U of MN Department of Psychology

Laboratory Safety Plan

Updated 8/17/2004

Chapter 1 - Introduction

1. Preamble:

1. All appendices listed in this document can be accessed from the University of Minnesota Department of Environmental Health and Safety (DEHS) website:

http://www.dehs.umn.edu/safety/lsp/

2. This Plan covers laboratory chemical safety issues only. The Department of Psychology's Electrical Safety Plan ("Lab Electrical Safety for Biological Monitoring Devices") is available at the following address:

http://online.psych.umn.edu/Chair/PolProc/ElectricalSafety.htm

2. Purpose

This Laboratory Safety Plan (LSP) describes policies, procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards in laboratories. This Plan is intended to meet the requirements of both the federal Laboratory Safety Standard, formally known as "Occupational Exposure to Hazardous Chemicals in Laboratories", a copy of which is found in Appendix A, and the Minnesota Employee Right To Know Act (MERTKA).

This LSP is intended to safely limit laboratory workers' exposure to OSHA- and MERTKA-regulated substances. Laboratory workers must not be exposed to substances in excess of the permissible exposure limits (PEL) specified in OSHA rule 29 CFR 1910, Subpart Z, Toxic and Hazardous Substances. PELs for regulated substances are provided in Appendix B. PELs refer to airborne concentrations of substances and are averaged over an eight-hour day. A few substances (listed under Individual Chemical Standard in the Federal column in Appendix C) also have "action levels". Action levels are air concentrations below the PEL which nevertheless require that certain actions such as medical surveillance and workplace monitoring take place.

MERTKA requires employers to evaluate their workplaces for the presence of hazardous substances, harmful physical agents, and infectious agents and to provide training to employees concerning those substances or agents to which employees may be exposed. Written information on agents must be readily accessible to employees or their representatives. Employees have a conditional right to refuse to work if assigned to work in an unsafe or unhealthful manner with a hazardous substance, harmful physical agent or infectious agent. Labeling requirements for containers of hazardous substances and equipment or work areas that generate harmful physical agents are also included in MERTKA.

An employee's workplace exposure to any regulated substance must be monitored if there is reason to believe that the exposure will exceed an action level or a PEL. If exposures to any regulated substance routinely exceed an action level or permissible exposure level there must also be employee medical exposure surveillance.

3. Scope and Application

The Laboratory Safety Standard applies where 'laboratory use' of hazardous chemicals occurs. Laboratory use of hazardous chemicals means handling or use of such chemicals in which all of the following conditions are met:

i. the handling or use of chemicals occurs on a 'laboratory scale', that is, the work involves containers which can easily and safely be manipulated by one person,
ii. multiple chemical procedures or chemical substances are used, and
iii. protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposures to hazardous chemicals.

At a minimum, this definition covers employees (including student employees, technicians, supervisors, lead researchers and physicians) who use chemicals in teaching, research and clinical laboratories at the University of Minnesota. Certain non-traditional laboratory settings may be included under this standard at the option of individual departments within the University. Also, it is the policy of the University that laboratory students, while not legally covered under this standard, will be given training commensurate with the level of hazard associated with their laboratory work.

This standard does not apply to laboratories whose function is to produce commercial quantities of material. Also, where the use of hazardous chemicals provides no potential for employee exposure, such as in procedures using chemically impregnated test media and commercially prepared test kits, this standard will not apply.

4. Coordination With Other Standards and Guidelines

The Laboratory Safety Standard and MERTKA address occupational safety issues. Other federal, state and local standards that address use of hazardous chemicals and other materials are listed in Appendix C. Note particularly the listed chemicals with individual standards in the 'Federal' column, since these compounds generally have *action limits* (usually set at half the TLV), *air monitoring requirements*, and *medical monitoring requirements.* If a researcher is using one of these chemicals, or in the unlikely event that there is a conflict between provisions of various standards, the Department of Environmental Health and Safety should be contacted.

5. Responsibilities

Implementation of the Laboratory Safety Standard at the University is a shared responsibility. Employees, supervisors, Research Safety Officers, department heads, deans, upper administrative staff, and DEHS staff all have roles to play. These roles are outlined below.

A. **President, Vice Presidents, Provosts and Chancellors (Central Administration)**
Upper level administrators are responsible for:
- promoting the importance of safety in all activities;
- promoting the same attitude among all levels of employment at the University;
- supporting a broad-based laboratory safety/chemical hygiene program that will protect U of MN laboratory employees from health effects associated with hazardous chemical, physical or biological agents; and
- ensuring that deans, directors and department heads provide adequate time and recognition for employees who are given laboratory safety responsibilities.

Performance will be measured by:
- DEHS's documentation and annual reporting of the level of compliance within each of the reporting units.

B. **Deans, Directors and Department Heads**

The Dean of the College of Liberal Arts is Steven Rosenstone. The Associate Dean for Faculty and Research in the College of Liberal Arts is James Parente. The Chair of the Department of Psychology is John Campbell.

Deans, Directors and Department Heads are responsible for:

- identifying at least one technically-qualified research safety officer for the unit. (Colleges or institutes that are made up of a number of large laboratory-based departments are urged to assign research safety officers within each department. Large departments may assign one research safety officer for each division);
- transmitting the name of the designated research safety officer to the U of MN's Chemical Hygiene Officer;
- ensuring that the designated research safety officer is adequately trained regarding the roles and responsibilities of the position;
- ensuring that the designated research safety officer modifies this generic Laboratory Safety Plan to incorporate location-specific information;
- ensuring that the designated research safety officer reviews and evaluates the tailored LSP at least annually, and submits a copy of the modified plan to the Chemical Hygiene Officer for approval;
- taking appropriate measures to assure that college/department/division activities comply with University and OSHA laboratory safety policies;

Performance will be measured by:

- DEHS's record of a trained, research safety officer for the unit.
- DEHS's record of a current, tailored Laboratory Safety Plan for the unit.

