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Laboratory Health and Safety

Laboratory Hazard Assessment and Controls and Standard Operating Procedures

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I. Introduction

A. University of Wyoming laboratories are sites of essential academic learning and valuable scientific and engineering research. Laboratories also present a variety of health and safety hazards. This document has been designed to provide an efficient method of analyzing possible laboratory based hazards and defining and documenting appropriate control methods through the development of standard operating procedures. For hazard assessment in non laboratory settings consult the UW General Workplace Hazard Assessment and Controls plan.

II. Purpose

A. The purpose of this plan is to identify hazards and corresponding control methods in university laboratory settings in order to minimize the risk injury, illness or accidents and to facilitate compliance with health and Safety regulations and grant requirements.

B. Compliance with various regulations and research grant requirements require documented standard operating procedures. Examples of agencies and groups requiring standard operating procedures are listed below:

1. University of Wyoming Institutional Animal Care and Use Committee (IACAC)
2. Department of Defense (DOD) grant
3. United States Nuclear Regulatory Commission (USNRC)
4. Department of Transportation (DOT) and
5. Occupational Safety and Health Administration (OSHA), Including the University Chemical Hygiene Plan and other specific OSHA regulations

III. Scope

A. This plan pertains to anyone who is involved in projects, experiments, or jobs involving hazardous substances in laboratory settings. For general workplace environments see “General Workplace Hazard Assessment and Controls”.

IV. Abbreviations

A. **DOD**: United States Department of Defense
B. **DOT**: United States or State of Wyoming Department of Transportation
C. **UW Safety**: University of Wyoming Safety Department
D. **IACUC**: University of Wyoming Institutional Animal Care and Use Committee
E. **IBC**: UW Institutional BioSafety Committee
F. **IRB**: UW Institutional Review Board for Human Subjects
G. **LC50**: Lethal Concentration 50, Median Lethal Concentration. The calculated concentration of a material in air, which based on laboratory tests (respiratory route) is expected to kill 50% of a group of test animals when administered as a single exposure in a specific time period, usually 1 hour.
H. **LD50**: Lethal Dose 50, Median Lethal Dose. The estimated single dose of material which, based on laboratory tests, is expected to kill 50% of a group of test animals. The material may be administered orally or applied to the skin. The LD50 dose is usually expressed as milligrams or grams of material per kilogram of animal body weight (mg/kg or g/kg).

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I. **SDS**: Safety Data Sheet
J. **OSHA**: United States Occupational Safety and Health Administration; or State of Wyoming Department of Labor Workers Safety
K. **PPE**: Personal Protective Equipment
L. **RSC**: UW Radiation Safety Committee
M. **USNRC**: United States Nuclear Regulatory Commission
N. **UW**: University of Wyoming

V. Definitions

A. **Administrative controls** (or **work practice controls**): changes in work procedures such as written safety policies, rules, supervision, schedules, and training with the goal of reducing the duration, frequency, and severity of exposure to hazards.

B. **Biological agents**: includes bacteria (and similar organisms), viruses, parasites, and fungi. Most are harmless but some are infectious and pathogenic. Harmful biological agents are living things which multiply and change rapidly causing disease/damage. They can be transmitted from person to person and are not always easily detectable. Effects include either a rapid (acute) onset of symptoms or a slow (chronic) or more long-term response where symptoms (if they are present) may last for years.

C. **Chemical substances**: with a high degree of acute and chronic toxicity are not defined in the Laboratory Standard. Therefore, the Occupational Safety and Health Administration (OSHA) Hazard Communication definition of a highly toxic chemical will be used. Chemicals with a high degree of acute toxicity are chemicals that have a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each. The LD50 is that dose at which a lethal response is observed in 50% of the test animals. The hazard(s) of a chemical may also be listed on its container label. Additionally, if the hazard of a chemical is not evident from the container label, the Safety Data Sheet (SDS) will list the specific hazards. Use the SDS to address chronic toxicity.

D. **Engineering controls:** eliminate or reduce exposure to a chemical or physical hazard through the use or substitution of engineered machinery or equipment. Examples include self-capping syringe needles, ventilation systems such as a fume hood, sound-dampening materials to reduce noise levels, safety interlocks, and radiation shielding.

E. **Faculty**: Limited to regular, full-time personnel at UW whose regular assignments include instruction, research, and/or public service as a principal activity, and who hold academic rank as professor, associate professor, assistant professor or instructor at UW.

