratory Supervisor, Departmental Chemical Hygiene Officer and affected personnel, will be sent to Risk Management, Attn. University Chemical Hygiene Officer, Box 1914. Updates are due at least annually.

C. Standard Operating Procedures and Work Practices for Chemicals or Classes
Including Personal Protective Equipment

I. Brief Description of Research:

Research on the biosynthesis, chemistry, biochemistry, and molecular genetics of natural products. This work may involve the handling, storage, and disposal of various classes of chemicals including flammables, corrosives, reactives, compressed/flammable gases, radioactive materials, and, rarely, carcinogens or potential carcinogens or particularly hazardous materials. In most, but not all, cases the amounts used for chemical reactions will not exceed 0.5 - 1 g, but may at times involve quantities, as appropriate, up to 500-1000 g.

II. Standard operating procedures for handling, storage, and disposal of chemicals used in research:

- A. All laboratory workers carrying out research with chemicals are expected to be familiar with the proper procedures for the prudent handling, storage, and disposal of laboratory chemicals.
- B. **Chemistry Department Chemical Inventory and Tracking:** Upon receipt, *all* chemicals in the Chemistry Department are barcoded and entered into a chemical inventory and tracking system. It is required that any chemical that is moved from one room to another, or discarded, be updated in the system. Instructions can be found on the Department Website: <http://www.chem.brown.edu/facilities/inventory.html> under "Chemical Inventory".
- C. Shipping of laboratory chemical samples to outside analytical facilities or to other laboratories is subject to Federal regulation. Brown University is required by Federal Law to comply with various requirements of the Department of Transportation (DOT) including hazardous materials transportation. If University faculty, staff or student's duties at any time includes arranging or offering any potentially hazardous or otherwise regulated material for transport by vehicle, consultation with Brown University Environmental Health & Safety is required. Appropriately trained EHS staff will determine what requirements must be met for hazardous material transport. *Before attempting to ship any chemical samples, contact the appropriate official in the Office of Environmental Health and Safety, Patrick Humphrey (Patrick.Humphrey@brown.edu).* Further information can be found on the EH&S website: http://www.brown.edu/Administration/EHS/safety_alert/dot.htm
- D. In general, all laboratory procedures should be designated and carried out so as to minimize chemical exposure, to avoid underestimation of associated risk to laboratory personnel, to provide adequate ventilation, and to avoid uncontrolled release of chemicals into the environment or public sanitation facilities, consistent with applicable Federal and State regulations.
- E. When carrying out research with any chemical, research workers should inform themselves of the relevant properties of the chemical(s) involved, as well as methods for the prudent and

safe manipulation, storage, and eventual disposal of individual materials. This information is readily available from a variety of sources, including, but not limited to, the following:

1. All laboratory workers are provided with copies of the Department of Chemistry Graduate Student Handbook (current Version 2007-2008) that outlines procedures for the conduct of chemical reactions, the use of fume hoods, eye protection, dealing with chemical hazards, use of the computerized Chemical Inventory system, and storage and disposal of chemicals within the Department of Chemistry, along with substantial other chemical and laboratory safety information. The Handbook itself is updated periodically. The current version can be accessed on the web at: http://www.chem.brown.edu/grad/GradStudent_Handbook.pdf Click on the link for the **Graduate Student Handbook**.
2. Included in the Handbook are references to several more detailed sources of specific information on the chemical and toxicological properties of laboratory materials, as well as methods for the prudent handling and disposal of laboratory chemicals. All of these materials are readily available in the Chemistry Department Stockroom of the GeoChem Laboratory along with numerous other references. Among the most useful are:

"Prudent Practices for Handling Hazardous Chemicals in Laboratories," National Academy Press. This book is available online:

<http://www.nap.edu/openbook/0309052297/html/>

"Safety. Sigma-Aldrich Library of Safety Data," Edition II.

