Angelo State University

Chemical Hygiene Plan

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Chemical Hygiene Committee

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Chemical Hygiene Officer

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Acronyms used in this Chemical Hygiene Plan

ACGIH	American Conference of Governmental Industrial Hygienists
ASU	Angelo State University
BBP	Bloodborne Pathogen
BERT	Building Emergency Response Team
CHP	Chemical Hygiene Plan
EHSRM	Environmental, Health, Safety, and Risk Management
EXP	Exposure Control Plan
IARC	International Agency for Research on Cancer
M	Molar
mA	Milliamps
MSDS	Material Safety Data Sheet (obsolete terminology - see SDS)
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PPE	Personal Protective Equipment

REL	Recommended Exposure Limit
SDS	Safety Data Sheet
SOP	Standard Operating Procedures
TLV	Threshold Limit Value
TOXNET	An online toxicology information source
UPD	University Police Department

1. Purpose

1.1 The Chemical Hygiene Plan protects Angelo State University (ASU) faculty, students, visitors, and staff from physical and chemical health hazards associated with laboratory environments. This document supplements OP 34.16, Chemical Hygiene Plan.

2. Scope and Key Terms

2.1 This procedure applies to all Angelo State University laboratories that use chemicals, to all university employees and students, and to external organizations that work in or use ASU laboratories. **Remember, safety is everyone's responsibility.**

2.2 Laboratory Supervisor means the faculty member or graduate assistant overseeing the curriculum and laboratory preparation.

2.3 Laboratory Personnel means all persons present or participating in a teaching or research laboratory, including employees, students, and volunteers. Depending on the context, the laboratory supervisor may also be included or excluded.

2.4 Lab Coordinator means the specific person(s) designated by a department to maintain equipment and supplies, provide supervision and training, and coordinate chemical supply ordering and receiving.

2.5 Laboratory means the teaching and research space being used and not a specific room. A course may use multiple rooms, and a room may be used by multiple classes and Laboratory Supervisors.

3. Contact Information

3.1 Emergencies

A) General emergency number: 9-911
B) ASU Police Department Emergency number: (325) 942-2071 (x2071)
C) City of San Angelo Fire Department: (325)657-4283
D) City of San Angelo Police Department: (325) 657-4315
E) Poison Control number: 1-800-222-1222
F) ASU EHSRM (325) 942-2180 (x2180) or (325) 486-6725

3.2 Non-Emergencies

A) For small spills or with questions or concerns about laboratory safety, contact EHSRM at (325) 942-2180 (x2180), (325) 486-6725 (x6725), or (325) 486-6275 (x6275).

4. Culture of Safety

4.1 Safety and training programs have been implemented to promote the safe handling of chemicals from ordering to disposal and to train Laboratory Personnel in safe practices. The welfare and safety of everyone depend on clearly defined attitudes of teamwork and personal responsibility. Learning to participate in this culture of habitual risk assessment, experiment planning, and consideration of worst-case possibilities - for oneself and fellow workers - is as much part of scientific education as learning the theoretical background of experiments or the step-by-step protocols for professionally doing them. A crucial component of chemical education for all personnel is to nurture basic attitudes and habits of prudent behavior so that safety is a valued and inseparable part of all laboratory activities throughout our careers.

4.2 A sound safety organization that is respected by all requires the participation and support of laboratory administrators, workers, and students. A successful health and safety program requires a daily commitment from everyone in the organization. To be most effective, safety and health must be balanced with and incorporated into laboratory processes.

4.3 Laboratory Personnel must consider the health, physical, and environmental hazards of the chemicals they plan to use in an experiment to perform work prudently. However, the ability to accurately identify and assess laboratory hazards must be taught and encouraged through training and ongoing organizational support. This training must be at the core of every good health and safety program. For management to lead, personnel to assess worksite and laboratory hazards, and hazards to be eliminated or controlled, everyone involved must be trained.

5. Procedures

5.1 Standard Operating Procedures

A) Only Laboratory Supervisors can authorize experiments.

1) Laboratory Supervisors are faculty or staff of ASU who are assigned as the individual responsible for controlling or administering the work being conducted in a specific laboratory.

B) Any student, faculty, or staff who disregards safety policies or procedures and puts themselves or others at risk is subject to disciplinary actions per established University procedures. This includes:

1) Unauthorized experiments.

2) Neglect of established protective procedures.

3) Neglect of proper PPE use.

C) Laboratory Supervisors may be held responsible for failure to enforce safety procedures.

D) Never leave biological, radiological, or chemical material or containers unattended outside a laboratory.

5.2 Emergency Procedures

A) Fire alarm policy: When a fire alarm sounds in the facility, evacuate immediately after extinguishing all equipment flames. Check on and assist others who may require help evacuating.

B) Follow the instructions of the BERT (Building Emergency Response Team) member.

C) Emergency safety equipment: The following safety elements should be met:

1) A written emergency action plan has been provided to workers;

2) Fire extinguishers, eyewash units, and safety showers are available and tested regularly; and

3) First-aid equipment, fire alarms, and telephones are available and accessible.

5.3 Accidents, Spills

A) Follow SDS or Laboratory Chemical Safety Summary recommendations for eye and skin contact, ingestion, respiratory protection, and clean-up.

B) For small spills follow the instructions on the chemical spill kits located in each laboratory.

1) Contact EHSRM (325) 942-2180 or x2180 for assistance or to pick up and replace a spill kit.

C) For large spills immediately evacuate the area and call 9-911 or x2071 (UPD).

D) The Laboratory Emergency Planning resource on the EHSRM website contains more detailed information on spill control and spill response.

5.4 Minimize All Chemical Exposures and Risks

A) Few laboratory chemicals are without hazards, so general precautions for handling all laboratory chemicals have been adopted. Specific guidelines for chemicals used frequently or particularly hazardous have also been adopted.

B) Laboratory Personnel should work under conditions that minimize the risks from known and unknown hazardous substances. Before beginning any laboratory work, the hazards and risks associated with an experiment or activity should be determined, and the necessary safety precautions should be implemented. Every laboratory should develop facility-specific policies and procedures for the highest-risk materials and procedures used in their laboratory. To identify these, consideration should be given to past accidents, process conditions, chemicals used in large volumes, and particularly hazardous chemicals.

5.5 Perform Risk Assessments for Hazardous Chemicals and Procedures Before Laboratory Work:

A) Identify chemicals to be used, amounts required, and circumstances of use in the experiment. Consider any special employee or laboratory conditions that could create or increase a hazard. Consult sources of safety and health information and experienced scientists to ensure that those conducting the risk assessment have sufficient expertise.

B) Evaluate the hazards the chemicals pose (located in the respective safety data sheet) and the experimental conditions. The evaluation should cover toxic, physical, reactive, flammable, explosive, radiation, biological hazards, and any other potential hazards posed by the chemicals.

C) Reaction scale-ups pose special risks for various physical and chemical reasons, which merit additional prior review and precautions.

D) Select appropriate controls to minimize risk, including engineering controls, administrative controls, and personal protective equipment (PPE) to protect workers from hazards. The controls must ensure that OSHA's Permissible Exposure Limits (PELs) are not exceeded. Prepare for contingencies and be aware of ASU's procedures in emergencies and accidents.

E) One sample approach to risk assessment is to answer these five questions:

1) What are the hazards?
2) What is the worst thing that could happen?
3) What can be done to prevent this from happening?
4) What can be done to protect from these hazards?
5) What should be done if something goes wrong?

5.6 Avoid Underestimation of Risk

A) Even for substances of no known significant hazard, exposure should be minimized; special precautions should be taken when working with substances that present special hazards.

Reference should be made to each chemical's safety data sheet (SDS). Unless otherwise known, one should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.

B) Determine the physical and health hazards associated with chemicals before working with them. This determination may involve consulting literature references, laboratory chemical safety summaries (LCSSs), SDSs, or other reference materials. Consider how the chemicals will be processed and determine whether the changing states or forms will change the nature of the hazard. Review your plan, operating limits, chemical evaluations, and detailed risk assessment with other chemists, especially those with experience with similar materials and protocols.

C) know ASU's policies and procedures for handling an accidental spill or fire before working with chemicals. Emergency telephone numbers should be posted in a prominent area. Know the location of all safety equipment and the nearest fire alarm and telephone.

5.7 Adhere to the Hierarchy of Controls

A) The hierarchy of controls prioritizes intervention strategies based on the premise that the best way to control a hazard is to systematically remove it from the workplace rather than relying on employees and students to reduce their exposure. The measures that may protect employees and students (from most effective to least effective) are engineering controls, administrative controls, work practices, and PPE. Engineering controls, such as chemical hoods, physically separate the employee from the hazard. Administrative controls, such as employee scheduling, are established by management to help minimize the employees' exposure time to hazardous chemicals. Work practice controls are tasks performed in a designated way to minimize or eliminate hazards. Personal protective equipment and apparel are additional protection provided under exceptional circumstances and when exposure is unavoidable.