F. **Hazard Assessment**: The hazard assessment is a documented process of identifying the hazards associated with a work environment, project or task; prescribing relevant control measures and personal protective equipment to reduce the risk from the hazards.

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G. **Highly toxic chemical**: A chemical falling within any of the following categories:

1. A chemical that has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD50) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.
3. A chemical that has a median lethal concentration (LC50) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

H. **Instructor**: Any person responsible for directing the activities of students in research project work.

I. **Ionizing radiation**: includes alpha rays, beta rays, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other atomic particles; but such term does not include sound or radio waves, or visible light, or infrared or ultraviolet light.

J. **Material Handling**: Includes but not limited to forklifts or motorized pallet jacks. Personal must be certified by attending classroom training and demonstrating proficiency with the equipment.

K. **Non-ionizing radiation**: a series of energy waves composed of oscillating electric and magnetic fields traveling at the speed of light. Non-ionizing radiation includes the spectrum of ultraviolet (UV), visible light, infrared (IR), microwave (MW), radio frequency (RF), and extremely low frequency (ELF). Lasers commonly operate in the UV, visible, and IR frequencies.

L. **Particularly hazardous substances**: includes select carcinogens, reproductive toxins, neurotoxins and chemicals with a high degree of acute and chronic toxicity.

M. **Personal Protective Equipment:** Devices worn by the worker to protect against hazards in the environment. Personal protective equipment is designed to protect many parts of the body (e.g., eyes, head, face, hands, feet, and ears). Includes specialized clothing or equipment worn by employees for protection against health and Safety hazards (respirators, gloves, and hearing protectors are examples). Last resort control when engineering, administrative and substitution do not address the hazard adequately.

N. **Principal Investigator** - Scientist in charge of an experiment or research project.

O. **Reproductive toxins**: are defined by OSHA as any chemical which affects the reproductive capabilities of males or females, including chromosomal damage (mutagenesis) and effects on fetuses (teratogenesis). Information on reproductive affects will be listed on the SDS.

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P. **Select carcinogens**: are chemicals listed by OSHA as carcinogens, by the National Toxicology Program (NTP) as "known to be carcinogens" and by the International Agency for Research on Cancer (IARC) as Group 1 carcinogens. Also included are chemicals or processes listed in either Group 2A or 2B by IARC or under the category "reasonably anticipated to be carcinogens" by NTP and that cause 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/m3
2. After repeated skin application of less than 300 mg/kg of body weight per week
3. After oral dosages of less than 50 mg/kg of body weight per day

Q. **Substitution**: replacing a hazardous chemical or process with a less hazardous one.

R. **Supervisor:** Any person responsible for directing the activities of employees, contractors or visitors, including, but not limited to trade supervisors, working leaders, principal investigators (PIs), lab managers, and nurse managers.

S. **Toxic Substance**: Any substance that can cause injury or illness, or which is suspected of being able to cause injury or illness under some conditions.

VI. Responsibilities

A. Administrators, Deans, Directors, and Department Chairs

1. Provide support and training as needed to assist personnel in developing hazard assessments and appropriate standard operating procedures.
2. Provide staff the time to prepare and review standard operating procedure plans.
3. Provide support and training as needed to assist personnel conducting hazard assessments and developing appropriate standard operating procedures.

B. Supervisors, Managers, Instructors, Principal Investigators (PIs)

1. Identify and anticipate potential hazards in the work environment, project, or task.
2. Perform a hazard assessment.
3. Develop appropriate standard operating procedures based on the hazard assessment.
4. Ensure that all affected personnel are trained in and understand the standard operating procedures relevant to their job and are given the opportunity to ask questions.

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5. Based on identified hazards, ensure affected personnel receive appropriate training.
6. Ensure everyone understands and follows the standard operating procedures.
7. Periodically review the hazard assessment and update as needed

C. Faculty and Staff

1. Attend Safety and health training classes related to the nature of the hazards identified by the hazard assessment.
2. Follow the relevant standard operating procedures for their work utilizing identified control measures (e.g., exhaust ventilation and required personal protective equipment PPE).
3. Maintain assigned personal protective equipment by proper cleaning, storage, and replacement as instructed.
4. Report to supervisor any defective hazard controls or personal protective equipment.
5. Ask questions if instructions do not seem clear and update relevant standard operating procedures as needed with the help from the supervisors/instructors/principal investigators (PIs).

