UTSA Laboratory Safety

STANDARD OPERATING PROCEDURE
GUIDANCE TO LABORATORIES

Procedures and protocols for each individual laboratory or group of laboratories should be developed to minimize potential emergency situations. Standard operating procedures (SOP) for using specific chemicals or apparatus that could cause injury should be developed. This guidance is meant to inform what procedures or protocols should be developed and what information should be contained within the procedures or protocols. The SOPs should be brief and to the point. If it is too lengthy, it will not be read. However, they must also be complete and designed for consistent, reproducible outcomes. SOPs can also be extremely valuable in academic laboratories and can be employed anytime there is procedure that potentially more than one person will use in a research group. They can be written to:

- outline sampling procedures, describe the proper procedures for the transportation of research materials;
- standardize the methods of training for often used experimental methods and/or analytical instrumentation; and to
- document the methods used in data handling and/or analysis.

To be effective, SOPs need to describe not only what needs to happen, but who is qualified to carry it out, and under what conditions the procedure can be performed reliably.
SOPs can be invaluable to students involved in undergraduate research in providing written guidelines detailing how to carry out new/unfamiliar methods reliably. The action of authoring an SOP can be beneficial in helping you to think through the procedures you use in a thoughtful step-by-step manner and document clearly and succinctly in writing your understanding.

What information is needed in a laboratory standard operating procedure?
Well-developed Standard Operating Procedures (SOPs), or Standard Laboratory Practices, are essential tools for any laboratory that manipulates chemical and/or biological research materials. SOPs serve as a resource to train new lab staff, supplement recurrent training curriculum, and as a valuable reference in the event of an emergency. The following components should be considered when establishing *minimum* best practices in a research laboratory. However, the value of an SOP only holds merit if it is implemented by all laboratory workers and enforced by the Principal Investigator.

Principal Investigator Responsibilities
The Principal Investigator (PI) has the primary responsibility for ensuring that their laboratory is safe through establishment of the initial risk assessment, administrative controls, and by ensuring that all work is conducted with appropriate engineering controls. PIs must adhere to all applicable guidelines and regulations. The PI is responsible for the safe use of reagents and equipment in their laboratory.

Laboratory Staff/Student Responsibilities

The laboratory staff and students are responsible for knowing the potential hazards contained within their respective work areas, in particular the biological material and appropriate procedures and practices to be used in the laboratory. Laboratory employees must follow approved laboratory procedures and safety guidelines at all times. For information regarding minors working in laboratory areas, please contact EHS.

Training

SOPs should be reviewed by the PI or at least one peer who is doing similar research. Once an SOP is written, everyone performing work described by that SOP should read it carefully and sign the SOP Training Documentation page at the end of the SOP Template. The location of SOPs should be noted in the "Standard Operating Procedures (SOPs)" section of each laboratory's Chemical Hygiene Plan.

Laboratory staff should have both instructional and hands-on training for all biological, chemical, and physical hazards present in the laboratory. Laboratory-specific training should be provided by the PI, lab manager or senior scientist who has several years' experience working with the biological materials or chemicals and can direct staff in safe handling of the materials so as to avoid any accidental exposures. Technicians and students should demonstrate proficiency in techniques before being permitted to perform laboratory procedures independently.

All training sessions should be documented, to include the training session topic, information covered, instructor, date, and attendees. Depending on the significance of the hazards involved, curriculum training and proficiency testing may be warranted. A training record table is included at the end of the SOP Template

All research groups should have copies of their SOPs available in the lab at all times. This can easily be achieved by maintaining a binder with sections for each SOP, including training/acceptance records.

GENERAL FORMAT OF SOP

General Emergency Contact Information
The first page of the SOP should include emergency contact information so that it is quickly and easily accessible, and the laboratory location.