B) Face and eye protection is necessary to prevent ingestion and skin absorption of hazardous chemicals. At a minimum, safety glasses, with side shields, should be used for all laboratory work. Chemical splash goggles with face shield are more appropriate than regular safety glasses to protect against hazards such as projectiles, as well as when working with glassware under reduced or elevated pressures (e.g., sealed tube reactions), when handling potentially explosive compounds (particularly during distillations), and when using glassware in high-temperature operations. Do not allow laboratory chemicals to come in contact with skin. Select gloves carefully to ensure that they are impervious to the chemicals being used and are of correct thickness to allow reasonable dexterity while also ensuring adequate barrier protection.

C) Lab coats and gloves should be worn when working with hazardous materials in a laboratory. Wear closed-toe shoes and long pants or other clothing that covers the legs when in a laboratory where hazardous chemicals are used. Additional protective clothing should be used when there is significant potential for skin-contact exposure to chemicals. The protective characteristics of this clothing must be matched to the hazard. Never wear gloves or laboratory coats outside the laboratory or into areas where food is stored and consumed.

5.8 Provide Laboratory Ventilation

A) The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere using chemical fume hoods and other ventilation devices. Laboratory chemical fume hoods are the most important components used to protect Laboratory Personnel from exposure to hazardous chemicals.

1) Toxic or corrosive chemicals that require vented storage should be stored in vented acid cabinets under a chemical fume hood.

2) Chemical waste should not be disposed of by evaporation in a chemical fume hood.

3) Always keep chemical fume hood areas clean and free of debris.

4) Solid objects and materials, such as paper, should be prevented from entering the exhaust ducts as they can reduce the air flow.

5) Chemical fume hoods should be maintained, monitored, and routinely tested for proper performance. ESHRM will coordinate annual certification.

B) A laboratory ventilation system should include the following characteristics and practices:

1) Heating and cooling should be adequate for the comfort of students, workers, and operation of equipment. Before modification of any building HVAC, the impact on laboratory or hood ventilation should be considered, as well as how laboratory ventilation changes may affect the building HVAC.

2) A negative pressure differential should exist between the amount of air exhausted from the laboratory and the amount supplied to the laboratory to prevent uncontrolled chemical vapors from leaving the laboratory.

3) Local exhaust ventilation devices should be appropriate to the materials and operations in the laboratory.

4) The air in chemical laboratories should be continuously replaced so that concentrations of odoriferous or toxic substances do not increase during the workday.

5) Laboratory air should not be recirculated but exhausted directly outdoors.

6) Air pressure should be negative with respect to the rest of the building.

7) Ventilation systems should be inspected and maintained on a regular basis. There should be no areas where air remains static or areas that have unusually high airflow velocities.

C) Before work begins, Laboratory Personnel should be provided with proper training that includes how to use the ventilation equipment, how to ensure that it is functioning properly, the consequences of improper use, what to do in the event of a system failure or power outage, special considerations, and the importance of signage and postings.

5.9 Avoidance of Routine Exposure

A) Every chemical has the potential to be harmful which is why students, faculty, and staff of ASU shall treat **ALL** chemicals as if they are harmful to human health.

B) All chemical mixtures shall be treated as hazardous as its most hazardous component. When risk is unknown, treat as extremely hazardous.

1) For assistance contact EHSRM.

C) Do not allow direct contact with any chemical.

1) Wear eye and hand protection as directed by the SDS for the chemical being always used while in the laboratory.

2) Follow PPE recommendations provided in SDS.

(a) Wear lab coats, aprons, or a combination of both to minimize chances of exposure and remove lab coats and aprons prior to exiting the laboratory.

(b) Inspect gloves prior to use.

(c) Wash hands immediately upon removal of gloves.

3) Wear respirators and other personal protective equipment (PPE) as recommended by the SDS, Laboratory Chemical Safety Summary, NIOSH Pocket Guide to Chemical Hazards, TOXNET, or another reputable source.

(a) Contact EHS for assistance in PPE selection or to determine permissible exposure levels (PEL). Respirator use requires medical fit test and annual evaluation.

D) Concentrations above the OSHA PEL shall be considered a hazardous condition and require immediate actions to either reduce the concentration or exit the laboratory and notify EHSRM. If a chemical does not have an OHSA PEL, use either the NIOSH REL or the ACGIH TLV whichever is more protective (contact EHSRM for assistance).

E) Do not use smell or taste to identify any chemical.

F) Release of toxic substances into warm or cold rooms (recirculated air) shall not be allowed.

G) Use fume hoods appropriate for the work to be conducted.

5.10 Chemical Selection and Handling

A) Prior to working with any chemical, assure that the quality of the available ventilation system is appropriate.

B) The quantity of chemical being used should be as small as possible to complete the required work.

C) Any use of methanol, ethanol, isopropanol, acetone, etc. or other flammables should be either avoided completely or restricted to minimal amounts, which have been safely dispensed at remote locations.

D) Bulk containers (> 2L) of flammable liquids must never be positioned or handled near viewing audiences, especially when there are potential ignition sources present.

E) Chemicals shall be handled in the manner recommended in the SDS.

F) Read and adhere to the chemical labels and SDS before handling any chemical.

G) Know chemical and physical hazards associated with the chemicals being used in the laboratory and ensure you have the proper training, equipment, and procedures in place to safely conduct work.

H) Proper PPE must be worn when handling hazardous chemicals.

I) Do not hold chemical containers by their cap.

J) Point test tubes away from yourself and others in the laboratory.

K) When using carts to transport chemicals only carts with side rails shall be used.

L) Always add acid to water "A to W dilution," not the other way around. (Note: mixing concentrated acids/bases with water can cause violent reactions, use caution)

M) Do not mix organic chemicals with oxidizers.

N) Separate incompatible chemicals during storage and do not mix incompatible materials, for assistance contact EHSRM.

1) See Appendix A for chemical compatibility storage groups and a list of chemicals within each group.

5.11 Chemical Procurement, Distribution, and Storage

A) Chemical Procurement:

1) Information on proper handling, storage, and disposal should be known to those who will be involved before a substance is received.

2) All research and teaching chemicals must be purchased through a centralized process, with faculty members purchasing chemicals through the department office coordinator.

3) Only containers with adequate identifying labels should be accepted.

4) An SDS is required for all chemicals where we do not already have a current SDS.

5) SDSs may be maintained centrally if the information is readily available for reference in the laboratory.

6) Materials Management is the centralized receiving location for laboratory chemicals for the main campus, where the package will be received and delivered to the department coordinator.

(a) Compressed gas cylinders may be delivered directly to laboratories and departments.

(b) The MIR may receive direct shipments of chemicals used in agricultural instruction and research and shall develop standard receiving processes.

7) Shipments with breakage or leakage should be refused or opened in a chemical hood.

8) Only the minimum amount of the chemical needed to perform the planned work should be ordered.

9) Purchases of Extremely Hazardous Substances must be reviewed and approved by the CHO.

10) Proper protective equipment and handling and storage procedures should be in place before receiving a shipment.

B) Chemical Storage:

1) Laboratory Supervisors are the only authorized personnel to access chemicals stored in chemical storerooms.

2) Chemicals should be separated and stored according to hazard category and compatibility.

3) Manufacturer SDS and label information should be followed for storage requirements.

4) Maintain existing labels on incoming containers of chemicals and other materials.
5) Labels on containers used for storing hazardous chemicals must include the chemical identification and appropriate hazard warnings.
6) The contents of all other chemical containers and transfer vessels, including, but not limited to, beakers, flasks, reaction vessels, and process equipment, should be properly identified.
7) Chemical shipments should be dated upon receipt and stock rotated.
8) Peroxide formers should be dated upon receipt, again dated upon opening, and stored away from heat and light with tightfitting, nonmetal lids.
9) Secondary containment devices should be used, as necessary.
10) Consult the SDS and keep incompatibles separate during transport, storage, use, and disposal.
11) Oxidizers, reducing agents, and fuels should be stored separately to prevent contact in the event of an accident.
12) Chemicals should not be stored in the chemical hood, on the floor, overhead, in areas of egress, on the benchtop, or in areas near heat or in direct sunlight.
13) Laboratory-grade, flammable-rated refrigerators and freezers should be used to store sealed chemical containers of flammable liquids that require cool storage. Do not store food or beverages in the laboratory refrigerator.
14) Highly hazardous chemicals should be stored in a well-ventilated and secure area designated for that purpose.
15) Flammable chemicals should be stored in a spark-free environment and in approved flammable-liquid containers and storage cabinets. Flammable liquids should not be dispensed from a container within a storage cabinet unless the storage cabinet is properly grounded due to potential static charge build-up.
16) Chemical storage and handling rooms should be controlled-access areas. They should have proper ventilation, appropriate signage, diked floors, and fire suppression systems.