D. Coordination of students, visitors, and volunteers

1. An employee of UW who coordinates the activities of visitors, students, or volunteers for a specific purpose or functions shall follow the procedures in section B above.
2. Visitors and volunteers, follow the procedures in C above.

E. Safety Coordinators

1. Assist in the coordination of hazard assessments and standard operating procedures in a given work area. (e.g., if there are five instruments identical used in three laboratories, only one hazard assessment and standard operating procedures may need to be done for all three).

F. UW Safety Department

1. UW Safety provides initial training for specific hazards as required. See the UW Safety website at http://www.uwyo.edu/safety for a current listing of classes offered.
2. Provide guidance and resources for performing hazard assessments and developing standard operating procedures.
3. Maintains the hazard assessment plan and ensures that is available for review and available on the UW Safety website.

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VII. Hazard Assessment Procedure

A. Attend and successfully complete the Hazard Assessment and Controls training conducted by UW Safety.

B. Perform the hazard assessment using Comprehensive Hazard Assessment Form located in Appendix A. Review other necessary resources needed to accomplish this goal (e.g., SDSs).

C. Prioritize and decide how controls and personal protective equipment will be implemented.

D. Based on the hazards identified and controls chosen, develop standard operating procedures.

VIII. Standard Operating Procedure Development

A. Examples of standard operating procedures are located in the Appendices and the UW Safety web site. Generic standard operating procedures may be modified to fit the situation.

B. Using the information from the Hazard Assessment, identify a format for the standard operating procedure that will best cover the laboratory's chemicals or processes. Standard operating procedure can be written in one or more of the following ways:

1. By Individual Chemical (such as acrylamide, formaldehyde or toluene). This approach may be most useful if a limited number of hazardous substances are used in the laboratory or for particularly hazardous substances.
2. By Hazard. This standard operating procedure format works well when chemicals are similar or if the same precautions are used in a variety of processes or procedures. Examples are: compressed gas cylinders, cryogenics, carcinogens, and nanoparticles.
3. By Class of Chemical (such as mineral acids, organic solvents or peroxidizable chemicals). This approach may be most useful if a number of similar procedures are performed using similar substances.
4. By Process: This type of standard operating procedure is used to address the hazards associated with a process. Examples include distillation, peptide synthesis, or gel electrophoresis.

C. Ensure all components of the standard operating procedure are addressed, as specified in Appendix C.

D. After completing the standard operating procedure, file it so that it is readily available. Notify all affected personnel of the file location and properly train them in the procedure. If you develop an standard operating procedure which you believe can be used by other departments in the University, please forward a copy electronically to the UW Safety Department at uwehs@uwyo.edu

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E. Periodically review standard operating procedures and update as necessary. If you make changes to the procedures, ensure that out-dated versions are removed and that affected personnel are notified of the changes.

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Appendix A: Comprehensive Hazard Assessment and Controls Form

Laboratory, Work Site, Project, or Grant:
Department/College:
Completed by (print name and title):
Principle Investigator (print name):
Department Head (print name):

Instructions:

Review the Hazard Description (column 3) of each Exposure Condition (column 2) and check the ones that are present (column 1). For every condition present, review the Examples of Engineering Controls and Personal Protective Equipment (column 4) and then complete the Specific Engineering Controls and PPE (column 5) that you intend to use to reduce or eliminate the hazard.

Check if Present	Exposure Condition	Hazard Description	Examples of Engineering Controls and Personal Protective Equipment (PPE)	Specific Engineering Controls and Personal Protective Equipment (PPE)
Biological Hazards				
☐	Animals	Splash, bites, exposure to animal body fluids; injuries due to animal size, caging; allergies, and disease transmission	Requires approval by IACUC	
☐	Carcinogens	Cancer	Posted work areas, glove box, fume hood, special handling, and gloves	
☐	Human Blood or other potentially infectious materials	Disease transmission	May require IRB approval; Blood-borne Pathogen training, and Universal Precautions	
☐	Infectious Pathogens	Disease transmission	Good microbiological methods, engineering controls, gloves	
☐	Nano-particles	Unknown health hazards due to small size	Containment, respirators	
☐	Recombinant DNA	Depends on nature of DNA segments, host vector systems. Introduction of foreign genetic materials into personnel or environment	Requires IBC Approval; Good microbiological methods, engineering controls, gloves	
☐	Select agents and toxins	Infectious agents and toxins with potential to pose a severe threat to human health.	Contact UW SAFETY 766-3277; Requires special permission. See www.selectagents.gov	