C. **Department of Environmental Health and Safety (DEHS)**

The Chemical Hygiene Officer for the University is Dawn Errede, and the entire DEHS staff will participate in providing resources for departments in the development of their individual health and safety programs. The Department of Environmental Health and Safety is responsible for:

- preparing and updating the University's generic Laboratory Safety Plan;
- distributing the LSP to departments or other units who will tailor and implement the plan;
- training designated departmental research safety officers regarding compliance with the laboratory safety standard;
- monitoring the progress of departments toward achieving compliance.

Performance will be measured by

- DEHS's documentation that review and evaluation of the generic LSP occurs at least annually, updates as necessary;
- annual feedback to DDDs regarding DEHS's records of lab safety officer training and current LSP s within the units;

D. **Research Safety Officer**

The Research Safety Officer (RSO) for the Department of Psychology is Jonathan Gewirtz.

The RSO's Roles and Responsibilities are described in greater detail in the RSO Toolkit (http://www.dehs.umn.edu/training/rso/roles.shtml). Briefly, the RSO will:

- serve as liaison between employing department and the Department of Environmental Health and Safety;
- know the rules, to help researchers comply with applicable state, federal and university requirements;
- develop and implement a Laboratory Safety Plan for the department;
- coordinate training to ensure all researchers understand their responsibilities and the policies that apply to their research.
- coordinate inspections of laboratories and ensure laboratory supervisors address any noted deficiencies;
- keep records to document compliance with state, federal and university requirements.

Performance will be measured by DEHS's documentation that:

- review and evaluation of the tailored LSP occurs at least annually;
- the research safety officer's personal training records are current.

E. **Supervisors/Principal Investigators**

The Principal Investigators are listed above in Section 2.

The immediate supervisor of a laboratory employee is responsible for:

- assuring that potential hazards of specific projects have been identified and addressed before work is started;
- ensuring there are written, laboratory-specific standard operating procedures for the protocols carried out in the laboratory that incorporate directions about how to mitigate the hazards of the procedures.
- informing and training employees regarding the specific hazards in their area and in the work they will be doing;
- scheduling time for the employee to attend designated training sessions;
- enforcing U of MN safety policies and safe work practices;
- conducting periodic audits of the research space under the supervisors control;
- reporting hazardous conditions to the college or departmental research safety officer;
- investigate laboratory accidents and send an Accident Investigation Worksheet (Appendix N) with recommendations to the departmental research safety officer for review.

Performance will be measured by:

- The Department of Psychology's documentation of current, pertinent safety training for the supervisor and each employee in the supervisor's group;
- The Department of Psychology's documentation of regular audits for laboratory space under the control of the supervisor.

F. **Employee**

Employees who have significant responsibility for directing their own laboratory work are responsible for assuring that potential hazards of specific projects have been identified and addressed before work is started. All laboratory employees however, are responsible for:

- attending safety training sessions;
- following safety guidelines applicable to the procedures being carried out;
- assuring that required safety precautions are in place before work is started; and
- reporting hazardous conditions as they are discovered.

Performance will be measured by:

- supervisor's assessment of employee's adherence to topics covered in safety training.

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Chapter 2 - Standard Operating Procedures

As noted in Chapter 1, Principal Investigators are responsible for ensuring there are written standard operating procedures (SOPs) for the research protocols conducted in their area. The SOPs must identify the hazards of the protocol, as well as measures to be taken to mitigate those hazards. The references listed below may provide enough detail to serve as the SOPs for some research protocols. Others

1. Chemical Procedures

A. **Prudent Practices in the Laboratory**

Laboratory standard operating procedures found in Prudent Practices in the Laboratory: Handling and Disposal of Chemicals (National Research Council, 1995) are adopted for general use at the University of Minnesota. Departmental Research Safety Officers have hard copies of this text, and the entire contents are accessible on the web. Note especially the following topics which are covered in Chapters 5 and 6 of Prudent Practices:

Chapter 5 Working with Chemicals

- Introduction
- Prudent Planning
- General Procedures for Working with Hazardous Chemicals
- Working with Substances of High Toxicity
- Working with Biohazardous and Radioactive Materials
- Working with Flammable Chemicals
- Working with Highly Reactive or Explosive Chemicals
- Working with Compressed Gases

Chapter 6 Working with Laboratory Equipment

- Introduction
- Working with Water-Cooled Equipment
- Working with Electrically Powered Laboratory Equipment
- Working with Compressed Gases
- Working with High/Low Pressures and Temperatures
- Using Personal Protective, Safety, and Emergency Equipment
- Emergency Procedures

B. **The American Chemical Society's "Safety in Academic Chemistry Laboratories"**

ACS's "Safety in Academic Chemistry Laboratories" another useful text. This manual presents information similar to that found in Prudent Practices, but in a considerably condensed format.

C. **Hazardous Waste Management**

Extensive and detailed policies regarding hazardous waste management are specified in the University's guidebook "Hazardous Chemical Waste Management, 5th edition". Please refer to this text for approved waste handling procedures.

D. **Emergency Procedures for Chemical Spills**

The procedures listed below are intended as a resource for your department in preparing for emergencies before they happen. If you are currently experiencing an emergency such as a chemical or blood spill, please contact the Department of Environmental Health and Safety at 612-626-6002.

Complete spill response procedures are described in the Hazardous Chemical Waste Management guidebook (http://www.dehs.umn.edu/guidebook/guidebook3.html). However, the quick reference guide is included for convenience in this Laboratory Safety Plan.

Quick Reference Guide

Evacuate

- Leave the spill area; alert others in the area and direct/assist them in leaving.
- Without endangering yourself: remove victims to fresh air, remove contaminated clothing and flush contaminated skin and eyes with water for 15 minutes. If anyone has been injured or exposed to toxic chemicals or chemical vapors, call 911 and seek medical attention immediately.