Chemical Handling and Storage

- Prior to the use of any chemical, you should be familiar with information on proper handling, storage and disposal of that chemical.
- Always purchase the minimum amount necessary to maintain operations.
- Chemical containers with missing or defaced labels or that violate appropriate packaging regulations should not be accepted.
- Chemicals utilized in the laboratory must be appropriate for the laboratory's ventilation system.
- Chemicals should not be stored on high shelves and large bottles should be stored no more than two feet from floor level.
- No chemicals should be stored on the floor.
- Chemicals shall be segregated by compatibility.
- Chemical storage areas must be labeled as to their contents.
- Storage of chemicals at the lab bench or other work areas shall be kept to a minimum.
- Any chemical mixture shall be assumed to be as toxic as its most toxic component.
- Substances of unknown toxicity shall be assumed to be toxic.
- All waste disposal containers must be kept closed when not in use and stored in an appropriate spill containment tray.

Transferring Chemicals

- Carry glass containers in specially designed bottle carriers or a leak resistant, unbreakable secondary container.
- When transporting chemicals on a cart, use a cart that is suitable for the load and one that has high edges to contain leaks or spills.
- When possible, transport chemicals in freight elevators to avoid the possibility of exposing people on passenger elevators.

Compressed Gases

- Special systems are needed for handling materials under pressure. Cylinders pose mechanical, physical and/or health hazards, depending on the compressed gas in the cylinder.
- Cylinders must be secured in an upright position at all times. Use suitable racks, straps, chains, or stands to support cylinders against an immovable object, such as a bench or a wall, during use and storage. Do not allow cylinders to fall or lean against one another.
- Use an appropriate cart to move cylinders.
- Oil or grease on the high-pressure side of an oxygen cylinder can cause an explosion.
Do not lubricate an oxygen regulator or use a fuel gas regulator on an oxygen cylinder.
Use an oxygen-approved regulator.
- Always wear goggles or safety glasses with side shields when handling compressed gases.
- Always use appropriate gauges, fittings and materials compatible with the particular gas being handled.
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When work with a toxic, corrosive or reactive gas is planned, EH&S Chemical Hygiene and Laboratory Safety staff should be contacted for information concerning specific handling requirements. Contact info: Daniel Sarachick, Chemical Hygiene Officer, Daniel_Sarachick@brown.edu; Patrick_Humphrey, Environmental Compliance Specialist, Patrick_Humphrey@brown.edu; Tel: at X3-1737. Generally, these gases will need to be used and stored with local exhaust ventilation such as a lab hood or a gas cabinet designed for that purpose.

- Cryogenic Liquefied Gases (liquid argon, nitrogen and oxygen) are transported and stored in special, insulated containers designed to keep them from warming up. Coming in contact with them can rapidly freeze and destroy skin tissues. Appropriate gloves should always be worn when transferring these materials.

III. Special procedures for particularly hazardous substances including carcinogens, acute toxins, radioactive isotopes, and any other special hazards:

- A. Work with radioactive chemicals should take into account the specific *chemical* properties of the substances involved. In addition, all work with radioisotopes is regulated by appropriate State and Federal licensing regulations requiring specific procedures for the procurement, receipt, handling, storage, disposal, monitoring, and relevant record keeping involving such materials.
- B. Many cancer-causing chemicals (carcinogens) as well as numerous cancer suspect agents are under strict governmental control. Detailed lists of these controlled substances are contained in the Handbook as well as in the above-mentioned safety references along with recommended special procedures for the containment of these materials in order to avoid personal exposure and environmental contamination. Similar considerations apply to the use of known or suspected mutagens or teratogens. Laboratory workers who are uncertain about the proper way to handle any such materials should consult in advance with their research supervisor.
- C. **See Appendix J (pp 75-139) of this manual for further information.**