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Check if Present	Exposure Condition	Hazard Description	Examples of Engineering Controls and Personal Protective Equipment (PPE)	Specific Engineering Controls and Personal Protective Equipment (PPE)
Chemical Hazards				
☐	Chemicals, low hazard with low splash probability	Skin and eye irritation	Safety glasses, chemical resistant gloves, lab coat, closed shoe of good structure, long pants; Be aware of the nearest eyewash and shower	
☐	Compressed gases	Aphyxiation, accidental tip over, content release,and pinch points	Gas cylinders must be secured to stationary objects in a safe location away from danger or impact; Safety glasses and gloves	
☐	Controlled Substances	Drugs and certain other chemicals (narcotic and non-narcotic)	Proper training, handling & dispensing procedures, recordkeeping, Safety glasses; Under the jurisdiction of federal and state laws	
☐	Corrosive liquids w/reasonable probability of splash	Skin and eye damage	Chemical splash goggles or face shield, neoprene gloves, lab coat, closed shoes, chemical resistant apron	
☐	Cryogenic liquids, ultra-cold freezers, dry ice	Aphyxiation, skin, eye and tissue damage, frostbite	Ventilation, Safety glasses, goggles or face shields for splash hazards, insulated gloves, closed shoes	
☐	Organic solvents	Skin/eye damage, absorption through skin, organ damage	Chemical splash goggles or face shield, heavy resistant gloves, lab coat, closed shoes, chemical resistant apron, eyewash and shower	
☐	Volatile hazardous or highly hazardous chemicals	Inhalation of toxic vapors, skin contact	Fume hood, glove box, Safety glasses, and gloves	
☐	Regulated Wastes	Exposure,environmental release	Safety glasses, gloves, proper storage and disposal procedures; Training and safe handling procedures	

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Check if Present	Exposure Condition	Hazard Description	Examples of Engineering Controls and Personal Protective Equipment (PPE)	Specific Engineering Controls and Personal Protective Equipment (PPE)
☐	Special cleaning agents	Exposure, allergies	Material Safety Data Sheets, hazard communication training, proper procedures, gloves, Safety glasses	
☐	Toxic Substances	Poisons, neurotoxins, teratogens, mutagens, carcinogens, and subsequent environmental impact.	Proper training, procedures, storage, and disposal	
☐	Washing glassware	Skin lacerations from broken glass	Safety glasses, rubber gloves, lab coat.	
Radiological Hazards				
☐	Ionizing Radiation	Cancer, teratogenic	Time,distance, shielding; Permit and controls approved by Radiation Safety Committee	
☐	Non-Ionizing Radiation	Eye or skin damage, burns, heat, cancer.	Training, curtains (welding), signage, interlocks, beam blocks, Safety eyewear	
Physical Hazards				
☐	Compression (pressure)	Injury from sudden release of energy from valves, compression chambers	Energy control, Safety classes, shields, body position	
☐	Confined Spaces	Exposure, falls, dangerous atmospheres, asphyxiation, noise, vibration	Buddy system, lanyards, ventilation, monitoring	
☐	Elevated heights	Fall injury	Lanyards, anchors	
☐	Energized Equipment	Pinch, crush, caught, pulled in, electrocution	Energy control, signage, guards, no jewelry, tie back long hair	
☐	Extreme Environmental Conditions	Hypothermia (cold), frostbite (cold), heat exhaustion (heat) or heat stroke.	Training, physiological monitoring. Rest cycles and fluid replacement	
☐	Impact	Injury to head or body	Hard hat, impact resistant toed shoes, body position	
☐	Manipulation of large objects	Injury, death	Training, proper lifting equipment, procedures, inspections, buddy system	

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Check if Present	Exposure Condition	Hazard Description	Examples of Engineering Controls and Personal Protective Equipment (PPE)	Specific Engineering Controls and Personal Protective Equipment (PPE)
☐	Material Handling	Physical injury, strains, sprains	Training, buddy system, gloves, standard operating procedures	
☐	Noise	Deafness, hearing damage, inability to communicate	Noise monitoring, hearing protection, training, and engineering controls (e.g., enclosures, baffles, mufflers)	
☐	Penetration	Injection, wounds	Training, padding of surfaces, signage, and body position	
☐	Respirable Dust	Lung damage	Local exhaust ventilation. monitoring, respirator	
☐	Vibrating Equipment	Cumulative trauma disorders.	Gloves, protective shoes, hearing protection	

Additional Comments:

Certification: I certify this hazard assessment was conducted according to University Policy and the signatures below indicate acknowledgement.