Section 1 - Purpose
What is the overall purpose of the SOP?
As an example: *This SOP has been developed to outline the hazards involved with research using bacterial pathogens and how to safely manipulate these materials to avoid any lab acquired infection (LAI).*

Section 2 — Process
List the process or type of process involving hazardous chemicals - for example, "atomic absorption spectroscopy for heavy metals." Include any unique equipment used. If the term "process" does not apply, proceed to Section 3.

Section 3 —Hazardous Chemicals Involved
List the hazardous chemicals (or class of chemicals) involved, including any hazardous products or by-products. Material Safety Data Sheets (MSDSs) for highly reactive or unstable chemicals should be on hand; MSDSs for all chemicals should be readily accessible. MSDSs for most chemicals are available through the EHS web site or through the chemical manufacturer.

Section 4—Potential Hazards
Describe the potential dangers for each hazardous chemical, biological material, or each element of the hazardous process or procedure. Include physical, health, and environmental hazards. To find hazard information, look up the MSDSs (available from the EHS web site or from chemical manufacturers) or look online for other sources such as Cameo Chemicals, a National Oceanic and Atmospheric Administration (NOAA) database that provides hazard information in a user-friendly format. In addition, the Millipore Sigma web site has technical bulletins that provide detailed information about various processes, equipment and classes of chemicals.

Section 5—Approvals Required
List the circumstances under which a particular laboratory operation, procedure, or activity requires prior approval from the Principal Investigator (PI), laboratory supervisor, or other personnel.

Section 6—Designated Area
Consider establishing a designated area for this operation within the laboratory. A fume hood, portion of the laboratory, or the entire laboratory may be the designated area.

Section 7—Special Handling Procedures and Storage Requirements
Describe special handling procedures and storage requirements including, (but not limited to): specific laboratory techniques; ventilation requirements; temperature controls; chemical incompatibilities;

special containment devices; and access restrictions. If applicable, describe safe methods to transport the chemicals.

Section 8—Personal Protective Equipment (PPE)
List the PPE required for each activity or chemical. PPE includes gloves, laboratory coats, safety glasses, goggles, face shields, and respirators. If applicable, indicate the type of PPE (e.g., gloves, splash protection) needed for each phase of a process. For help with PPE selection or to determine if respirator use may be necessary, contact EHS.

Section 9—Engineering/Ventilation Controls
List any engineering controls used. An engineering hazard control is generally defined as equipment or physical infrastructure that reduces or removes hazards from the laboratory. It can include specifically selected and arranged experimental equipment. Common engineering controls include the fume hood, glove box, biosafety cabinet and laser interlock.

Section 10—Spill and Accident Procedures
Describe procedures for handling potential emergencies related to this chemical or process such as accidental releases to the sanitary sewer, spills, fires, chemical burns to skin or eyes, shattered glassware, etc. Note the location of emergency equipment such as spill kits, emergency eyewash/showers, fire extinguishers, etc. Take care to describe any special procedures for dealing with personal exposures (e.g., calcium gluconate should be used for HF exposures). Identify the location of emergency response phone numbers and emergency contact phone numbers. **Emergency situations** can affect your ability to think clearly. It is important that everyone feel confident in their understanding of proper emergency procedures, including nearby lab members whose work may not be related to this SOP but who may need to respond in an emergency.

Section 11 —Waste Disposal
Describe waste disposal procedures for chemicals and biological materials.

Section 12—Decontamination
Discuss any appropriate decontamination procedures for equipment, glassware, and clothing. Where applicable, include controlled areas (e.g., fume hoods, glove boxes) in the text.

Section 13 — Process Steps (Optional)
This section is useful for particularly complex or multi-step processes. List each step of the process or procedure chronologically on the left side of the SOP Template page. On the right side of the page and directly across from the corresponding process steps, list precautionary safety measures to be taken, including the use of specific laboratory techniques and PPE. If possible, describe indicators (visual or otherwise) which show whether the reaction, equipment, etc. is working safely as intended or that a hazardous situation may be developing.

Training
Include at the end a place to record review and acceptance of the SOP by lab personnel. Add additional pages as required.