IV. Standard safety and protective equipment:

- A. All laboratory workers are required to wear safety glasses when working in the laboratory. These are available for purchase in the Chemistry Department stockroom.
- B. Each laboratory researcher should have available appropriate disposable or reusable gloves for use as needed. Each lab also has available heavy duty rubber gloves or insulated gloves as required for special procedures.
- C. All labs in which chemicals are routinely handled (rooms 401, 403, 404, 405, 406, 407, 455) have available 1-4 fume hoods. Emergency showers all located at the entrance to Rooms 401, 403, 405, and 407. Emergency eye washes are located in the corridors at both the East and West ends of the building on each floor. Fire extinguishers are located in each laboratory and in the corridors.
- D. Each laboratory contains appropriate well-marked individual cabinets for the storage of flammable chemicals as well as vented cabinets for the storage of corrosive or other noxious materials.
- E. Fire Alarms, fire blankets, fire extinguishers, and First-Aid Kits are in well-marked locations at the East and West ends of the building on each floor.

V. Medical Provisions:

Provisions for medical treatment will be provided for those employees exceeding permitted levels of chemical exposure or exhibiting signs of overexposure. **See Sections 5 and 6 of this manual**

VI. Training:

- A. All laboratory researchers are provided with a copy of the Chemistry Department Graduate Student Handbook upon joining the Department.

- B. All laboratory researchers must complete required training courses on Hazardous Waste, Laboratory Safety Training, plus period refresher training. Laboratory researchers working with radioactive materials must also take the Radiation Safety Course. Detailed schedules can be found on the Web Site of the Office of Environmental Health and Safety (EHS): <http://www.brown.edu/Administration/EHS/training/index.htm> . These courses are held at regular intervals and are also announced via e-mail by EHS. Ms. Sheila Quigley is the Chemistry Department liaison for the EHS and in this role is authorized to see that all laboratory personnel comply with the mandated training requirements
- C. The Chemistry Department Safety Committee is a standing committee consisting of faculty, technical staff, and graduate students reporting to the Chairman (who is also the Chemical Hygiene Officer for the Department). The Safety Committee conducts regular inspections of all laboratories and brings any possible hazards to the attention of each laboratory supervisor.
- D. All laboratory workers are responsible for being familiar with all the provisions of this Chemical Hygiene Plan and must know the location of the detailed reference materials and safety equipment referred to herein. All new laboratory workers will be provided with a copy of the approved Chemical Hygiene Plan and given an orientation to the laboratory by Professor Cane or a senior co-worker. A copy of this plan is also available at: http://chemistry.brown.edu/research/dec/tech_handouts.html . Any laboratory worker can and should request additional information if confronted with a handling, exposure, or disposal situation for which he or she is uncertain about the proper procedures.

D. Elimination or Substitution

The first step in evaluating a new experiment, process or operation should be to investigate the possibility of eliminating the use of hazardous materials or substituting a less hazardous material. For example, instead of using an organic solvent or chromic acid based material for washing glassware, one should substitute an aqueous based detergent. Aromatic compounds (i.e., benzene) and chlorinated hydrocarbons (i.e., methylene chloride) in some experiments should be replaced with aliphatic compounds or non-chlorinated hydrocarbons, if possible.

The particular process, experiment or operation may also be modified to reduce the quantity of the hazardous material(s) necessary or limit the potential emission release rate or exposure time. For example, the use of microscale techniques may be applicable in measuring boiling points of a material. Another example is the substitution of closed systems for open vessels.

The use of a secondary containment device such as a pan can be helpful in preventing or minimizing the effects of chemical spills.

E. Enclosure, Isolation and Regulated AreasDesignated Areas

Reducing the potential for exposure to particularly hazardous chemicals is achieved by restricting the use of the material to a designated area equipped with the proper control devices. This designated area can be a glove box, fume hood, bench, or an entire laboratory depending on the manipulations required. Particularly hazardous substances are stored, used, and prepared for disposal only in designated areas. The boundaries of a designated area are defined by the researcher in the special provisions written for the specific particularly hazardous substance. The designated area is identified by signs so those entering the area are aware a particularly hazardous material may be present.