Completed by (print): _____ Date: _____

Completed by(signature):_____

Principle Investigator (print): _____ Date: _____

Principle Investigator (signature):_____

Department Head (print):_____ Date: _____

Department Head (signature):_____

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Appendix B: Standard operating procedure format and required components

Standard Operating Procedure Format

1. Standard operating procedures must be personalized to accurately describe the process, hazards and controls at hand. The standard operating procedure format depends upon the situation. Examples of formats are provided in the appendix.
2. Attach additional information, such as Safety Data Sheets (SDSs) to the standard operating procedure. Chemical-specific hazard information is available in the appendices of certain regulations (such as for arsenic and lead), the UW Safety website, internet websites and reference books.
3. If your laboratory generates a standard operating procedure and would like to make it available to other labs, please attach an electronic copy to an email addressed to uwehs@uwyo.edu
4. In the standardized standard operating procedure form (at the end of this appendix), items 1 through 8 must be completed for each process, class of chemicals, or individual chemical.

Safety Operating Procedure Required Components.

1. **Process of Experiment Description**: Identify the chemicals, process or equipment involved in such a way that there will be no confusion as to what the standard operating procedure does (and doesn't) pertain to.
2. **Hazardous Materials and Chemicals**: Identify all hazardous materials involved in the process (e.g., highly hazardous chemicals, biologicals, and radioactive materials). Even if the chemicals that will be produced in the process are not known, identify the stock chemicals, intermediates, final compounds and wastes involved. Also detail other factors involved in the process, such as catalysts, inert compounds, heat, cold, and varied operating pressures.
3. **Engineering/Ventilation Controls**: List all environmental controls and ventilation systems required by the process. This may include hoods, environmental rooms, aerosol suppression devices, filtering or absorption devices, etc. Describe ways to verify that the fume hood, survey meters, monitors, and other control system(s) are operating correctly before being used.
4. **PPE – Personal Protective Equipment**: Clearly describe what personal protective equipment is required, and at what stages of the procedure it shall be used. Refer to the UW Safety General Workplace Hazard Assessment and Controls document for PPE descriptions.
5. **Special Handling Procedures and Storage Requirements**: Note any special storage requirements for the chemicals. This may include restricted access areas, special containment devices, and safe methods of transportation.
6. **Spill and Accident Procedures**: Provide guidance for handling spills, who might be designated to clean up the spill, and if any special spill clean-up materials are needed. Also identify what size of spill creates a hazardous situation. (For example, laboratory personnel may be able to safely handle a spill of a liter of

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dilute acid, but may need to evacuate the lab if 100 milliliters of a toxic chemical are spilled outside a fume hood.) This also provides guidance as to the maximum size of containers that should be purchased.

7. **Waste Disposal**: Identify safe disposal methods for routinely generated wastes. Includes procedures to neutralize or treat wastes to make handling safer or to reduce the amount of hazardous waste. Refer to the UW Safety website under Waste Management for more information: http://www.uwyo.edu/safety.
8. **Special Precautions for Animal Use**: For each hazard identified in the Hazard Assessment, adequately describe special handling practices and qualifications of animal handlers.

   For "particularly hazardous substances" (acute toxicants, highly dangerous chemicals, carcinogens, neurotoxins, mutagens, teratogens), the 8 basic elements above should be expanded, and 3 additional elements, 9 through 11, must be completed. For additional information, refer to the definition section in the Chemical Hygiene Plan.
9. **Approval Required**: Is training or approval required before personnel can perform the procedure? Reference special requirements mandated by approvals or permits from UW regulations (e.g., UW Safety, IACUC, IBC, IRB, RSC) or granting agencies (e.g., DOD).
10. **Decontamination Procedures**: Specify techniques for proper removal of PPE, decontamination (of skin, clothing, work surfaces), and disposal of contaminated materials.
11. **Designated Area/Equipment**: Specify the building and room, and any specific equipment (e.g., fume hoods or glove boxes) that are to be used for the particularly hazardous substance.