Confine

- Close doors and isolate the area. Prevent people from entering spill area.

Report

- From a safe place, call the Department of Environmental Health and Safety (EHS) (612) 626-6002 during working hours, 911 after hours (Twin Cities Campus 911 operators will contact on-call EHS personnel).
- Report that this is an emergency and give your name, phone and location; location of the spill; the name and amount of material spilled; extent of injuries; safest route to the spill.
- Stay by that phone, EHS will advise you as soon as possible.
- EHS or the Fire Department will clean up or stabilize spills, which are considered high hazard (fire, health or reactivity hazard). In the case of a small spill and low hazard situation, EHS will advise you on what precautions and protective equipment to use.

Secure

- Until emergency response personnel arrive: block off the areas leading to the spill, lock doors, post signs and warning tape, and alert others of the spill.
- Post staff by commonly used entrances to the area to direct people to use other routes.

After an accident, supervisor(s) must complete and fax in reporting forms within 24 hours. Workers' Compensation policy and reporting forms are available on the web (Appendix J).

2. Biohazardous Procedures

At the University of Minnesota, researchers must follow the policies in the CDC/NIH text, Biosafety in Microbiological and Biomedical Laboratories, 4th Edition, May 1999. A copy of this text is available on the web at http://bmbl.od.nih.gov/. Another useful reference is the National Research Council's text "Biosafety in the Laboratory: Prudent Practices for Handling and Disposal of Infectious Materials" (1989), available on the web at http://books.nap.edu/books/0309039754/html/R1.html#pagetop.

In addition, researchers working with biological materials must acquaint themselves with the policies of the university's Institutional Biosafety Committee (IBC), which are on the web at http://www.ibc.umn.edu/homepg.html. The IBC is charged under Federal Regulations and Regents' Policy with the oversight of all teaching and research activities involving:

- Recombinant DNA
- Artificial Gene Transfer
- Infectious Agents (bacteria, viruses, protozoans, fungi, etc.)

- Biologically Derived Toxins

If the research involves work with any of 31 infectious agents or 12 biological toxins (federally designated as Select Agents), follow the procedures outlined in the Select Agent section of the IBC Web page (http://www.ibc.umn.edu/select.html).

3. Radioactive Procedures

All researchers using radioactive materials at the University of Minnesota must:

- contact the Radiation Protection Division;
- obtain a permit for the possession and use of radioactive materials;
- complete required training modules; and
- comply with the radiation policies and procedures of the university (contained in the Radiation Protection manual).

The Radiation Protection manual contains information on a number of topics including license committees, the permitting process, purchasing procedures, transfer procedures, general safety, personnel dosimetry, waste management, emergency management (spill control), record keeping, and regulatory guides (declared pregnancy workers, risks from ionizing radiation exposure).

Initial training is required for all personnel who are authorized to access radiation areas. Training tapes can be viewed in Minneapolis in the Learning Resources Center (LRC) at the Biomedical Library in Diehl Hall, in the St. Paul Library LRC, and at the UMD Library LRC. After viewing the tapes, users fill out a questionnaire and then recieve specific, on-site training required by permit holder (trainer).

4. General Safety Procedures

Other University of Minnesota Policies for Safe Practices in Laboratories are accessible in Appendix E of this laboratory safety plan.

Lab Safety

- Emergency Eyewash and Safety Shower Installation
- Eye Protection/Personal Protective Equipment
- Flammable and Combustible Liquid Quantities in U of M Laboratories
- Controlled Substances
- Greenhouse Policy-Fumigation/Smoke Generation Procedure
- Labeling Chemicals
- Lock Out/Tag Out
- Respiratory Protection Program
- Termination of Laboratory Use of Hazardous Materials

Fire Safety

- Flammable and Combustible Liquid Quantities in U of M Laboratories
- Fire Safety at the University
- Portable Fire Extinguishers-Type and Placement

General Safety

- Emergency Procedures
- Eye Protection/Personal Protective Equipment
- Extension Cords in University Buildings
- Foot Protection/Safety-Toe Shoes
- Holiday Decorations
- Portable Fire Extinguishers-Type and Placement
- Public Corridors

- Respiratory Protection Program
- Step Ladders-Care and Use
- Temperature Standard
- University of Minnesota Twin Cities Campus Smoke-Free Indoor Air Policy
- Supervisors Injury/Illness Investigation Form
- Working with PCBs

5. Laboratory-Specific Standard Operating Procedures

This section summarizes laboratory-specific SOPs. Currently, all SOPs are covered by sections A, B, and C (see above). The full text of laboratory-specific SOPs , as they are developed, will be included as an appendix, or will be obtainable from the referenced PI, or from the research safety officer, Jonathan Gewirtz, for the Department of Psychology. Safety information will be included in each SOP, and may be highlighted in a Laboratory Safety Information Sheet, similar to the one included in Appendix F.

Principal Investigator Protocol Name(s) Location of Protocols

6. General Emergency Procedures

The procedures listed below are intended as a resource for your department in preparing for emergencies before they happen. If you are currently experiencing an emergency such as a chemical or blood spill, please contact the Department of Environmental Health and Safety at 612-626-6002.

For University employees who have been exposed to bloodborne or other infectious pathogens, please follow the procedures below under "Needle Stick." For all other emergencies call 911.

Campus Safety Information Guidebook (http://www.dem.umn.edu/guidebook/)

- bomb threats
- medical emergencies
- safety on campus
- severe weather
- utility outages
- warning systems/sirens

Chemical Spills (http://www.dehs.umn.edu/hwd/guidebook/guidebook3.html)

Fire Safety (http://www.dehs.umn.edu/safety/fire/)

Needle Sticks (http://www.dehs.umn.edu/emergency/needle.html)

Radiation Spills (http://www.dehs.umn.edu/safety/radspill.html)

Workplace Violence (http://www1.umn.edu/ohr/eap/graphics/violence.pdf)

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Chapter 3 - Criteria for Implementation of Chemical Control Measures

Engineering controls, personal protective equipment, hygiene practices, and administrative controls each play a role in a comprehensive laboratory safety program. Implementation of specific measures must be carried out on a case-by-case basis, using the following criteria for guidance in making decisions. Assistance is available from the Department of Environmental Health and Safety.

1. Engineering controls

a) Fume HoodsThe laboratory fume hood is the major protective device available to laboratory workers. It is designed to capture chemicals that escape from their containers or apparatus and to remove them from the laboratory environment before they can be inhaled. Characteristics to be considered in requiring fume hood use are physical state, volatility, toxicity, flammability, eye and skin irritation, odor, and the potential for producing aerosols. A fume hood should be used if a proposed chemical procedure exhibits any one of these characteristics to a degree that (1) airborne concentrations might approach the action level (or permissible exposure limit), (2) flammable vapors might approach one tenth of the lower explosion limit, (3) materials of unknown toxicity are used or generated, or (4) the odor produced is annoying to laboratory occupants or adjacent units.

Procedures that can generally be carried out safely outside the fume hood include those involving (1) water-based solutions of salts, dilute acids, bases, or other reagents, (2) very low volatility liquids or solids, (3) closed systems that do not allow significant escape to the laboratory environment, and (4) extremely small quantities of otherwise problematic chemicals. The procedure itself must be evaluated for its potential to increase volatility or produce aerosols.

In specialized cases, fume hoods will contain exhaust treatment devices, such as water wash-down for perchloric acid use, or charcoal or HEPA filters for removal of particularly toxic or radioactive materials.

b) Safety Shields

Safety shields, such as the sliding sash of a fume hood, are appropriate when working with highly concentrated acids, bases, oxidizers or reducing agents, all of which have the potential for causing sudden spattering or even explosive release of material. Reactions carried out at non-ambient pressures (vacuum or high pressure) also require safety shields, as do reactions that are carried out for the first time or are significantly scaled up from normal operating conditions.

c) Other Containment Devices

Other containment devices, such as glove boxes or vented gas cabinets, may be required when it is necessary to provide an inert atmosphere for the chemical procedure taking place, when capture of any chemical emission is desirable, or when the standard laboratory fume hood does not provide adequate assurance that overexposure to a hazardous chemical will not occur. The presence of biological or radioactive materials may also mandate certain special containment devices. High strength barriers

coupled with remote handling devices may be necessary for safe use of extremely shock sensitive or reactive chemicals.

Highly localized exhaust ventilation, such as is usually installed over atomic absorption units, may be required for instrumentation that exhausts toxic or irritating materials to the laboratory environment. Ventilated chemical storage cabinets or rooms should be used when the chemicals in storage may generate toxic, flammable or irritating levels of airborne contamination.

2. Personal Protective Equipment

Bare feet, sandals and open-toed shoes are not permitted in any laboratory. Short pants and short skirts are not permitted in any laboratory, unless covered by a lab coat. Lab coats are strongly encouraged as routine equipment for all laboratory workers. Lab coats are also required when working with select carcinogens, reproductive toxins, substances which have a high degree of acute toxicity, strong acids and bases, and any substance on the OSHA PEL list carrying a "skin" notation. See Appendix B for chemical listings.

Eye protection is required for all personnel and any visitors whose eyes may be exposed to chemical or physical hazards. Side shields on safety spectacles provide some protection against flying particles, but goggles or face shields are necessary when there is a greater than average danger of eye contact with liquids. A higher than average risk exists when working with highly reactive chemicals, concentrated corrosives, or with vacuum or pressurized glassware systems. Contact lenses may be worn under safety glasses, goggles or other eye and face protection. Experts currently believe the benefits of consistent use of eye protection outweigh potential risks of contact lenses interfering with eye flushing in case of emergency.

Gloves made of appropriate material are required to protect the hands and arms from thermal burns, cuts, or chemical exposure that may result in absorption through the skin or reaction on the surface of the skin. Gloves are also required when working with particularly hazardous substances where possible transfer from hand to mouth must be avoided. Thus gloves are required for work involving pure or concentrated solutions of select carcinogens, reproductive toxins, substances which have a high degree of acute toxicity, strong acids and bases, and any substance on the OSHA PEL list carrying a "skin" notation.

Since no single glove material is impermeable to all chemicals, gloves should be carefully selected using guides from the manufacturers. General selection criteria are outlined in Prudent Practices, p. 132, and glove selection guides are available on the web . However, glove-resistance to various chemicals materials will vary with the manufacturer, model and thickness. Therefore, review a glove-resistance chart from the manufacturer you intend to buy from before purchasing gloves. When guidance on glove selection for a particular chemical is lacking, double glove using two different materials, or purchase a mulitlayered laminated glove such as a Silvershield or a 4H.

Respiratory protection is generally not necessary in the laboratory setting and must not be used as a substitute for adequate engineering controls. Availability of respiratory protection for emergency situations may be required when working with chemicals that are highly toxic and highly volatile or gaseous. If an experimental protocol requires exposure above the action level (or PEL) that cannot be reduced, respiratory protection will be required. Rarely, an experimental situation may potentially involve IDLH (immediately dangerous to life or health) concentrations of chemicals, which will require use of respiratory protection. All use of respiratory protective equipment is covered under the University of Minnesota Respiratory Protection Program.

3. Hygiene Practices

Eating, drinking and chewing gum are all strictly prohibited in any laboratory with chemical, biological or radioactive materials. Researchers must also be careful to restrict other actions (such as applying lip balm or rubbing eyes) which could inadvertently cause exposure to research materials. Consuming alcohol or taking illegal drugs in a research laboratory are strictly prohibited, as such actions potentially endanger the health and safety of not only the user, but everyone in the building. Infractions will be met with serious disciplinary action.

Before leaving the laboratory, remove personal protective equipment/clothing (labcoat and gloves) and wash hands thoroughly. Do NOT wear laboratory gloves in public spaces such as hallways and elevators.

4. Administrative Controls

Researchers are strongly encouraged to prioritize research so that work with hazardous chemical, biological or physical agents occurs only during working hours (8 am – 5 pm, Monday through Friday). After-hours work (on nights and weekends) should be restricted to nonhazardous activities such as data analysis and report writing. If hazardous materials must be used at nights or on weekends, ensure that at least one other person is within sight and ear-shot to provide help in an emergency.

Supervisors shall consider the hazards involved in their research, and designate areas, activities, and tasks that require specific types of personal protective equipment as described above.

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Chapter 4 - Management of Chemical Fume Hoods and Other Protective Equipment

1. Monitoring Safety Equipment

Fume hoods must be monitored daily by the user to ensure that air is moving into the hood. Any malfunctions must be reported immediately to the appropriate Facilities Management zone office. The hood should have a continuous reading device, such as a pressure gauge, to indicate that air is moving correctly. Users of older hoods without continuous reading devices should attach a strip of tissue or yarn to the bottom of the vertical sliding sash. The user must ensure the hood and baffles are not blocked by equipment and bottles, as air velocity through the face may be decreased. DEHS staff will measure the average face velocity of each fume hood annually with a velometer or a thermoanemometer. A record of monitoring results will be made.

Eye washes must be flushed weekly by the user. This will ensure that the eye wash is working, and that the water is clean, should emergency use become necessary. The user should coordinate with [Facilities Management or Hospital Engineers (phone number)] to ensure that emergency showers and eye washes are checked annually. Fire extinguishers will be checked annually by a University contractor. The user is responsible for checking regularly to ensure that other protective equipment is functioning properly. Environmental Health and Safety staff can assist with these evaluations, should assistance be necessary.

General laboratory conditions must be monitored periodically by the users. A generic laboratory audit form is included in Appendix G, and may be tailored for use by individual laboratories. The departmental Research Safety Officer or the University's Chemical Hygiene Officer may also use this form for spot-checks of the laboratories.

2. Acceptable Operating Range

The acceptable operating range for fume hoods is 80 to 150 linear feet per minute, at the designated sash opening (usually 18 inches). If, during the annual check, a hood is operating outside of this range, DEHS staff may request that you check to ensure the baffles are adjusted properly, and that the exhaust slots are not blocked by bottles and equipment. If these adjustments do not help, DEHS staff will report the deficiency to the appropriate Facilities Management zone office for servicing.

3. Maintenance

During maintenance of fume hoods, laboratories must clean out and if necessary, decontaminate the fume hood and restrict use of chemicals to ensure the safety of maintenance personnel. See "Safe Practices During Servicing of Exhaust Systems in Research Facilities" in Appendix E.

4. Training

Training in the appropriate use and care of fume hood systems, showers, eyewashes and other safety equipment must be included in the initial and update training described in Section 5.

5. New Systems

When new ventilation systems, such as variable air volume exhaust, are installed in University facilities, specific policies for their use will be developed by the Department of Environmental Health and Safety and employees will be promptly trained on use of the new equipment.

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Chapter 5 - Employee Information and Training

1. Information

It is essential that laboratory employees have access to information on the hazards of chemicals and procedures for working safely. Supervisors must ensure that laboratory employees are informed about and have access to the following information sources:

The contents of the OSHA Laboratory Safety Standard

> "Occupational Exposure to Hazardous Chemicals in Laboratories" and its appendices (29 CFR 1910.1450). A copy of this federal standard can be found in Appendix A of this Laboratory Safety Plan.

The University of Minnesota's Laboratory Safety Plan

> This generic LSP is available to all employees on the Department of Environmental Health and Safety's web site (www.dehs.umn.edu) and in the Learning Resource Centers of the various campus libraries. Individual department Laboratory Safety Plans are available within those departments.

The Permissible Exposure Limits (PELs)

> PELs for OSHA regulated substances can be found in Appendix B. Also included in Appendix B are the ACGIH Threshold Limit Value (TLV) list, a list of OSHA health hazard definitions, lists of "select carcinogens" and reproductive toxins, and chemicals having a high degree of acute toxicity.

Signs and symptoms associated with exposures to hazardous chemicals.
http://www.hhmi.org/research/labsafe/overview.html

> Laboratory Chemical Safety Summaries (LCSSs) are included on pages 235-413 of the 1995 edition of Prudent Practices. LCSSs are similar to Material Safety Data Sheets (MSDS), but are tailored to the hazards of laboratory use of those chemicals. The LCSSs include toxicity information, and signs and symptoms of exposure to the chemicals.

Material Safety Data Sheets (MSDSs)

> MSDSs are available online through links from the Department of Environmental Health and Safety's web site. Hard copies of MSDS for many laboratory chemicals are also available from DEHS or departmental safety offices. Individual researchers are encouraged to keep hard copies in an easily accessible location for materials that are used in large quantities, which are used frequently, or which are particularly toxic.

Information on chemical waste disposal and spill response

> The University of Minnesota guidebook, Hazardous Chemical Waste Management 5th edition provides detailed information on proper waste handling procedures.

2. Training

Each laboratory supervisor is responsible for ensuring that laboratory employees are provided with training about the hazards of chemicals present in their laboratory work area, and methods to control exposure to such chemicals. Such training must be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new potential exposure situations. Refresher training must be provided annually.

Colleges and non-academic departments that engage in the laboratory use of hazardous chemicals are responsible for identifying employees who require training and for developing and delivering training programs for such employees. DEHS offers training on the third Thursday of each month that covers general laboratory safety issues, hazardous waste management, and biohazardous materials handling. Departments are welcome to send employees to this 'base' training at no charge. However, laboratory supervisors must provide additional training on laboratory-specific hazards to ensure all the OSHA-required training topics have been adequately addressed. Call DEHS at 626-6002 to register trainees.

Employee training programs will include, at a minimum, the following subjects:

Methods of detecting the presence of hazardous chemicals;

> Method include visual observation, odor, real-time air monitoring, time-weighted air sampling, etc.).

Basic toxicological principles;

> Principles include toxicity, hazard, exposure, routes of entry, acute and chronic effects, dose-response relationship, LD50, threshold limit values and permissible exposure limits, exposure time, and health hazards related to classes of chemicals.

Prudent laboratory practices;

> Prudent laboratory practices include general techniques designed to reduce personal exposure and to control physical hazards, as well as specific protective mechanisms and warning systems used in individual laboratories. Appropriate use of fume hoods is to be specifically addressed.

Description of available chemical information;

> Container labels, Material Safety Data Sheets, etc.

Emergency response actions appropriate to individual laboratories;

> Lists of emergency phone numbers, location of fire extinguishers, deluge showers, eyewashes, etc.

Applicable details of the departmental Laboratory Safety Plan;

> Details should include general and laboratory-specific Standard Operating Procedures.

An introduction to the Hazardous Chemical Waste Management guidebook; and

The script for the video Laboratory Chemicals and Your Health.

This video (script included in Appendix I) is an example of information meeting the requirements of the first three items of this list. Laboratory Chemicals and Your Health is available in either slide-tape or video format. A more complete list of audio-visual material available from the Department of Environmental Health and Safety, the University Library System, and other resources is included in Appendix H.

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Chapter 6 - Required Approvals

1.

The Department of Psychology requires pre-approval for the following operations/ chemicals, based upon the chemical, physical and toxicological characteristics of the material, as well as quantity, concentration, and potential for exposure during actual use.

Operation 1	Chemical 1
Operation 2	Chemical 2
etc...	etc...

B.

The Department of Psychology requires researches to follow the following procedure for obtaining approval for the operations/chemicals listed above.
Step 1
Step 2
etc...

A written record of approvals will be kept within the department.

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Chapter 7 - Medical Consultation and Examination

1. Employees Who Work With Hazardous Substances

All employees who work with hazardous substances will have an opportunity to receive medical attention, including any follow-up visits that the examining physician determines to be necessary, under the following circumstances:

Signs or symptoms of exposure

> Whenever an employee develops signs or symptoms associated with a hazardous substance or organism to which the employee may have been exposed in the laboratory, the employee will be provided an opportunity to receive an appropriate medical examination.

Exposure monitoring

> Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance will be established for the affected employee as prescribed by the particular standard.

Exposure incident

> Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee will be provided an opportunity for a medical consultation. Such consultation will be for the purpose of determining the need for a medical examination.

Physical Injury

> Whenever an employee is physically hurt or injured on the job, the affected employee will be provided an opportunity for a medical consultation and/or examination. Physical injuries include but ar not limited to cuts, burns, punctures and sprains.

Contact the Chemical Hygiene Officer whenever the need for medical consultation or examination occurs, or when there is uncertainty as to whether any of the above criteria have been met.

2. Medical Examinations and Consultations

In the event of a life-threatening illness or injury, dial 911 and request an ambulance. Employees with urgent, but non-life-threatening, illnesses or injuries should go to the nearest medical clinic. The University of Minnesota's Occupational Medicine Program is located in Boynton Health Service. If off-hours medical attention is required, the employee should be taken to the emergency room at Fairview University Medical Center's University campus. All medical examinations and consultations will be performed by or under the direct supervision of a licensed physician and will be provided without cost to the employee, without loss of pay and at a reasonable time and place.

3. Workers' Compensation Procedures and Forms

It is very important that even minor job-related injuries or illness are reported. These statistics help the Department of Environmental Health and Safety track trends that may indicate occupational hazards that need evaluation. To report an illness or injury, go to the Workers' Compensation website. University of Minnesota's Policy for Reporting Workers' Compensation Related Injuries is also available on the web. Both sites provide links to the forms listed below.

This policy explains the procedures and provides the necessary reporting forms. As long as the illness or injury is not life threatening, the supervisor should provide the employee with:

- a brochure describing Workers' Compensation Information for the University of Minnesota;
- a completed Employers' Authorization for Care form; and
- a Work Status Report for the physician to complete and return to the supervisor.

Within 24 hours, the supervisor should complete:

- a State of Minnesota First Report of Injury form;
- a U of MN Employee Incident Report form; and
- a U of MN Supervisor Incident Investigation Report.

Within 24 hours, supervisors must fax the State form to Sedgwick Claims Management Services at (612) 826-3785, and the U of MN forms to the University of Minnesota's Workers' Compensation Department (612)-627-1855.

4. Information Provided to Physician

The employee's supervisor or department will collect and transmit the following information to the examining physician:

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

5. Information Provided to the University of Minnesota

Supervisors should request that the examining physician provide them with a written report including the following:

- Any recommendation for further medical follow-up;
- The results of the medical examination and any associated tests;
- Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace; and
- A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

The written opinion will not reveal specific findings of diagnoses unrelated to occupational exposure.

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Chapter 8 - Personnel

The following individuals and groups have responsibilities for implementation of various aspects of the University of Minnesota's Laboratory Safety Plan.

Chemical Hygiene Officer

> The University of Minnesota's Chemical Hygiene Officer is Dawn C. Errede, Department of Environmental Health and Safety. Ms. Errede is a Certified Industrial Hygienist (CIH) and chemical hygiene specialist with an M.S. in Environmental Health. Address: W-140 Boynton Health Service. Phone: 612-626-2330.

College or Departmental Research Safety Officer

> The research safety officer for the Department of Psychology is Jonathan Gewirtz The specific duties of each safety officer will be determined at the departmental level. The duties of this RSO are included in Appendix K.