5.12 Eating, Drinking, Smoking

A) Smoking or vaping shall not occur in any ASU laboratory.
B) Eating and drinking shall not be allowed in a laboratory that has chemical, biological, or radiological materials. This includes the chewing of gum, tobacco, and the use of snuff or medications of any kind.
C) Do not place hands or fingers in or near the mouth.
D) Do not place hands near the face. This includes the application of cosmetics.
E) Wash hands immediately and thoroughly when leaving the laboratory even if gloves were worn.
F) Food items shall not be allowed in a laboratory.
    1) Exceptions based on the researcher's need can be made, contact EHSRM.

2) If exceptions are made, food items intended for human consumption shall be stored in a refrigerator (labeled "FOOD ONLY") that contains no chemical, biological, or radiological materials.

3) Refrigerators used to store/hold items for laboratory use shall not contain food items for human consumption and shall be labeled "LAB USE ONLY" and "NO FOOD OR DRINK."

5.13 Equipment and Glassware

A) Proper equipment selection and maintenance is essential to a safe laboratory.

B) Inspect all glassware and equipment prior to each use.

1) Follow manufacturer recommendations for inspections and maintenance.

2) Documentation of all equipment inspections and maintenance are the responsibility of the Laboratory Supervisor and maintenance and inspection records must be stored in a binder specific for that piece of equipment. Laboratory Supervisors may contact EHSRM for assistance in scheduling maintenance or inspections and record keeping.

3) Dispose of damaged or broken glassware in broken glass containers.

C) Glassware must be properly handled and stored. Any glassware with cracks or chips must not be used and must be discarded immediately in an approved broken glass container.

D) Vacuum-jacketed glassware must be handled with extreme care to prevent implosion.

E) Do not handle broken glass with bare hands. Use tongs, tweezers, puncture-resistant gloves, or brush/broom and dustpan.

F) Use extreme caution when using force to attach or remove hoses, tubing, or other items to or from glass. Always wear appropriate PPE to ensure hands, body, and eyes are protected.

5.14 Exiting the Laboratory

A) Ensure work area is clean and uncluttered prior to exiting.

B) Ensure all chemicals are properly labeled and stored before exiting.

C) Ensure hotplates are unplugged and no open flames exist before exiting.

D) Remove lab apparel prior to exiting the laboratory.

E) When leaving a laboratory, always wash your hands as soon as feasible.

5.15 Horseplay

A) Horseplay shall not be allowed in ASU laboratories.

1) Horseplay includes "rough fun," doing foolish, useless things, or using little or no judgment or common sense.

2) Horseplay may distract, startle, or confuse other workers/students and may create hazardous situations.

5.16 Mouth Pipetting

A) The use of mouth suction (pipetting, siphoning) shall not be allowed.

B) Always use mechanical means to create suction.

5.17 Personal Apparel

A) Long hair and loose clothing shall be always confined in a laboratory, including facial hair.

B) Shoes shall be always worn in a laboratory. Sandals, perforated shoes, and sneakers are not recommended for students. Staff and Laboratory Personnel shall wear proper shoes for the chemical and quantity being used as directed by the SDS.

C) Minimize skin exposure as appropriate by wearing long pants and long sleeves or cover exposed skin with a lab coat or appropriate PPE. Follow guidance of SDS or contact EHSRM.

5.18 Personal Protection Equipment

A) Personal Protective Equipment (PPE) includes all clothing and work accessories designed to protect employees from workplace hazards. Protective equipment should not replace engineering, administrative, or procedural controls for safety; it should be used in conjunction with these controls. Laboratory Personnel must wear protective equipment as required and when instructed by a supervisor.

B) Always wear the appropriate hand and arm protection.

C) Select and wear appropriate body protection.

D) Select and wear appropriate hearing protection.

E) Use safety glasses, safety goggles, or face shields, as required.

F) Do not wear contact lenses in laboratories without full eye protection.

G) Use proper head and foot protection as needed.

H) Respirators must be used when dealing with inhalation hazards above regulated or recommended atmospheres.

5.19 Housekeeping

A) **Work areas shall remain clean and uncluttered.**

B) Safety equipment must remain clear of obstructions at all times.

1) Fire extinguishers (3-foot clear zone).

2) Safety showers (unobstructed pathway to shower required).

3) Eyewash stations (unobstructed pathway to eyewash required).

C) Breaker panels require a clearance of 3 feet.

5.20 Planning

A) Proper planning is essential in creating a safe work environment when handling chemicals.

B) Know the locations of exits and all emergency exit routes prior to conducting any experiment.

C) Know emergency phone numbers prior to conducting any experiment.

1) General emergency number: 9-911
2) ASU Police Department Emergency: (325) 942-2071 (x2071)
3) City of San Angelo Fire Department: (325) 657-4283
4) City of San Angelo Police Department: (325) 657-4315

5) Poison Control number: 1-800-222-1222
6) EHSRM (325) 942-2180 (x2180) or (325) 486-6725

D) Know all chemical and physical hazards associated with chemicals being used.

1) Select procedures based on chemical and physical hazards.

2) Select equipment based on chemical and physical hazards, examples include:

(a) Fume hoods designed for explosives or perchloric acid.

(b) Lead aprons, gloves, etc. when working with radiation.

(c) Cryo-protective PPE when dealing with cryo-chemicals.

(d) Shields for high pressure experiments.

(e) Class D fire extinguisher for combustible metals.

E) Know the location and proper operation of all safety equipment.

F) Understand proper disposal of chemicals.

1) Do not pour chemicals down a drain unless the SDS indicates that it is appropriate.

2) Chemicals that are outdated or no longer needed are appropriately packaged, labeled, and prepared for storage under the supervision of a Laboratory Supervisor or Lab Coordinator.

3) Once the chemicals are no longer needed, coordinate storage in the Cavness basement vault through the Chemistry or Biology department chairs.

4) Students are not permitted in the vault unless accompanied by a staff member.

5) A person with a key to the vault must remain outside of the vault at all times during which it is occupied.

6) Only EHRSM may designate chemicals as “waste.”

(a) Prior to generation of waste chemicals contact EHSRM for assistance in waste characterization, proper management, and disposal.

5.21 Unattended Operations

A) ASU understands that certain experiments require continuous operation. If experiments need to run unattended, the Laboratory Supervisor must plan for interruptions in utility services. Operations should be designed to be fail-safe, and plans must be made to avoid hazards in case of failure.

B) Arrange to have someone check on your equipment while you are away if possible.

1) Ask a competent and trained colleague.

2) Contact EHSRM

3) Contact UPD

5.22 Hood Use

A) Laboratory fume hoods are designed to protect Laboratory Personnel by preventing contaminants such as chemical vapors, dusts, mists, and fumes from escaping into the laboratory environment. Laboratory fume hoods also provide Laboratory Personnel with a

physical barrier to chemicals and their reactions. Laboratory Supervisors should be familiar with the ASU Fume Hood Procedure.

B) Fume hoods are inspected annually and must have the date of inspection affixed to the chemical fume hood. Contact EHSRM in the event that a fume hood's inspection has expired.

C) Do not put your head in the hood when contaminants are being generated.

D) Verify that the fume hood exhaust system and controls are operating correctly.

E) Do not store chemicals or apparatus in the hood. Store hazardous chemicals in an approved safety cabinet.

F) Place any heat generating equipment in the rear of the hood.

G) Keep the slots in the hood baffle free of obstruction by apparatus or containers.

H) Place large apparatus to the rear of the hood and raise it off the surface with two to three-inch blocks to allow airflow under the object and into the lower rear baffle.

I) Minimize foot traffic past the face of the hood.

J) Keep laboratory doors and windows closed as drafts may interfere with proper vent hood operation.

K) Do not position fans or air conditioners in a manner that will direct airflow across the face of the hood and interfere with containment.

L) Do not block air supply vents or exhausts in the room.

M) Do not remove the hood sash or panels except when necessary for apparatus setup. Replace sash or panels before operating.

N) Do not place electrical receptacles or other spark sources inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in the hood unless approved by the manufacturer.

O) Spills should be neutralized and cleaned immediately.

P) Wear proper PPE when dealing with hazardous substances.

Q) Do not open the sash rapidly.

R) If fumes or odors are present, stop operating the fume hood, close the sash and contact EHSRM.

5.23 Vigilance

A) Remain alert to notice unsafe conditions and take immediate actions to either correct unsafe conditions or evacuate the laboratory.