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Standard Operating Procedure for _____

Standard operating procedures for Chemicals or Processes		
1 Process (if applicable)		
2 Hazardous Materials and Chemicals		
3 Environmental/Ventilation		
4 Personal Protective Equipment (PPE)		
5 Special Handling Procedures & Storage Requirements		
6 Spill and Accident Procedures		
7 Waste Disposal		
8 Special Precautions for Animal Use (if applies)		
Particularly hazardous substance involved?	__ YES:	Blocks 9 to 11 are Mandatory
	__ NO:	Blocks 9 to 11 are Optional.
9 Approval Required		
10 Decontamination		
11 Designated Area		

Name (print) (Assessor):	Title:
Signature (Assessor):	Date:
Name (print) (PI, Lab Manager, or Unit Head):	Title:
Signature (PI, Lab Manager, or Unit Head):	Date:
Date Sent to UW Safety:	

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Appendix C: Examples of Standard Operating Procedures

Acrylamide
Benzene
Ethidium Bromide
Formaldehyde
Mercury
Phenol
Work with MPTP and MPTP-Treated Animals

Examples of "Groups of Chemical" Standard Operating Procedures

Antineoplastic Administration, Handling and Disposal
Toxins of Biological Origin: Safe Work Practices
Flammable Solvent Use
Gas Cylinder Use
Inorganic Acid Use
Inorganic Base Use
Lipopolysaccharides Use
Oxidizer Use
Peroxide Forming Chemicals Use
Pyrophorics and Air Reactives Use

Examples of "Process" Standard Operating Procedures

5-Bromo-2-Deoxyuridine Use
Removal of Carbonates using HCl
Phytolith Extraction Using Heavy Liquid
High Temp Furnaces and Tube Furnaces
Sample Washing, Slide Mounting and Storage of Phytoliths in Ethanol
Processes Involving Xylene and Ethanol

More standard operating procedures can be found at:

http://www.uwyo.edu/safety/procedures/standard-operating-procedures.html

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Example of Individual Chemical: Standard Operating Procedure for Benzene Use

Standard operating procedures for Chemicals or Processes	
1 Process (if applicable)	Injections of Benzene Standards for Gas Chromatograph Calibrations and Sample Analyses (Note: *All use of benzene is strictly regulated by Wyoming OSHA.)*
2 Hazardous Materials and Chemicals	Benzene, at known and unknown concentrations.
3 Environmental Ventilation Controls	Benzene-containing solutions should be dispensed and used only in a properly operating fume hood. Syringe purging should also be done in the fume hood.
4 Personal Protective Equipment (PPE)	Chemical splash goggles, butyl or natural rubber gloves, and a lab coat or apron is required.
5 Special Handling Procedures & Storage Requirements	Mixing and dispensing done in an operating fume hood with all sources of ignition turned off (hot plates, burners, etc.). Benzene stored in metal Safety cans or glass bottles (1 liter maximum) as much as possible. Transported in spill-proof carriers. Benzene is stored in a flammable cabinet, separate from acids, bases, and oxidizers. The flammable cabinet is located _____.
6 Spill and Accident Procedures	Try to stop the spill if it is on-going. Remove all sources of ignition from the spill area. If splash on skin occurs, wash immediately with soap and water and remove any contaminated apparel while washing. Call 911 in the event of a spill beyond lab staff capabilities. Use absorbent pads or vermiculite to clean up small fume hood spills or to dike larger spills. Absorbent pads are stored in _____. If a spill of more than ___ ml of benzene occurs outside the fume hood, vacate the room, close the door and call 911. If the quantity of benzene is in solution and does not easily evaporate, a spill cleanup by a contractor could be obtained by calling UW Safety - RMMC at 307-766-3698. Otherwise, the benzene could be allowed to evaporate. After clean-up or evaporation, room air must be monitored by UW Safety prior to re-occupancy.
7 Waste Disposal	For spills: place used absorbent in metal can with leak-proof lid. Over-pack with additional absorbent. Seal can. For all waste, label with Hazardous Waste Label, accumulate according to requirements, and send in Chemical Collection Request or Routine Pickup request, both available on the UW Safety web site (www.uwyo.edu/safety).
8 Special Precautions for Animal Use (i.e., IACUC approval)	*

Particularly hazardous substance involved?	_X_ YES:	Blocks 9 to 11 are Mandatory
	___ NO:	Blocks 9 to 11 are Optional.