College or Departmental Safety Committee

> The designation of a safety committee to assist the safety officer in his/her required duties is strongly encouraged. At present the Psychology Department does not have a Safety Committee, owing to the relatively limited scope of lab-based research conducted there.

Department of Environmental Health and Safety

> The Department of Environmental Health and Safety offers assistance in a wide range of health and safety issues. A departmental organizational chart, list of services offered, and staff phone numbers are included in Appendix L. Address: W-140 Boynton. Phone: 612-626-6002.

Occupational Physician

> The University of Minnesota's Boynton Health Service provides limited occupational medicine services. The phone number for the Occupational Medicine program, which covers Research Animal Resources, respiratory protection, and pesticide exposures only, is 612-625-4906. Non-hospital employee chemical exposures should go through Boynton's urgent care.

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Chapter 9 - Additional Employee Protection for Work with Particularly Hazardous Substances

Additional employee protection will be considered for work with particularly hazardous substances. These include select carcinogens, reproductive toxins and substances that have a high degree of acute toxicity (see Appendix B). Pp. 90-93 of the 1995 edition of Prudent Practices provides detailed recommendations for work with particularly hazardous substances. These pages may be accessed from DEHS's web site at www.dehs.umn.edu. Also, DEHS has hard copies of the entire 1995 edition available for departmental Research Safety Officers. Laboratory supervisors and principal investigators are responsible for assuring that laboratory procedures involving particularly hazardous chemicals have been evaluated for the level of employee protection required. Specific consideration will be given to the need for inclusion of the following provisions:

1. Planning;
2. Establishment of a designated area;
3. Access control
4. Special precautions such as:
    - use of containment devices such as fume hoods or glove boxes;
    - use of personal protective equipment;
    - isolation of contaminated equipment;
    - practicing good laboratory hygiene; and
    - prudent transportation of very toxic chemicals.
5. Planning for accidents and spills; and
6. Special storage and waste disposal practices.

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Chapter 10 - Record Keeping, Review and Update of Laboratory Safety Plan

1. Record Keeping

Exposure evaluation

> Any records of exposure evaluation carried out by individual departments (including continuous monitoring systems) will be kept within the department and also sent to the Department of Environmental Health and Safety. Results of exposure evaluations carried out by DEHS will be kept by DEHS and sent to the affected department. Raw data will be kept for one year and summary data for the term of employment plus 30 years.

Medical consultation and examination

> Results of medical consultations and examinations will be kept by the Boynton Health Service for a length of time specified by the appropriate medical records standard. This time will be at least the term of employment plus 30 years as required by OSHA.

Training

> Individual employee training should be recorded on form BA 725A (see Appendix M) and should be kept in the individual's department or college for five years. These forms may be audited by the University Audit Department.

Fume hood monitoring

> Data on annual fume hood monitoring will be kept in the Department of Environmental Health and Safety. Fume hood monitoring data are considered maintenance records and as such the raw data will be kept for one year and summary data for 5 years.

B. Review and Update of Laboratory Safety Plan

On an annual basis, this Laboratory Safety Plan will be reviewed and evaluated for effectiveness by the Department of Environmental Health and Safety and updated as necessary. Any changes in the Laboratory Safety Plan will be transmitted to college and departmental research safety officers, who are responsible for carrying out a similar review and modification of their plans, and submitting a revised copy to the Chemical Hygiene Officer.

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Table 1 - Poisonous Gases

The gases on this list are either on the Department of Transportation's Category 1 list, or the Linde Specialty Gases company's Group 6 – Very Poisonous list. These chemicals are highly toxic gases at ambient temperature and pressure. They have an extremely high potential for causing significant harm if not adequately controlled.

Arsine	Boron trichloride	Chlorine pentafluoride
Chlorine trifluoride	Cyanogen	Cyanogen chloride
Diborane	Dinitrogen tetroxide	Fluorine
Germane	Hydrogen selenide	Nitric oxide
Nitrogen dioxide	Nitrogen trioxide	Nitrosyl chloride
Oxygen difluoride	Phosgene	Phosphine
Phosphorus pentafluoride	Selenium hexafluoride	Stibine
Sulfur tetrafluoride	Tellurium Hexafluoride	Tetraethyldithiopyrophosphate
Tetraethylpyrophosphate		

Guidance: Departments may choose to add other chemicals to the above list. For example, sulfur-containing compounds such as mercaptans can cause significant odor problems when used in the laboratory. Pre-approval of the conditions under which they can be used may prevent odor complaints.

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Table 2 - Shock Sensitive Chemicals

The classes of chemicals listed below may explode when subjected to shock or friction. Therefore users must have appropriate laboratory equipment, information, knowledge and training to use these compounds safely.

- Acetylenic compounds, especially polyacetylenes, haloacetylenes, and heavy metal salts of acetylenes (copper, silver, and mercury salts are particularly sensitive)
- Acyl nitrates
- Alkyl nitrates, particularly polyol nitrates such as nitrocellulose and nitroglycerine
- Alkyl and acyl nitrites
- Amminemetal oxosalts: metal compounds with coordinated and hydrazine, or similar nitrogenous donors and ionic perchlorate, nitrate, permanganate, or other oxidizing group
- Azides, including metal, nonmetal, and organic azides
- Chlorite salts of metals, such as $AgClO_2$ and $Hg(ClO_2)_2$
- Diazo compounds such as CH_2N_2
- Diazonium salts, when dry
- Fulminates such as mercury fulminate $(Hg(CNO)_2)$
- Hydrogen peroxide (which becomes increasingly treacherous as the concentration rises above 30%, forming explosive mixtures with organic materials and decomposing violently in the presence of traces of transition metals
- N-Halogen compounds such as difluoroamino compounds and halogen azides
- N-Nitro compounds such as N-nitromethylamine, nitrourea, nitroguanidine, and nitric amide
- Oxo salts of nitrogenous bases: perchlorates, dichromates, nitrates, iodates, chlorites, chlorates, and permanganates of ammonia, amines, hydroxylamine, guanidine, etc.
- Perchlorate salts (which can form when perchloric acid mists dry in fume hoods or associated duct work. Most metal, nonmetal, and amine perchlorates can be detonated and may undergo violent reaction in contact with combustible materials)
- Peroxides and hydroperoxides, organic
- Peroxides (solid) that crystallize from or are left from evaporation of peroxidizable solvents (see the following Section 3)
- Peroxides, transition-metal salts
- Picrates, especially salts of transition and heavy metals, such as Ni, Pb, Hg, Cu, and Zn
- Polynitroalkyl compounds such as tetranitromethane and dinitroacetonitrile
- Polynitroaromatic compounds especially polynitrohydrocarbons, phenols, and amines (e.g., dinitrotoluene, trinitrotoluene, and picric acid)

Note: Perchloric acid must be used only in specially-designed perchloric acid fume hoods that have built-in wash down systems to remove shock-sensitive deposits. Before purchasing this acid, laboratory supervisors must arrange for use of an approved perchloric acid hood.

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Table 3 - Pyrophoric Chemicals

The classes of chemicals listed below will readily oxidize and ignite spontaneously in air. Therefore, users must demonstrate to the department that they have the appropriate laboratory equipment, information, knowledge and training to use these compounds safely.

- Grignard reagents, RMgX
- Metal alkyls and aryls, such as RLi, RNa, R3Al, R2Zn
- Metal carbonyls such as Ni(CO)4, Fe(CO)5, Co2(CO)8
- Alkali metals such as Na, K
- Metal powders, such as Al, Co, Fe, Mg, Mn, Pd, Pt, Ti, Sn, Zn, Zr
- Metal hydrides such as NaH, LiAlH4
- Nonmetal hydrides, such as B2H6 and other boranes, PH3, AsH3
- Nonmetal alkyls, such as R3B, R3P, R3As
- Phosphorus (white)

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Table 4 - Peroxide-Forming Chemicals

The chemicals listed below can form explosive peroxide crystals on exposure to air, and therefore require special handling procedures after the container is opened. Some of the chemicals form peroxides that are violently explosive in concentrated solution or as solids, and therefore should never be evaporated to dryness. Others are polymerizable unsaturated compounds and can initiate a runaway, explosive polymerization reaction. All peroxidizable compounds should be stored away from heat and light. They should be protected from physical damage and ignition sources. A warning label should be affixed to all peroxidizable materials to indicate the date of receipt and the date the container was first opened. Due to these special handling requirements, users must have the appropriate laboratory equipment, information, knowledge and training to use these compounds safely.

A. Severe Peroxide Hazard with Exposure to Air (discard within 3 months from opening)

- diisopropyl ether (isopropyl ether)
- divinylacetylene (DVA)
- vinylidene chloride (1,1-dichloroethylene)
- potassium metal
- sodium amide (sodamide)
- potassium amide

B. Peroxide Hazard on Concentration

Do not distill or evaporate without first testing for the presence of peroxides (discard or test for peroxides after 6 months)

- acetaldehyde diethyl acetal (acetal)
- cumene (isopropylbenzene)
- cyclohexene
- cyclopentene
- decalin (decahydronaphthalene)
- diacetylene (butadiene)
- dicyclopentadiene
- diethyl ether (ether)
- diethylene glycol dimethyl ether (diglyme)
- dioxane
- ethylene glycol dimethyl ether (glyme)
- ethylene glycol ether acetates
- ethylene glycol monoethers (cellosolves)
- furan
- methylacetylene
- methylcyclopentane
- methyl isobutyl ketone
- tetrahydrofuran (THF)
- tetralin (tetrahydronaphthalene)
- vinyl ethers

C. Hazard of Rapid Polymerization Initiated by Internally-Formed Peroxides

Liquids (discard or test for peroxides after 6 months)

Chloroprene (2-chloro-1, 3-butadiene)

- vinyl acetate

- styrene
- vinylpyridine

Gases (discard after 12 months)

- butadiene
- vinylacetylene (MVA)
- tetrafluoroethylene (TFE)
- vinyl chloride

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Table 5 - Carcinogens, Reproductive Toxins or Highly Toxic Chemicals

The chemicals listed below are extremely hazardous. Workers must have knowledge of the dangers of these chemicals prior to use, and documentation of training in safe working procedures.

Biologically active compounds

- protease inhibitors (e.g. PMSF, Aprotin, Pepstatin A, Leopeptin);
- protein synthesis inhibitors (e.g. cycloheximide, Puromycin);
- transcriptional inhibitors (e.g. a-amanitin and actinomycin D);
- DNA synthesis inhibitors (e.g. hydroxyurea, nucleotide analogs (i.e.
- dideoxy nucleotides), actinomycin D, acidicolin);
- phosphatase inhibitors (e.g. okadaic acid);
- respiratory chain inhibitors (e.g. sodium azide);
- kinase inhibitors (e.g. NaF);
- mitogenic inhibitors (e.g. colcemid); and
- mitogenic compounds (e.g. concanavalin A).

Castor bean (Ricinus communis) lectin: Ricin A, Ricin B, RCA toxins

Diisopropyl fluorophosphate: highly toxic cholinesterase inhibitor; the antidote, atropine sulfate and 2-PAM (2-pyridinealdoxime methiodide) must be readily available

Jaquirity bean lectin (Abrus precatorius)

N-methyl-N'-nitro-N-nitrosoguanidine: carcinogen (this chemical forms explosive compounds upon degradation)

Phalloidin from Amanita Phalloides: used for staining actin filaments

Retinoids: potential human teratogens

Streptozotocin: potential human carcinogen

Urethane (ethyl carbamate): an anesthetic agent, potent carcinogen and strong teratogen, volatile at room temperature

***See the DEHS Web site at http://www.dehs.umn.edu/safety/lsp/ for appendices.**