B) Be aware of others in the laboratory and report any symptoms of exposure to the Laboratory Supervisor immediately.

C) Working in a laboratory while under the influence of any substance that impairs one's judgment or ability to work safely is not allowed at ASU.

D) Be aware of work being conducted in neighboring laboratories, especially if that work is being conducted alone. Take the time to check up on lone workers.

E) Report unauthorized individuals to UPD immediately.

F) Never use your key or swipe access to allow another person entry into a laboratory.

5.24 Waste Disposal

A) Laboratory Supervisors must comply with ASU procedures regarding waste. Remember, chemicals are not declared as "waste" until EHSRM makes that determination. Contact EHSRM regarding any questions about chemicals that are no longer needed in your laboratory. All chemical waste must include appropriate labelling to include a pictogram(s), a signal word, hazard and precautionary statements, the product identifier, and supplier identification.

B) Biological Waste

1) All contaminated sharps are to be discarded as soon as feasible in sharps containers located as close to the point of use as feasible.

(a) Contact EHSRM to have sharps containers removed or replaced.

2) Regulated waste, other than sharps, is placed in appropriate containers that are closable, leak resistant, labeled with a biohazard label, and closed prior to removal. If outside contamination of the regulated waste container occurs, use approved secondary containment or decontaminate with 15% Clorox solution and contact EHSRM for assistance in waste disposal.

5.25 Working Alone

A) ASU prohibits working alone when using hazardous materials and equipment or hazardous procedures. For example, pressurized or evacuated glassware (e.g., rotary evaporators) would be considered hazardous equipment.

B) ASU recommends that no undergraduate Laboratory Personnel work alone.

C) Take extra precaution when working alone with high-speed equipment.

D) Working alone with infectious materials is prohibited.

E) Take extra precaution when working alone with equipment that poses a risk of fire or electrocution.

F) Use the "buddy" system if possible. Working alone must be approved by the Laboratory Supervisor prior to conducting work.

1) Laboratory Supervisor must know the work to be done and the time the work will be conducted.

G) If others are in the building, lone workers shall notify at least one other person as to the work being conducted, the room, and the timeframe the worker expects to be alone in the laboratory.

H) If no one is in the building, reconsider working alone. If work must be done contact the University Police Department and inform them of the work being conducted, the location, and the timeframe expected.

I) If work must be conducted behind locked doors, notify someone in the immediate area with key or swipe access to the laboratory prior to starting work.

5.26 Radiation Safety

A) Any faculty or staff member who desires to work with radioisotopes or radiation-producing devices must apply for and receive authorization from the Radiation Safety Officer or Laser Safety Officer. In addition, Laboratory Personnel who work with sources of radiation must receive formal training in equipment operation, safety guidelines, and emergency procedures.

B) ASU Radiation Safety Procedure can be found in OP 34.11 (Procurement, Usage, and Disposal of Radioactive Materials, Radiation Producing Devices, and Lasers), and by contacting the Radiation Safety Officer or Laser Safety Officer.

1) Items covered in ASU Radiation Safety Procedure include:

(a) Radioactive materials (RAM)

(b) Radiation producing devices (RPD)

(c) Lasers

(1) For awareness, anything above 500 mW is Class IV and anything above 5 mW (but less than 500 mW) is Class IIIb. All other lasers are license exempt.

2) Selection and use of engineering controls, administrative procedures, and PPE.

(a) For assistance contact EHSRM.

C) Radioactive materials may only be used for purposes specifically described in the license.

D) Never eat, drink, smoke, handle contact lenses, apply cosmetics, or take or apply medicine in the presence of radioactive material.

E) Food and drinks must not be allowed in a laboratory containing radioactive materials.

F) Experiments must be planned to minimize exposure by reducing time, using shielding, increasing distance from the radiation source, and utilizing monitoring and decontamination practices.

G) Proper PPE must be used by all personnel in a laboratory running experiments with radioactive materials.

H) An accurate inventory of all radioisotopes must be maintained.

I) All waste materials from experiments involving radioactive materials must be checked for contamination before discarding.

J) Place all materials that are known or suspected to have radioactive contamination in appropriate radioactive waste containers.

5.27 Cryo-material

A) Cryogens can cause extreme tissue damage and are particularly dangerous due to the risk of asphyxiation.

B) Use cryo-material in a well-ventilated area.

C) Ensure pressure relief devices are properly functioning.

5.28 Compressed Gas

A) Inspect each cylinder.

B) Empty cylinders should be removed as soon as the cylinder is known to be empty.

C) Select the smallest cylinder needed to perform the required work.

   1) Cylinders containing toxic gasses should not exceed a lecture-size gas bottle (2'X12')

D) Use a cylinder cart to move cylinders.

   1) Never roll a cylinder or lay a cylinder on its side.

   2) Do not allow a cylinder to fall or strike anything.

   3) Do not allow a cylinder to be struck by anything.

   4) Never move a cylinder without safety caps.

   5) Only vendors shall refill cylinders. Have empty cylinders removed and replacement cylinders delivered.

E) Cylinders must be properly secured at all times both during storage and in the laboratory.

   1) Secure cylinders in an enclosure with a length of chain anchored at both ends to masonry or stone walls, or

   2) Use a synthetic fiber strapping clamped to an immovable object.

   3) Tanks shall be secured by either of the two methods listed above at a height of ⅔ the height of the tank or midway between waist high and shoulder high.

F) Do not purchase bottles if at all avoidable. Leasing bottles ensures ASU laboratories do not become cluttered with empty or half empty bottles.

G) Cylinders must be labeled with the contents and the hazards of the chemical. Do not rely on the color of the bottle for identification.

H) If label is unclear or defaced it must immediately be marked as "UNKNOWN" and notify EHSRM immediately.

I) Laboratory Personnel shall not carry out reactions in, or apply heat to, an apparatus that is a closed system unless it has been designed and tested to withstand pressure.

J) Always use appropriate tools when assembling equipment and valves and never use excessive force. Do not use pliers, vice grips, or similar tooth-jawed tools to change gas fittings. Use only flat faced wrenches to avoid damage to equipment and fittings.

K) Tubing shall not be used to support any weight.

L) Do not over tighten fittings.

   1) Thread connections must match and only parts in good condition shall be used.

   2) Tapered pipe threads must not be joined with parallel machine threads.

   3) Do not force threads.

   4) Never use oil or lubricant on any equipment that will be used with oxygen.

   5) Teflon tape or thread lubricant may be used as appropriate. Metal on metal seals are best as Teflon tape does not hold at high pressure.

M) Select the correct tubing for the chemical being used.

1) Be careful when using copper tubing as it will harden and crack with repeated bending.

2) Metals can become brittle when used with hydrogen or corrosive gasses.

3) Alloys containing nickel or iron can generate carbonyls in carbon monoxide atmospheres.

4) Carbonyls like $NI(CO)_4$ can be toxic by absorption or inhalation. Iron and Manganese carbonyls may be toxic from stainless tubing.

N) If using acetylene or ammonia, laboratory personnel shall not use vessels or equipment containing copper or silver (including joints and solder).

O) Mercury forms amalgams (dissolves into) a number of metals and releases considerable heat in the process. The heat from amalgam formation can cause burns. Additionally, amalgam formation softens and deforms metals, many of which then re-harden upon cooling. This is a particular concern with silver and gold jewelry. Do not use mercury when wearing metal jewelry on your fingers even if you use gloves. Gloves can fail. Other metals that may be of concern are copper, brass, zinc, tin, and lead.

P) Always depressurize prior to making any leak corrections or adjustments to the apparatus.

1) Never attempt to repair a cylinder. If a gas cylinder requires repair, return it to the vendor and get a functional one.

Q) Valve caps shall be kept on the cylinder at all times when the cylinder is not being used.

R) Cylinders should be stored in well-ventilated areas.

1) Do not store near flames, sparks, sources of heat, or electrical circuits.

2) Cylinders need to be kept below $130^{o}F$.

S) Empty cylinders should be labeled as “EMPTY.”

T) When opening the cylinder valve, stand to the side in the event that the face on the regulator becomes a projectile.

U) Cylinders stored outside may become home to a variety of biting or stinging insects. Take extra precaution when approaching these cylinders.

V) If gasses are bubbled into liquids or reaction mixtures make certain to use proper traps to prevent back flow of the liquid into the gas cylinder.

1) Check valves are also required for gas supply lines.

5.29 Corrosive acids and bases

A) Recommend using a rubberized safety bucket when transporting bottles of concentrated acids or bases. Many of these materials may be purchased with plastic over-coatings on the bottles to slow the release of contents if dropped and broken.

B) Wear proper PPE when handling corrosive chemicals.

1) Chemical splash goggles shall be worn at all times when handling corrosives in liquid state (Note: full face shields shall be worn when handling concentrated acids of 10M or more).

(a) Wear same PPE as person handling corrosive materials if you are in the immediate area where corrosives are being used.

2) Face shields are recommended (required for 10M and above).

3) Chemical resistant gloves and aprons should be worn.

4) Use the specially designed rubber transport buckets if moving "bulk" (>2L) chemicals in glass bottles from place to place, especially in hallways.

5) Staff and Laboratory Personnel shall wear proper shoes for the chemical and quantity being used as directed by the SDS. Sandals and perforated shoes shall not be worn in laboratories. The foot, including toes and heels, must be covered.

6) The Laboratory Supervisor is responsible for ensuring proper PPE is being utilized in his/her laboratory.

C) Minimize large volumes of corrosives.

D) Exercise extreme caution when working with concentrated acids or bases.

E) Always add corrosive materials to water not the other way around. Remember to "Always add acid" (AAA).

5.30 Electrically Powered Laboratory Equipment

A) Before using any piece of equipment, the user must be trained in the proper use of the device and use it only as it is designed to be operated.

B) All personnel must know the location of any emergency shutoff switches and know the inherent mechanical and electrical hazards associated with the equipment in use.

C) All personnel must be aware of the amperage and voltage they are using. Even seemingly small currents (10 mA) and relatively low voltages can be dangerous to life or cause sparks that can cause ignition (even 1.5V-9V batteries).

D) Check the condition of any wires, plugs, and panels before using equipment and report any damaged materials.

E) Unplug hotplates and any other thermal equipment after each use. If possible, unplug any equipment that is not in use.

F) When using electrically powered equipment, make sure that you have adequate space to work safely and that you do not pose a threat to those around you.

5.31 Fire, Explosion

A) No more than 12 combined gallons of any flammable materials are allowed outside of the flammable storage cabinet in the laboratory at any time.

B) Any experiments involving flammable material must be done in a well-ventilated area or in a fume hood, and away from any ignition sources.

C) Any individuals handling flammable material must be aware of the hazards that material represents, not just in its current form but also any form it may degrade into during the course of the experiment.

D) In the event of a fire or explosion related emergency, relocate to a safe area and contact local emergency professionals.

1) General emergency number: 9-911
2) ASU Police Department Emergency: (325) 942-2071 (x2071)
3) City of San Angelo Fire Department: (325) 657-4283
4) City of San Angelo Police Department: (325) 657-4315
5) Poison Control number: 1-800-222-1222
6) EHSRM: (325) 942-2180 (x2180) or (325) 486-6725

5.32 Pressurized and Vacuum Operation

A) Do not use material that will corrode the pressurized vessel.

B) Do not carry out reactions in, or apply heat to, an apparatus that is a closed system unless it has been designed and tested to withstand the generated pressure.

C) Operators of pressurized vessels shall record any and all instances of overpressure or over-temperature that occur.

D) Run reactions under pressure in metal equipment, if possible. If glass is required, use a metal reactor with a glass or Teflon liner instead of a glass vessel under pressure.

E) If running a small-scale reaction at low pressure in a glass vessel, the operator shall wrap the vessel in a cloth or mesh that can contain any broken glass in the event the vessel fails.

F) Glass vessels under pressure shall be no more than three-quarters full.

5.33 Carcinogens

A) Work with “Select Carcinogens” must have prior approval from the Chemical Hygiene Officer.

1) Select Carcinogens include any substance that:

(a) Is regulated by OSHA as a carcinogen.

(b) Is listed under the category “Known to be carcinogens” by the Annual Report on Carcinogens published by the National Toxicology Program.

(c) Is listed under Group 1 by the International Agency for Research on Cancer.

(d) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(1) After inhalation exposure of 6 - 7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m(3);

(2) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(3) After oral dosages of less than 50 mg/kg of body weight per day.

2) APPENDIX B contains a list of “Select Carcinogens.” Note: Appendix B is not all inclusive.

B) New chemicals are added as they are discovered to be carcinogens. EHSRM encourages Laboratory Supervisors to regularly ensure the chemicals being used are not “Select Carcinogens.” Links to resources are included in APPENDIX B.

C) Large scale or long-term experiments with carcinogens shall be kept below the occupational exposure limits for the substance in use.

D) Proper PPE must be in use by all personnel handling carcinogenic material.

E) Place carcinogenic material that is no longer needed into an appropriate and properly labeled and sealed container for storage in the basement vault (see section 5.20).

5.34 Acute Toxicants

A) Take special precautions when dealing with chemicals known to cause adverse health effects.

B) Conduct a Toxicity Risk Assessment of any chemicals expected to be used in the laboratory (Note: The Chemical Hygiene Officer is available for assistance upon request).

1) Consult sources of information:

(a) SDS

(b) NIOSH Pocket Guide to Chemical Hazards

(c) TOXNET

(d) EHS

2) Evaluate type of toxicity.

(a) Acutely toxic

(b) Corrosive

(c) Irritant

(d) Sensitizer

(e) Carcinogens

(f) Neurotoxins

(g) Others

3) Evaluate routes of exposure.

(a) Inhalation

(b) Ingestion

(c) Absorption

(d) Injection

4) Evaluate quantitative information on toxicity.

5) Select procedures to reduce exposure.

(a) Engineering controls

(b) Administrative procedures

(c) PPE

6) Prepare contingencies.

(a) First aid

(b) Containment

5.35 Field Work

A) Laboratory work may extend into the field. Field work may expose researchers, faculty, staff, and students to potential risks not outlined in this Chemical Hygiene Plan. It is the responsibility of the Laboratory Supervisor to ensure safety precautions for potential risks are adhered to while in the field. Potential risks include:

1) Thermal/Heat Stress
2) Sunburn
3) Heavy Equipment
4) Agricultural Risks
5) Workplace Hazards
6) Encounters with poisonous or wild animals
7) Fire
8) Inclement Weather
9) Lightning Strike

5.36 Safety Recommendations - Hazards

A) Physical hazards in the laboratory include combustible liquids, compressed gases, reactives, explosives and flammable chemicals, as well as high pressure/energy procedures, sharp objects and moving equipment. Injuries can result from bodily contact with rotating or moving objects, including mechanical equipment, parts, and devices. Personnel should not wear loose-fitting clothing, jewelry, or unrestrained long hair around machinery with moving parts.

1) Ensure that research-specific hazards are evaluated and then controlled by developing specific written protocols and training.
2) Expand existing laboratory safety plans to ensure that all safety hazards, including physical hazards of chemicals, are addressed.
3) Develop a verification program that ensures that the safety provisions of the CHP are communicated, followed, and enforced at all levels within the organization.
4) Document and communicate all laboratory near-misses and previous incidents to track safety, provide opportunities for education and improvement to drive safety changes at the university.
5) Manage the hazards unique to laboratory chemical research in the academic environment. Utilize available practice guidance that identifies and describes methodologies to assess and control hazards.

5.37 Exposure Control Plan

A) The primary principle of biological safety is containment. The term containment refers to a series of safe methods for managing infectious agents in the laboratory. Exposure Control Plans are an integral part in biological safety and must be prepared for site-specific conditions.

B) The elements of biological safety are covered in the Biological Safety Plan. EHSRM can assist Laboratory Supervisors in preparing an exposure control plan.

1) Laboratory Supervisors must notify EHSRM if there is any potential for exposure to bloodborne pathogens prior to conducting work.

2) If Laboratory Personnel are exposed to any media with the potential to transmit bloodborne pathogens, Laboratory Supervisors must immediately notify EHSRM.

C) Circumstances requiring approval from the Chemical Hygiene Officer

1) The following activities require prior approval from the Chemical Hygiene Officer before any laboratory work can begin.

(a) Work involving highly reactive or energetic (explosive) compounds or reactions.

(b) The capture, transportation, housing, experimentation, and any other work or interactions involving poisonous or venomous creatures.

(c) The acquisition, use, and disposal of the following substances require prior approval from the Chemical Hygiene Officer:

(1) Select carcinogens (see 5.33 for definition).

(2) Highly acute toxins

(3) Radioactive materials

(4) Air reactive substances

(5) Water reactive substances

(6) Reproductive Toxins

D) Laboratory Specific Safety Plan

1) A safety plan is a written program developed to establish procedures, protective equipment and standard work practices that promote a safe work environment for all Academic and Research Laboratory Personnel handling hazardous chemicals, equipment, or processes in the workplace. At ASU, Laboratory Supervisors are responsible for ensuring the preparation and training of their Laboratory Safety Plan. Laboratory Personnel may be involved in Plan development and training. The Plan may cover one or more rooms, laboratories, or sites associated with a work group and should consider all health and safety issues (See Appendix E)

2) Written safety protocols and training are necessary to manage laboratory risk.

6. Responsibilities and Authority

6.1 At least one Chemical Hygiene Officer shall be established for ASU.

A) The Chemical Hygiene Officer's responsibilities are:

1) Development and implementation of chemical hygiene policies and practices.

2) Management of procurement, use, and disposal of chemicals.

3) Audits.

4) Knowledge of legal requirements concerning regulated substances.

5) Improvement of chemical hygiene program.

6.2 A Chemical Hygiene Committee shall be formed, and a list of members and the minutes of meetings shall be kept and filed with EHSRM.

A) The Chemical Hygiene Committee shall meet annually to review the current chemical hygiene plan.

6.3 Laboratory Supervisors

A) Laboratory Supervisors are faculty, staff, or graduate assistants of ASU who are assigned as the individual responsible for controlling or administering the work being conducted in a laboratory. Laboratory Supervisors:

1) Are responsible for all experiments that occur in laboratories under their supervision.

2) Are responsible for implementation of all ASU safety procedures and must ensure that safety procedures are followed by all occupants of supervised laboratories.

3) Must ensure laboratory personnel are aware of the chemical and physical hazards associated with the work being conducted in laboratories under their supervision.

4) Are responsible for ensuring all Laboratory Personnel have required training for the work being conducted in laboratories under their supervision. By not later than the second laboratory sessions, all Laboratory Personnel shall receive orientation and complete an exercise that documents their training on additional hazards and procedures for laboratories under their supervision (see section 7.2).

5) Must establish safe procedures based on chemical and physical hazards.

6) Provide regular, formal chemical hygiene and housekeeping inspections, including routine inspections of emergency equipment.

7) Monitor the facilities and chemical fume hoods to ensure they are maintained and function properly. Report problems with the facilities or chemical fume hoods.

8) Must report any evidence of exposure to Laboratory Personnel to EHSRM immediately. The Laboratory Supervisor shall follow up with an Employee Accident/Incident Report or Student Accident/Incident Report, as appropriate.

6.4 Laboratory Personnel (Including Students)

A) Read, understand, and follow all safety rules and regulations that apply to the work area.

B) Plan and conduct each operation in accordance with the institutional chemical hygiene procedures.

C) Promote good housekeeping practices in the laboratory or work area.

D) Notify the supervisor of any hazardous conditions or unsafe work practices in the work area.

E) Use PPE as appropriate for each procedure that involves hazardous chemicals.

6.5 Environmental Safety, Health, and Risk Management (EHSRM)

A) EHSRM plans, organizes, and directs Risk Management, Environmental Health and Safety, Emergency Management, and related programs and activities in accordance with Federal, State, and University laws, regulations, rules, and procedures.

1) EHSRM may adopt and direct policies, practices, or procedures necessary to ensure a safe and healthful workplace and may stop any work or activity determined to be an immediate hazard to life or property.

B) Colleges and departments are responsible maintaining a safe and healthful learning and workplace free from recognized hazards, ensuring work environments and practices are consistent with TTUS and EHSRM policies and practices, and requiring employees and students to comply with regulations, rules, and procedures.

1) EHSRM serves as a technical resource to assist colleges and departments, faculty, staff, and students, as ASU fosters a safe and healthful learning and workplace free from recognized hazards.

2) EHSRM will assist colleges and departments in development and delivery of training.

7. Training

7.1 All Laboratory Personnel must have required training for the work being conducted in laboratories under their supervision. All laboratory students shall be assigned the general Laboratory Safety Training Course in Blackboard and successfully pass the accompanying test prior to the second laboratory session. The Chemical Hygiene Plan shall be made available for review before students participate in a laboratory setting. Laboratory specific safety plan templates are available in appendix E of the Chemical Hygiene Plan.

A) Instructors may, in their sole discretion, assign laboratory credit for review and successfully passing the test or may treat it as pass/fail.

B) Students do not need to retake the program and test unless it is significantly revised, or it is specifically required by their instructor or laboratory supervisor.

7.2 Instructors and laboratory supervisors are responsible for any additional training required due to specific activities or environment.

A) The Laboratory Specific Safety Plan can serve as the basis for the training.

7.3 It is best practice to include a hazard assessment and safety briefing based upon planned activities in every lab. A “safety minute” can be used if no hazard assessment is necessary for the day.

8. Record Retention

8.1 No official state records may be destroyed without permission from the Texas State Library as outlined in Texas Government Code, Section 441.187 and Texas Administrative Code, Title 13, Part 1, Chapter 6, Subchapter A, Rule 6.7. The Texas State Library certifies Agency retention schedules as a means of granting permission to destroy official state records.

8.2 ASU’s Records Retention Schedule is certified by the Texas State Library and Archives Commission. ASU EHSRM will follow ASU’s Records Retention Schedule as stated in the Operating Procedure OP 02.07 Records Retention. All official state records (paper, microform, electronic, or any other media) must be retained for the minimum period designated.

9. Incident Investigation

9.1 ASU considers any unusual event as an incident.

9.2 An incident has neither a positive nor a negative connotation and is an event or occurrence.

9.3 ALL incidents at ASU will be investigated. These investigations allow ASU students, faculty, and staff the opportunity to participate in the safety culture ASU has created, and ensure that any occurrence, no matter how small it may seem, is critically examined to confirm ASU is providing safe laboratory conditions.

9.4 The EHSRM Website includes classroom medical procedures, an Employee Accident/Incident Report, and a Student Accident/Injury Report. These reports should be completed as soon as practicable after the incident has been stabilized and sent to EHSRM. The CHP Incident Investigation Report in Appendix D documents a more thorough review and will be submitted once corrective actions are determined.

9.5 The Human Resources website includes workers' compensation reports for injured employees and witnesses of employee injuries.

9.6 Initial Incident Investigations will be conducted with the Laboratory Supervisor and may include EHSRM.

A) The investigation should identify the information in Appendix D.

1) Along with documenting the incident and how it occurred, the investigation shall focus upon analyzing and identifying root causes and effective and appropriate corrective actions.

2) Corrective actions must be implemented or addressed in another fashion.

3) If corrective actions will take a period to implement, other appropriate warnings or controls must be used as interim methods.

B) EHSRM and the department chair must be notified if a pattern of unsafe procedures or conditions is identified and is not corrected immediately.

C) Completed forms must be sent to EHSRM and the appropriate department chair.

D) An Incident Report Form is attached to this CHP in Appendix D.

Appendix A – Compatible Storage Group Classification System

Compatible Storage Group Classification System

Should be used in conjunction with specific storage conditions taken from the manufacturer's label and MSDS/SDS.

STORAGE GROUPS

Wherever possible, store chemicals in containment cabinets and, where appropriate, secondary spill containment trays.

Standford ChemTracker Categories	A&M System Revised Storage Categories	
G	GEN	General Storage; Not Intrinsically Reactive or Flammable or Combustible
L	FLAM	Non-Reactive Flammables and Combustibles, including solvents
E	Ox	Compatible Oxidizers including Peroxides
F	IA	Compatible Inorganic Acids not including Oxidizers or Combustibles
D	OA	Compatible Organic Acids
C	IB	Compatible Inorganic Bases
A	OB	Compatible Organic Bases
B	W	Compatible Pyrophoric & Water Reactive Materials - Separate from other storage groups
-	T	Toxic / Health Hazard with no other primary safety hazard
-	BIO	Infectious / Select Agents Mutagens / Carcinogens
J	XT*	Acutely Toxic Materials or Poison Compressed Gases
K	XX*	Explosive or Other Highly Unstable Materials
X	X*	Incompatible with ALL other storage groups

***Storage Groups X, XT and XX: Contact AR-EHS (x2270) for specific guidance; also refer to the supplier's MSDS/SDS sheets.**

If space does not allow Storage Groups to be kept in separate cabinets the following scheme can be used with extra care taken to provide stable, uncrowded, and carefully monitored conditions.

SHELF 1

SHELF 2

Isolate Storage Groups "X_" from all other chemicals.

Segregate toxics and biohazards from other chemicals.

Storage group W is incompatible with any other storage group.

APPENDIX A

Examples of Chemicals in the Compatible Storage Groups, Stanford University ChemTracker

Group A: Compatible Organic Bases

- Ethanolamine
- Isopropylamine
- Triethanolamine
- Triethylamine
- TEMED
- (Tetramethylethylenediamine)
- Diaminobenzidine (DAB)

Group D: Compatible Organic Acids

- Butyric acid
- Citric acid monohydrate
- Formic acid
- Glacial acetic acid (also - store with flammables if segregated)
- 4-Morpholinepropanesulfonic acid (MOPS buffer)
- Propionic acid

Group G: Not Intrinsically Reactive or Flammable or Combustible (solids, store separately above liquids)

- Acrylamide, bis-acrylamide
- Agarose
- Ammonium thiosulfate
- Chloroquine diphosphate
- Coomassie brilliant blue
- Dextrose
- Dithiothreitol
- Guanidine hydrochloride
- Magnesium chloride
- Methotrexate
- Sodium citrate
- Sodium phosphate, monobasic
- Potassium chloride
- Potassium ferricyanide
- X-Gal (5-Bromo-4-chloro-3-indolyl-B-D-galactopyranoside)

Group L: Non-Reactive Flammables and Combustibles, Including Solvents

- Alcohols
- Acetaldehyde
- Acetone
- Acetonitrile
- Amyl acetate
- Benzene
- Carbon disulfide
- Cyclohexane
- Dichloromethane
- Diethyl pyrocarbonate
- Dimethylformamide
- Dimethyl sulfate
- Dimethylsulfoxide (DMSO)
- Dioxane
- Ethyl ether
- Ethyl acetate
- Formaldehyde, 37%
- Formamide
- Hexane
- Hydrazine
- Isoamyl alcohol
- β-Mercaptoethanol
- Methyl ethyl ketone
- Methylene chloride
- Paraformaldehyde solid
- Phenol
- Piperidine
- Propanol
- Sodium dodecyl sulfate (SDS)
- Tetrahydrofuran
- Toluene
- Xylenes

Group C: Compatible Inorganic Bases

- Ammonium hydroxide
- Potassium hydroxide
- Sodium hydroxide solutions

Group E: Compatible Oxidizers, Including Peroxides

- Ammonium nitrate
- Ammonium perchlorate
- Ammonium persulfate
- Benzoyl peroxide, wet
- tert-Butyl hydroperoxide
- Calcium hypochlorite
- Chlorosulfonic acid
- Chromic acid
- Fuming nitric acid
- Hydrogen peroxide, 30%
- Isoamyl nitrite
- Potassium chlorate
- Potassium dichromate
- Potassium permanganate
- Silver nitrite
- Sodium chlorate
- Sodium chlorite
- Sodium hypochlorite solution (bleach)

Group F: Compatible Inorganic Acids Not Including Oxidizers or Combustibles

- Hydrochloric acid
- Nitric acid
- Phosphoric acid
- Sulfuric acid

Group G: Not Intrinsically Reactive or Flammable or Combustible (liquids)

- Chloroform
- Isoflurane

Non-reactive chlorinated solvents may be stored with flammables.

APPENDIX A

Examples of Chemicals in the Compatible Storage Groups, Stanford University ChemTracker			
Group X: Incompatible with ALL Other Storage Groups	**Group B: Compatible Pyrophoric and Water Reactive Materials**	**Examples of Compressed Gasses and Their Respective CT Compatible Storage Group**	**Examples of Group K: Compatible Explosive or Other Highly Unstable Materials**
• Sodium azide • Picric acid 10-40% water	• Acetyl chloride • Lithium aluminum hydride, other metal hydrides • Phosphorus pentachloride • Silanes such as Silane gas, Dimethyldichlorosilane • Sodium • Sodium hydride • Toluene 2,6-diisocyanate	• Ammonia (C) • Arsine (X) • Carbon monoxide (L) • Chlorine (E) • *Cyanogen chloride (J - poison)* • Fluorine (E) • Formaldehyde gas (L) • Hydrogen (L) • Hydrogen chloride (F) • Hydrogen cyanide (C) • Hydrogen sulfide (L) • Nitric oxide (E) • Ozone (E) • Phospine (B) • Silane (B) • Stibine (B) • Sulfur tetrafluoride (B) • *Tellurium hexafluoride (J - poison)*	• Ammonium picrate, dry • Benzoyl peroxide, 97% • Dinitrophenol • Mercury fulminate • Nitroglycerin • Picric acid, dry • Trinitrotoluene (TNT)

Appendix B - Select Carcinogens by Classification

This list is not all encompassing, for a full list view the online resources for these programs.

1. OSHA Regulated Carcinogens 29 CFR 1910 Subpart Z
https://www.osha.gov/carcinogens

1.1 Asbestos
1.2 4-Nitrobiphenyl
1.3 alpha-Naphthylamine
1.4 Methyl chloromethyl ether
1.5 3,3'-Dichlorobenzidine
1.6 bis-Chloromethyl ether
1.7 beta-Naphthylamine
1.8 Benzidine
1.9 4-Aminodiphenyl
1.10 Ethyleneimine
1.11 beta-Propiolactone
1.12 2-Acetylaminofluorene
1.13 4-Dimethylaminoazobenzene
1.14 N-Nitrosodimethylamine
1.15 Vinyl chloride
1.16 Inorganic arsenic
1.17 Chromium (VI)
1.18 Cadmium
1.19 Benzene
1.20 Coke oven emissions
1.21 1,2-dibromo-3-chloropropane
1.22 Acrylonitrile
1.23 Ethylene oxide
1.24 Formaldehyde Methylenedianiline
1.25 1,3-Butadiene
1.26 Methylene chloride

2. NTP Classified "Known to be Carcinogens."
https://ntp.niehs.nih.gov/

2.1 Aflatoxins
2.2 4‑Aminobiphenyl
2.3 Analgesic Mixtures Containing Phenacetin
2.4 Aristolochic Acids
2.5 Arsenic and Inorganic Arsenic Compounds
2.6 Asbestos
2.7 Azathioprine
2.8 Benzene
2.9 Benzidine

2.10 Beryllium and Beryllium Compounds
2.11 Bis(chloromethyl) Ether and Technical-Grade Chloromethyl Methyl Ether
2.12 1,3-Butadiene
2.13 Cadmium and Cadmium Compounds.
2.14 Chlorambucil
2.15 1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (see Nitrosourea Chemotherapeutic Agents)
2.16 Chromium Hexavalent Compounds
2.17 Coal Tars and Coal-Tar Pitches
2.18 Coke-Oven Emissions
2.19 Cyclophosphamide
2.20 Cyclosporin A
2.21 Diethylstilbestrol
2.22 Dyes Metabolized to Benzidine (Benzidine Dye Class) (see Benzidine and Dyes Metabolized to Benzidine)
2.23 Erionite
2.24 Estrogens, Steroidal
2.25 Ethylene Oxide
2.26 Formaldehyde
2.27 Hepatitis B Virus
2.28 Hepatitis C Virus
2.29 Human Papillomaviruses: Some Genital-Mucosal Types
2.30 Melphalan
2.31 Methoxsalen with Ultraviolet A Therapy
2.32 Mineral Oils: Untreated and Mildly Treated
2.33 Mustard Gas
2.34 2-Naphthylamine
2.35 Neutrons
2.36 Nickel Compounds
2.37 Radon
2.38 Silica, Crystalline
2.39 Strong Inorganic Acid Mists Containing Sulfuric Acid
2.40 Tamoxifen
2.41 2,3,7,8-Tetrachlorodibenzo-p-dioxin
2.42 Thiotepa
2.43 Thorium Dioxide
2.44 Ultraviolet Radiation, Broad-Spectrum
2.45 Vinyl Chloride
2.46 X-Radiation and Gamma Radiation

3. IARC Classified Group 1
http://www.iarc.fr

3.1 Acid mists, strong inorganic
3.2 Aflatoxins
3.3 Aluminium production
3.4 4-Aminobiphenyl

3.5 Areca nut
3.6 Aristolochic acid
3.7 Aristolochic acid, plants containing
3.8 Arsenic and inorganic arsenic compounds
3.9 Asbestos (all forms, including actinolite, amosite,
3.10 anthophyllite, chrysotile, crocidolite, tremolite)
3.11 Auramine production
3.12 Azathioprine
3.13 Benzene
3.14 Benzidine
3.15 Benzo[a]pyrene
3.16 Beryllium and beryllium compounds
3.17 Bis(chloromethyl)ether; chloromethyl methyl ether (technical-grade)
3.18 Busulfan
3.19 1,3-Butadiene
3.20 Cadmium and cadmium compounds
3.21 Chlorambucil
3.22 Chlornaphazine
3.23 Chromium (VI) compounds
3.24 Clonorchis sinensis (infection with)
3.25 Coal, indoor emissions from household combustion of
3.26 Coal gasification
3.27 Coal-tar distillation
3.28 Coal-tar pitch
3.29 Coke production
3.30 Cyclophosphamide
3.31 Cyclosporine
3.32 Diethylstilbestrol
3.33 Epstein-Barr virus
3.34 Erionite
3.35 Estrogen therapy, postmenopausal
3.36 Estrogen-progestogen menopausal therapy (combined)
3.37 Estrogen-progestogen oral contraceptives (combined)
3.38 Ethylene oxide
3.39 Etoposide
3.40 Etoposide in combination with cisplatin and bleomycin
3.41 Fission products, including strontium-90
3.42 Helicobacter pylori (infection with)
3.43 Hepatitis B virus (chronic infection with)
3.44 Hepatitis C virus (chronic infection with)
3.45 Human immunodeficiency virus type 1 (infection with)
3.46 Human papillomavirus types 16, 18, 31, 33, 35, 39, 45,51, 52, 56, 58, 59
3.47 Human T-cell lymphotropic virus type I
3.48 Ionizing radiation (all types)
3.49 Iron and steel founding (occupational exposure during)
3.50 Isopropyl alcohol manufacture using strong acids
3.51 Kaposi sarcoma herpesvirus
3.52 Magenta production

3.53 Methoxsalen (8-methoxypsoralen) plus ultraviolet A radiation
3.54 4,4'-Methylenebis(2-chloroaniline) (MOCA)
3.55 Mineral oils, untreated or mildly treated
3.56 MOPP and other combined chemotherapy including alkylating agents
3.57 Neutron radiation
3.58 Nickel compounds
3.59 N'-Nitrosonornicotine (NNN) and 4-(NNitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)
3.60 Opisthorchis viverrini (infection with)
3.61 Painter (occupational exposure as a)
3.62 3,4,5,3',4'-Pentachlorobiphenyl (PCB-126)
3.63 2,3,4,7,8-Pentachlorodibenzofuran
3.64 Phenacetin
3.65 Phenacetin, analgesic mixtures containing
3.66 Phosphorus-32, as phosphate
3.67 Plutonium
3.68 Radioiodines, including iodine-131
3.69 Radionuclides, alpha-particle-emitting, internally deposited
3.70 Radionuclides, beta-particle-emitting, internally deposited
3.71 Radium-224 and its decay products
3.72 Radium-226 and its decay products
3.73 Radium-228 and its decay products
3.74 Radon-222 and its decay products
3.75 Rubber manufacturing industry
3.76 Schistosoma haematobium (infection with)
3.77 Semustine [1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea, Methyl-CCNU]
3.78 Shale oils
3.79 Silica dust, crystalline, in the form of quartz or cristobalite
3.80 Soot (as found in occupational exposure of chimney sweeps)
3.81 Sulfur mustard
3.82 Tamoxifen
3.83 8-Tetrachlorodibenzo-para-dioxin
3.84 Thiotepa
3.85 Thorium-232 and its decay products
3.86 ortho-Toluidine
3.87 Treosulfan
3.88 X- and Gamma-Radiation

Appendix C -Compounds with High Levels of Acute Toxicity

1.1 Acrolein
1.2 Arsine
1.3 Chlorine
1.4 Diazomethane
1.5 Diborane
1.6 Dimethyl mercury
1.7 Hydrogen cyanide
1.8 Hydrogen fluoride
1.9 Methyl fluorosulfonate
1.10 Nickel carbonyl
1.11 Nitrogen dioxide
1.12 Osmium tetroxide
1.13 Ozone
1.14 Phosgene
1.15 Sodium azide
1.16 Sodium cyanide (other cyanide salts)

Appendix D – Incident Investigation Report

Angelo State University

□ Employee
□ Student

Chemical Hygiene Plan
Incident Investigation Report

_____
Incident No.

Name: _____ CID: _____ Phone: _____

Dept: _____ Supervisor: _____ Phone: _____

Date: _____ Time: _____ Location: _____

Reported To: _____ Date: _____ Time: _____

Investigator: _____ Investigation Date: _____

Event Description (What were you doing, what happened, how did it happen, what was the result?):

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Description of Injuries and Damage (Who, where, what, extent of injury and damage):

_____

_____

_____

_____

_____

Chemicals, Tools, or Devices Involved (Brand, model, type, or other description):

_____

_____

_____

Root Cause Analysis (Possible Causes or Contributing Factors):

Equipment: _____

Tools/PPE: _____

Environment: _____

Procedure: _____

Personnel: _____

Training: _____

Other: _____

Causal Factors:

_____

_____

_____

Recommendations:

Corrective/Preventative Actions	Person Responsible	Due Date

Investigator Signature: _____ Date: _____

Supervisor Comments: _____

_____

_____

_____

_____

_____

Supervisor Signature: _____ Date: _____

Appendix E – Laboratory Specific Safety Plan Template

Angelo State University

Laboratory Safety Plan

A Laboratory Specific Safety Plan is a written program developed to establish procedures, protective equipment and standard work practices that promote a safe work environment for all Academic Laboratory Personnel handling hazardous chemicals, equipment, or processes in the workplace. At Angelo State University, Laboratory Supervisors are responsible for the preparation of their Laboratory Specific Safety Plan and may involve Laboratory Personnel in Plan development and training. The plan may cover one or more rooms, laboratories, or other sites associated with a work group and should consider all health and safety issues when work involves the use of hazardous chemicals, equipment, and processes.

The document provided is a template that can be used by any ASU academic and research laboratory. This plan was developed to meet the guidelines of Angelo State University, the Texas Tech University System, and regulatory requirements. Filling in the specific information for your laboratory will complete this plan. Each Laboratory Supervisor is responsible to develop this plan and can designate a Laboratory Safety Coordinator who can assist in implementing the plan.

The plan must then be reviewed with everyone working in the laboratory and made readily available to all Laboratory Personnel. The plan must be reviewed at least annually by the Laboratory Supervisor and any designated Laboratory Safety Coordinator. Each person named within the Chemical Hygiene Plan should have a copy of the CHP, which is referenced in this plan.

This section will be completed by the Laboratory Supervisor or Laboratory Safety Coordinator for the laboratory unit to outline procedures that are specific to the laboratory. It is a convenient way to compile all required documentation into a single manual.

Introduction

This is the "laboratory specific" part of the Chemical Hygiene Plan (CHP) and uses terms as defined in the CHP.

Unique Hazards and Safety Measures

In this location, identify the unique hazards and safety processes that are required in addition to those identified in the ASU Chemical Hygiene Plan.

Laboratory Supervisor

The Laboratory Supervisor has ultimate responsibility for chemical, equipment, and process safety within the laboratory and must, with other administrators, provide continuing support for laboratory chemical hygiene.

Laboratory Safety Coordinator

The Laboratory Safety Coordinator, if applicable, is designated by the Laboratory Supervisor and has responsibility for chemical hygiene in the laboratory. The Laboratory Safety Coordinator is an additional person who can assist in implementing the plan.

Laboratory Personnel (Including Students)

Laboratory Personnel are responsible for planning and conducting each operation in accordance with the institutional chemical hygiene procedures, laboratory specific SOPs, and developing good personal chemical hygiene habits.

It is the responsibility of the Laboratory Supervisor and Laboratory Safety Coordinator (if designated) to compile, review, and update this information.

Laboratory Unit: (*Building and Room Number or Other Location)*

Laboratory Supervisor (Faculty or Graduate Assistant): *(First and Last Name)*
Office Location: (*Building and Room Number)*
Work Phone Number: *(xxx) xxx-xxxx*
Alternate Phone Number: *(xxx) xxx-xxxx*

Department Chair: *(First and Last Name)*
Office Location: *(Building and Room Number)*
Work Phone Number: *(xxx) xxx-xxxx*
Alternate Phone Number: *(xxx) xxx-xxxx*

Laboratory Safety Coordinator (LSC) (if designated): *(First and Last Name)*
Office Location: *(Building and Room Number)*
Work Phone Number: *(xxx) xxx-xxxx*
Alternate Phone Number: *(xxx) xxx-xxxx*

Certification and Annual Review and Updates

By signing and dating here the Laboratory Supervisor and Laboratory Safety Coordinator (if designated) certify that this Laboratory Specific Safety Documentation is accurate and that it effectively provides for the safety of employees and students in this laboratory.

Laboratory Supervisor

Signature	Printed Name	Date

Laboratory Safety Coordinator (if applicable)

Signature	Printed Name	Date

Angelo State University
Laboratory Specific Safety Plan
Acknowledgement

Laboratory Unit: (*Building and Room Number or Other Location)*

I am (check one):

☐ A new employee or student using this laboratory

☐ Acknowledging a revision to this laboratory specific plan

I certify that I have been provided copies of the ASU *Chemical Hygiene Plan* and my *Laboratory Specific Safety Plan*, and that I have read and understand this SOP. I agree to fully adhere to its requirements.

Employee or Student

Signature	Printed Name	Date

APPENDIX E

Laboratory Unit: (Building and Room Number or Other Location)

By signing and dating here, the Laboratory Supervisor certifies that the required annual review (and update, if needed) of the Laboratory Specific Safety Plan Documentation has been completed, and that this document continues to be accurate and to effectively provide for the safety of all Laboratory Personnel in this laboratory or course.

Printed Name	Signature	Date	Updated Yes/No