9 Approval Required	Users must receive specific physical and health hazard information and safe laboratory work practices training from their supervisor. Representative breathing zone air sampling shall be taken to ensure that exposures do not exceed regulated levels.
10 Decontamination	Immediately wash with soap and water.
11 Designated Area	Room _____. Special signage may be required depending on air sampling results.

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Phone: (307) 766-3277
Email: uwehs@uwyo.edu
Regulated Materials Management Center
Phone: (307)766-3698 Fax: (307)766-3699
Email: HAZMAT@uwyo.edu

Name (print) (Assessor):	Title:
Signature (Assessor):	Date:
Name (print) (PI, Lab Manager, or Unit Head):	Title:
Signature (PI, Lab Manager, or Unit Head):	Date:

Additional Information about Benzene

OSHA Exposure Limits:

8-hour Permissible Exposure Limit (PEL): 1.0 ppm

15-minute Short Term Exposure Limit (STEL): 5.0 ppm

8-hour Action Level (AL): 0.5 ppm

Hazards:

Benzene liquid is highly flammable. It should be stored in tightly closed containers in a cool, well ventilated area. Benzene vapor may form explosive mixtures in air. All sources of ignition must be controlled. Use non-sparking tools when opening or closing benzene containers. Fire extinguishers, where provided, must be readily available. Know where they are located and how to operate them. Smoking is prohibited in areas where benzene is used or stored.

Benzene can affect your health if inhaled, if it contacts skin or eyes, or if ingested. The most frequent work place route of entry is by inhalation, but benzene can be absorbed through the intact skin and will be absorbed faster through abraded skin.

High, short-term (acute) exposures may result in feelings of breathlessness, irritability, euphoria, giddiness, or irritation of the eyes, nose or respiratory tract. Also, headache, dizziness and feelings of nausea or intoxication may occur. Severe exposures may lead to convulsions and loss of consciousness.

Periodic exposures at lower levels (chronic exposures) may result in various blood disorders, ranging from anemia to leukemia (an irreversible, fatal disease). Many blood disorders associated with benzene exposure may occur without symptoms.

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Exposure Monitoring

The supervisor must determine by breathing zone air monitoring if employees are over the AL or STEL. If levels are below the AL and STEL, no further air sampling is required unless procedures change. Affected employees must be informed of air monitoring results within 15 days of the supervisor receiving the results.

Training Requirements:

The Principal Investigator or supervisor must provide initial training to all personnel using benzene. If airborne levels reach or exceed the AL, annual benzene training is required. The training content must include the hazards of benzene, Safety information, regulatory requirements, signs and symptoms of possible exposures to benzene, and medical surveillance requirements.

Medical Surveillance

Any employee who is exposed to benzene above the AL for more than 30 days per year, or exposed to benzene above the PEL for more than 10 days per year, must be evaluated by the Occupational Health Nurse. Based on the evaluation results, the nurse may recommend further evaluation, exposure restrictions, or job reassignment. Contact UW Safety at 307-766-3277 for Safety information, guidance for air monitoring strategies, equipment and analytical result interpretation.

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Example of Group of Chemicals: Standard Operating Procedure-Flammable Solvent Use