For example:

"ACRYLAMIDE BALANCE" over balance area

"DANGER! HIGHLY REACTIVE MATERIAL" in storage area

"AFLATOXIN IN USE" on glove box

Radiation and Biohazard signs are available from the Radiation and Biological Safety staff in the Office of EHS at x3-1738.

In addition to establishing the physical boundaries which define the designated area, the procedures used in a designated area should be described under special provisions by the laboratory supervisor, (see below). These include storage, use of protective equipment, use of containment, equipment disposal and decontamination procedures.

Special Provisions for Particularly Hazardous Substances.

Including reproductive hazards, carcinogens, acutely toxic, blood and body fluids, radioactive isotopes and any other special hazards. Please include the regulated areas for this laboratory.

Consult with Appendices. A & B.

Special Procedures for handling and disposal of radioactive materials are described in Procedures for Use of Radioactive Material, Ordering, Unpacking, Storage, Handling, Disposal, Safety kept in the Isotope Lab (Rm 406) and all practices must be in conformity with the radiation safety license (CHE-03). A copy of the Procedures is available for download at:

http://chemistry.brown.edu/research/dec/tech_handouts.html

F. Exposure Control Procedures

1. Whenever possible, chemical operations should be conducted in the fume hoods provided in each laboratory. Malfunctions of any fume hood should be reported immediately to **the Departmental Coordinator, Sheila Quigley, Rm 203 (x3-9618)**. After hours, contact Plant Operations directly and let Sheila know the next working day, in person or by e-mail, what the problem was and that you have already contacted Plant Operations, so that she can follow up on the service.
2. Solvents and reagents should be stored in the proper locations in each laboratory for flammable, corrosive, noxious, or otherwise acutely toxic materials. Quantities in large excess of the available storage facilities should not be stored in the laboratory, nor should chemicals be stored on the floor of the laboratory.
3. Proper disposal of laboratory chemicals is described in the Handbook and in **Section 4 of this manual, pp 34-37**.
4. Spill Control Material is available in the Chemistry Department Stockroom, including controlled breathing apparatus. There is also a spill cart in the telephone closet at the East end of each corridor. In the event of a spill, immediate steps should be taken to minimize the risks of exposure, evaluate the possibility of fire or exposure to toxic material, notify anyone at immediate risk, and to contain and neutralize the spill. See **Section 6 of this manual**.
5. **Material Safety Data Sheets** for all chemicals are available on the Web. A good starting point is: <http://www.ilpi.com/msds/>. MSDS information can also be obtained at any time from the Office of Environmental Health and Safety. (<http://www.brown.edu/Administration/EHS/>)
6. **All laboratory workers working with radioactive materials must be familiar with the approved Procedures for Use of Radioactive Material, Ordering, Unpacking, Storage, Handling, Disposal, Safety kept in the Isotope Lab (Rm 406) and all practices must be in conformity with the radiation safety license (CHE-03). A copy of the Procedures is available for download at http://chemistry.brown.edu/research/dec/tech_handouts.html**
7. Lab workers must also be familiar with the approved Bio-Safety procedures. See http://chemistry.brown.edu/research/dec/tech_handouts.html .

G. Personal Hygiene and Sanitation

- **Do not eat, drink, smoke, chew gum, or apply cosmetics in areas where laboratory chemicals are present.**
- **Do not store, consume, or handle food or beverages in any laboratories.**
- **Do not wear lab coats in an area where food is consumed.**
- **Be aware that open packages of tobacco products can absorb chemical vapors. Smoking is forbidden in the GeoChem Building**
- **Wash areas of exposed skin well before leaving the laboratory.**
- **Avoid direct contact with any hazardous chemical.**
- **Confine long hair and loose clothing and wear footwear that fully covers the feet.**
- **Never mouth pipette.**