Standard operating procedures for Chemicals or Processes	
1 Process	Flammable Solvents Use and Storage - including the following: chemicals:
2 Hazardous Materials and Chemicals	Flammable solvent vapors can travel and can produce fire and explosion if an ignition source is contacted. Some flammable solvents are more hazardous than others. Many solvents also have an effect on the central nervous system and at high concentrations cause sedation, coma and death. Contact with solvents can de-fat skin and cause irritation of skin and mucous membranes.
3 Environmental Ventilation Controls	Solvents should be dispensed only in a fume hood or in a well-ventilated space which has been approved and permitted by the Laramie Fire Department.
4 Personal Protective Equipment (PPE)	Wear flame-resistant lab coat and chemical splash goggles, consult the UW Safety Hazard Assessment Document (Appendix F) for proper glove selection. Call UW Safety (307-766-3277)) for further information. A flame-resistant apron is recommended for personal protection and is required when dispensing or cleaning up spill quantities greater than 1 liter.
5 Special Handling Procedures & Storage Requirements	Mixing or dispensing should be done in a hood with all sources of ignition eliminated (hot plates, burners, etc.). Store in metal Safety cans whenever possible. Solvents should be stored in appropriate flammable cabinets, separate from acids, bases, and oxidizers. Flammable cabinets located _____.
6 Spill and Accident Procedures	Remove all sources of ignition from the spill area if it is safe to do it. Small fires may be extinguished if it is safe and the operator is trained to use the fire extinguisher. Wipe down spill area with solvent absorbent pads. Solvent absorption pads are stored in _____.
7 Waste Disposal	Label with Hazardous Waste Label, accumulate according to requirements, and send in Waste Pickup request available on www.uwyo.edu/safety Do not evaporate flammable solvents in the fume hood.
8 Special Precautions for Animal Use	

Particularly hazardous substance involved? (See Appendix H, Lab Safety Manual)		
	_YES:	Blocks 9 to 11 are Mandatory
	X NO:	Blocks 9 to 11 are Optional.

9 Approval Required	N/A
10 Decontamination	N/A
11 Designated Area	N/A

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Signature (Assessor):	Date:
Name (print) (PI, Lab Manager, or Unit Head):	Title:
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Example of Hazardous Equipment Standard Operating Procedure

High Temperature Furnace and Tube Furnace

Purpose and Scope:

This plan describes the procedures and policies for using High Temperature and Tube furnaces. The scope of this plan is to establish user procedures. Instrument maintenance and repair are outside the scope of this plan.

Responsibilities:

This plan is maintained by the department Lab manager or Scientific Instructional Technician (SIT). The SIT is responsible for general maintenance and for arranging repair when necessary. If you feel that the instrument is in need of repair or is not operating correctly please notify the SIT immediately. The SIT will operate the instruments according to the procedures set down in this plan and will provide instruction and training to users within the department. Users are responsible for using the instrument described according to these procedures. These procedures assume that the user has had at least one training session.

Definitions:

N/A

Prerequisites:

All users must read this plan and obtain approval and training from the SIT.

Precautions:

Use the proper Safety equipment and Safety protocols when using these furnaces. They reach a temperature of 1700 Celsius. The elements for the furnaces are exposed and can be easily damaged if bumped or scraped. They are very expensive to replace. The furnace elements are operated at a high current and can be dangerous if touched.

Do not attempt repair or service. If service is required, contact your supervisor or the SIT immediately. Always use the provided hearth plate on the bottom of the furnace.

If material being used is hazardous or contains burn-off products that can damage the furnace the user must first make arrangements with the SIT or supervisor..

Procedure:

Following is a step by step description of a general operating procedure. Each process can be unique and some steps may not be required or the order may vary.

1. Determine the type of process required before beginning. If your process doesn't require temperatures above 1000 Celsius then please use a box furnace. If your process will utilize temperatures below 1000 Celsius it could damage the elements
2. Check that the furnace is available.
3. Fill out the furnace use log.
4. Program the furnace: See controller manual.
5. Place the material carefully in the furnace. Do not touch the edges. Do not put material in the furnace that is too big or that could boil over, sputter, or in any other way cause damage to the furnace. It is best to maintain a ⍰" clearance around all items in the furnace to assure proper convective currents around your sample. Placing the samples on stands assures currents around the majority of the bottom of the sample.
6. Material should be placed in the furnace before starting the program. Opening the furnace at high temperatures will damage the elements.

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7. High temperature gloves, face shields, and furnace tongs are provided for your Safety.
8. Do not set materials from the furnace onto any wood surfaces. There is a metal table and high temperature refractory materials in the lab for that purpose.
9. Do not hesitate to ask questions.
10. A burn kit is available in the lab. If an accident occurs that is life threatening, call 911 immediately. If a minor accident occurs, it is recommended that the injured party go to Student Health Service and also to fill out an accident report.

Implementation and Training:

This standard operating procedures will be available to all users and must be adhered to.

Name (print) (Assessor):	Title:
Signature (Assessor):	Date:
Name (print) (PI, Lab Manager, or Unit Head):	Title:
Signature (PI, Lab Manager, or Unit Head):	Date: