Idaho State University

Chemical Hygiene Plan

Idaho State University

Environmental Health and Safety

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Contents

Purpose

Idaho State University (ISU) recognizes the importance of the prudent acquisition, storage, use and management of laboratory chemicals to protect people, property and the environment, and to support university academic and research laboratory activities.

This ISU Chemical Hygiene Plan (CHP) is provided to ensure safety and health by limiting occupational exposures to hazardous chemicals in laboratories. The CHP is the foundation of the laboratory safety program and can assist in promoting a culture of safety to minimize the potential human exposure to hazardous materials in laboratories.

The CHP fulfills the requirements outlined in the OSHA Laboratory Standard, 29 CFR 1910.1450 "Occupational Exposure to Hazardous Chemicals in Laboratories"[1] which are inspected and enforced by the Idaho Division of Building Safety (DBS).

It is the responsibility of all persons working in university laboratories (e.g., principal investigators, administrative personnel, managers, laboratory researchers, and teaching assistants.) to be familiar with and perform work consistent with the provisions of this document. The CHP also has value in assisting ISU students in developing laboratory health and safety knowledge and practices, expected in future workplaces.

Scope

This CHP applies to all chemical use laboratories within Idaho State University, including the Pocatello Campus, the Idaho Falls Campus, the Meridian Health Science Center, other branch campuses, off-campus facilities and Center for Advanced Energy Studies (CAES). Chemical safety in non-laboratory work environments at Idaho State University are covered by the OSHA Hazard Communication Standard.

Laboratory Specific Safety Plan

Each Laboratory must have a current Laboratory Specific Safety Plan (LSSP). The purpose of the LSSP is to protect the health and safety of personnel working in that laboratory when handling hazardous materials specific to that laboratory. See Appendix D: Laboratory Specific Safety Plan template.

1. RESPONSIBILITIES, AUTHORITY AND RESOURCES

1.1. ISU Chemical Hygiene Officer (CHO)

The Chemical Hygiene Officer (CHO) resides in the Environmental Health and Safety Department (EHS). The CHO assists ISU Principal Investigators (PIs), department heads, and Academic Laboratory Managers (ALMs) to provide a safe and healthful laboratory environment, to maintain compliance with chemical health and safety regulations and recognized best practices in laboratory chemical safety. The CHO's laboratory safety responsibilities and authority in regards to the CHP are to:

- Coordinate the evaluation, annual review and implementation of the ISU CHP.
- Coordinate safety assessments of laboratories and storage areas and recommended follow-up activities.

[1] https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1450

- Provide and coordinate chemical hygiene training through EHS.
- Assist with personal protective equipment (PPE) selection and its proper use.
- Act as a liaison with regulatory health and safety agencies on the local, state and federal levels.
- Assist PIs/ALMs in conducting hazard assessments.
- Support the investigation of all reports of laboratory hazardous incidents, chemical spills and near-misses to prevent repeat occurrences.
- Perform workplace evaluations which may include exposure monitoring to evaluate personnel exposure levels to chemicals.
- Lead the investigation of exposure complaints or concerns for medical consultation referral or performance of exposure monitoring.
- Assist investigators leaving the institution to ensure proper inactivation and disposal of chemicals, through the use of the ISU laboratory close out procedures. See Laboratory Close Out Procedures on the EHS web site.
- Perform inspections of laboratory facilities for compliance with the OSHA regulation and this Chemical Hygiene Plan.

The CHO and the EHS Director have the authority to restrict access to a laboratory in the event of an imminent danger or an extremely serious safety violation.

1.2. Departments and Organizations

The leadership of departments, colleges, divisions and other university organizations have responsibilities for safety and health in their laboratories. This includes supporting and promoting compliance with this CHP by faculty within that organization.

1.3. Laboratory Safety Coordinator

Each department with chemical laboratories must designate one or more individuals within the department to serve as a Laboratory Safety Coordinator. The role of the Laboratory Safety Coordinator is to:

- Work with the EHS CHO to implement this chemical hygiene plan within the department.
- Distribute laboratory safety information to lab departmental laboratory personnel.
- Act as a safety liaison between the department and EHS, especially with respect to chemical safety.
- Attend occasional laboratory safety trainings, workshops or meetings initiated by the CHO.

1.4. Departmental Laboratory Safety Committees

Each department/organization with chemical laboratories should establish and maintain a Safety Committees or Laboratory Safety Committee to assist in ensuring that research and academic laboratory tasks are planned and executed safely and consistent with the ISU CHP. These committees can establish, maintain, and contribute to a strong safety culture for ISU and provide safety leadership for their department or organization. Safety committee members may meet on a regular basis to discuss safety issues and provide feedback on policies, programs, and procedures. The Departmental Laboratory Safety Coordinator should be the chair of this committee. Below are some of the potential responsibilities of an organizational Laboratory Safety Committee.

- Provide recommendations and assistance with developing safe work practices and procedures.
- Ensure employees and students have knowledge of safety policies and procedures.
- Identify potential hazards presented by laboratory activities and encourages safety analyses and development of SOPs to mitigate risk.
- Ensure training is provided on use of PPE and that PPE is provided, accessible and used.
- Investigate and document causes of accident/injury/exposure incidents and recommend methods for prevention. (CHO available for assistance and guidance.)
- Assist with developing research protocols or SOPs for hazard identification and safety requirements (as necessary), availability of facility safety and emergency response equipment.
- Conduct and review operations and facility safety assessments.
- Maintain communication with faculty and staff concerning the quality of the work environment, including indoor air quality, ergonomics, thermal comfort, etc.
- Communicate concerns upward within the department/organization.
- Coordinate as needed with the CHO.

CHO is available to advise these committees.

1.5. Principal Investigators (PIs) and Academic Laboratory Managers (ALMs)

The Principal Investigator (PI) or Academic Laboratory Manager (ALM) ensure that all safety policies and procedures outlined in the CHP are followed by personnel working under their direction. Personnel must be trained in safe work practices appropriate to their work and projects. The PI has overall responsibility for a research laboratory and the research equipment, practices, procedures and techniques employed in the research laboratory. The PI/ALM holds the responsibility of ensuring laboratory workers are working in a safe environment. A PI/ALM may designate some of the responsibilities to another individual but the PI/ALM is ultimately responsible.

The PI/ALM must:

- Maintain a safe and healthful working environment, by identifying hazards in the laboratory and selecting the most appropriate controls to protect health and safety of the workers.
- Ensure all work performed in the laboratory is conducted in accordance with the CHP and other applicable university policies and programs.
- Review compliance and discrepancies in safety performance as necessary, and work toward resolution of such issues to ensure that safe practices and techniques are continuously being employed.
- Review accident reports, share lessons learned and make recommendations for future procedures or practices to minimize the repetition of similar types of accidents.
- Ensure that chemicals are inventoried into the University's inventory system (CHIMERA) and stored safely per this CHP.
- Establish supplemental training and SOPs for the laboratory.

- Provide oversight that helps ensure employees are properly trained and understand procedures applicable to safety in their laboratories and work areas.
- Provide required personal protective equipment to laboratory workers and ensure proper use.
- Maintain a Laboratory Specific Safety Plan per Appendix D.

1.6. Laboratory Worker

A laboratory worker is any person performing or supervising work in an ISU laboratory, including PIs. Laboratory workers are subject to the CHP and all its provisions and are responsible for following it. Laboratory workers must:

- Understand and follow all laboratory safety related policies, programs, procedures and training received.
- Know the physical and health hazards, handling procedures and emergency response information for the chemicals and tasks used as part of their research.
- Understand the function and proper use of all PPE and wear required PPE when appropriate.
- Promptly report all work-related incidents, injuries and illnesses to their supervisor and Risk Management. Report near misses, potential serious safety issues or environmental contamination to EHS.
- Contact the lab supervisor/PI, CHO, or safety committee for further clarification if any of the above information or procedures are not clearly understood.

2. TRAINING REQUIREMENTS

All laboratory workers must read and understand the CHP and complete required training prior to the start of any laboratory work. Periodic refresher training is required as determined by the CHO.

2.1. Chemical Hygiene Training

Chemical Hygiene and Laboratory Hazard Communication training is available for self-enrollment and completion on Moodle. To self-enroll for this training in Moodle, select site home on the left side-bar of Moodle, then scroll down to search courses, and search for EHS, and select EHS - 01 Chemical Hygiene & Laboratory Hazard Communication.

Laboratory supervisors or PIs may assign additional training based on the types of hazards present in the work area.

2.2. Hazardous Waste Generator Training

All employees (staff, faculty and student workers) and students who generate and/or manage hazardous waste must complete Hazardous Waste Generator training, **prior** to generating and/or managing hazardous waste at any university facility. There is an annual refresher training requirement for hazardous waste generator training.

2.3 Laboratory Specific Training

The PI or designee must introduce new laboratory workers to operations and safety requirements unique to their laboratory and specific projects. The new employee is responsible for becoming familiar with the hazards of chemicals he or she will be handling through safety data sheets, hazard labeling, and other forms of information prior to using the chemicals.

The PI or designee must provide laboratory workers with chemical safety instruction and information that is specific to the project including any project procedures or protocols. This information and instruction should be documented by the PI. Safety instruction for the use of chemicals must satisfy the hazard awareness requirements including:

- The name of the chemical and its hazardous component(s);
- The health and physical risk(s) associated with the chemical;
- Signs of release and symptoms of exposure;
- How and when to use engineering controls and personal protective equipment;
- Labeling and storage requirements;
- Disposal procedures;
- Emergency procedures for spills and exposures; and
- Laboratory SOPs.

The majority of the hazard awareness information above is contained in the Safety Data Sheet. All laboratory workers will be trained on the Laboratory Specific Safety Plan. This includes safety requirements of the laboratory and the bulleted items above.

3. HAZARD IDENTIFICATION

3.1. Chemical Container Labeling

A chemical container label is the primary means for communicating the contents of a container and its hazard(s). Every container, even those just containing water, must be labeled to ensure employees and students are aware of its contents.

Original Container

Chemicals in original vendor containers must have labels indicating the chemical or product name and the vendor's name. Hazard warning signs or symbols should be prominently visible on the labels.

Secondary Container

All containers of chemicals decanted from an original container or prepared in the laboratory must be labeled with the chemical or product name(s) and primary hazard(s). This includes containers of reaction products or byproducts as well as separation processes such as distillations and extractions. The percentage of individual constituents will be included on the label.

Expiration Date

Time sensitive chemicals (e.g., peroxide formers) must be labeled with an appropriate expiration date, date opened and date tested for presence of unstable peroxides. All peroxide forming chemicals must be tested for peroxide formers every 3 months. If peroxides are present EHS should be notified and a hazardous waste pick up requested. See Appendix B: Chemical Storage and Segregation for more information.

Waste Containers

All containers of chemical waste must be labeled. Please see ISU Hazardous Waste Management Plan for requirements and further guidance. If the waste chemical is a hazardous waste, containers must be labeled with the words "Hazardous Waste", the full

name of the chemical(s), and an indication of the primary hazard. Labels are available from EHS or can be printed from the Hazardous Waste management Plan on the EHS web site.

3.2. OSHA Globally Harmonized Hazard Communication Standard (HCS/GHS) Pictograms

In 2015 OSHA adopted the United Nations standard pertaining to labeling of chemical containers, classification of chemical hazards and the distribution of the information in a standardized manner. This system is known as the Globally Harmonized System (GHS). Included in this change are pictograms that indicate the hazard(s) of a chemical, a new format for Safety Data Sheets (SDSs, formerly called Material Safety Data Sheets or MSDSs) and a simplification of the signal words used in labeling. These changes improve quality and consistency in the classification and labeling of all chemicals and enhance worker comprehension.

HCS/GHS Pictograms

Health Hazard  • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	**Flame**  • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides	**Exclamation Mark**  • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
Gas Cylinder  • Gases Under Pressure	**Corrosion**  • Skin Corrosion/Burns • Eye Damage • Corrosive to Metals	**Exploding Bomb**  • Explosives • Self-Reactives • Organic Peroxides
Flame Over Circle  • Oxidizers	**Environment (Non-Mandatory)**  • Aquatic Toxicity	**Skull and Crossbones**  • Acute Toxicity (fatal or toxic)

3.3. Safety Data Sheets (SDSs)

An SDS is a document prepared by a supplier to summarize the health and safety information associated with a product. Manufacturers and suppliers are required to provide an SDS for each chemical they make or offer. As required by OSHA, each SDS must contain the following sections:

- Identification
- Hazard(s) identification
- Composition/information on ingredients
- First-aid measures
- Fire-fighting measures
- Accidental release measures
- Handling and storage
- Exposure controls/personal protection
- Physical and chemical properties
- Stability and reactivity
- Toxicological information
- Ecological information
- Disposal considerations
- Transport information
- Regulatory information
- Other information

Obtaining an SDS

An SDS typically accompanies a chemical shipment or is mailed separately. Companies may be contacted via phone or mail to obtain one, but many SDSs are online or may be requested via company websites.

ISU staff, students and faculty may access SDS look-up at the following link from any ISU networked device: https://chimeracloud.org/sds/.

In cases of new materials when SDS are not available on the SDS look up, please contact EHS with the name and manufacturer, and CAS # from the label. The SDS will then be researched and added to the SDS look-up feature.

3.4. Chemical Inventory

In accordance with the CHP and 29 CFR 1910.1200 Hazard Communication, each department and laboratory PI or faculty member is responsible for maintaining an inventory of chemicals in the laboratory that is updated at least annually. ISU personnel use the Chimera chemical inventory application to manage inventories of hazardous chemicals and materials. PIs, laboratory faculty and their designees should apply for a Chimera login at: https://chimeracloud.org/chimera/register.php?c=isu

Each department laboratory must maintain an inventory that contains every chemical and product, and every supplier of that product/chemical, used in the laboratory. SDSs must be readily accessible to any laboratory user. Once a chemical product name is entered in the laboratory's inventory on CHIMERA it is linked to the SDS. This enables workers to have ready access to the chemical inventory and SDS as required.

3.5. Laboratory Signage

Lab Entry Door Signage

Laboratories must have a sign posted on the door that clearly identifies potential laboratory hazards and entry requirements. The signs remind laboratory staff and visitors of proper PPE and safety measures and may aid first responders. The sign must also include the laboratory's after work hours and emergency contact information, PI and room number. It may include general contact information as well. Laboratory door signs are integrated into CHIMERA, ISU's chemical inventory system.

Laboratory signs will be updated as needed and reviewed at least annually. Individual Department Heads, PIs or designees will work with EHS to update door signage as needed.

Safety Equipment Signage

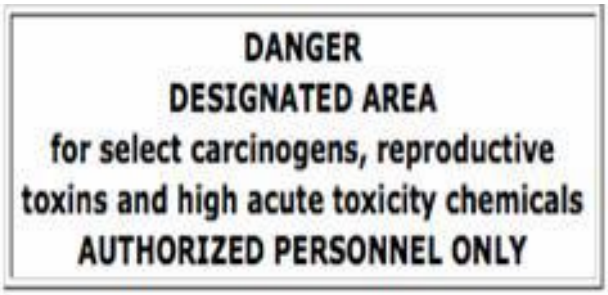
Signage must be conspicuously posted indicating location of eyewashes and safety showers. The area around and path to the eyewashes and safety showers must be kept clear. Signage must also identify the location of fire blankets, fire extinguishers, spill kits, and any other safety equipment by name or an appropriate symbol. Access to all safety equipment must be unobstructed (at least 30 inches of clear access from the safety equipment).

3.6. Particularly Hazardous Substances (PHSs)

The OSHA Laboratory Standard (29 CFR 1910.1450) defines a Particularly Hazardous Substance as a select carcinogen, reproductive toxin or substance with a high degree of acute toxicity. Consult the SDS. See the EHS website for a listing of some PHSs.

Use of any PHS requires:

- Establishment of a designated area;
- Use of appropriate containments devices such as fume hoods or gloves boxes;
- Standard Operating Procedures for safe handling of the PHS and for the needed disposal of resulting waste materials; and
- Decontamination procedures.



OSHA requires that the room or area where work with PHSs is performed to be posted with a ***Designated Area*** sign. The posting of an established "designated area" identifies areas of higher health risk. In some laboratories, it is appropriate to establish the entire room as a "designated area." In other laboratories, a work bench or fume hood is more appropriate.

The controls and SOPs used to minimize exposures to PHSs must be documented in the Laboratory Specific Safety Plan. Information on SOPs and sample templates are available on the EHS web site.

3.7. Occupational Toxicology

Routes of Entry

To evaluate the risks of adverse health effects from chemicals, one must be aware of the routes of entry into the body, duration of exposure, toxicity of the chemical, exposure limits, and odor threshold of the chemical. This section explains these principles and describes how to reduce chemical exposure.

Inhalation

Inhalation is the most common route of chemical exposure in the laboratory. Exposure by this route can produce poisoning by absorption through the mucous membrane of the nasal passage, mouth, throat and lungs and can seriously damage these tissues. Inhaled gases or vapors may pass rapidly into the capillaries of the lungs and be carried into the circulatory system. Exposure can be minimized by keeping containers closed when not in use, proper storage and the use of engineering controls (e.g., fume hood). Respiratory protection may be necessary if engineering controls cannot be used or do not provide sufficient protection. ISU laboratory users who wear respirators must be enrolled in the ISU Respiratory Protection Program.

Skin and Eye Contact

Contact with the skin is the second most frequent route of chemical exposure. A common result of skin contact is localized irritation. Many materials are absorbed through the skin and quickly pass into the underlying blood vessels where they are carried through the blood stream and may cause systemic poisoning. The main routes of entry for chemicals through the skin are the hair follicles, sebaceous glands, sweat glands and cuts or abrasions of the outer layers of the skin. The follicles and the glands are abundantly supplied with blood vessels, which facilitate the absorption of many chemicals.

Skin and eye contact with chemicals can be avoided by the use of appropriate personal protective equipment. At a minimum, wear a lab coat, the appropriate chemical-resistant gloves and safety glasses with side shields when working with hazardous chemicals. For more information, contact EHS.

Ingestion

Chemicals used in the laboratory can be extremely dangerous if they enter the mouth and are swallowed. In addition, some chemicals may damage the tissues of the mouth, nose, throat, lungs and gastrointestinal tract producing systemic poisoning if absorbed through these tissues. To prevent entry of chemicals into the mouth, laboratory workers should wear gloves and wash their hands immediately after use of any chemical substance and before leaving the laboratory. Keep hands and tools (pens and pencils) away from the face and mouth. Storing or consuming food and drinks in the laboratory is prohibited. Mouth pipetting is also prohibited.

Injection

Exposure to chemicals by injection can inadvertently occur through mechanical injury from glass or metal contaminated with chemicals or when chemicals are handled in syringes. Use proper sharps handling practices. Inspect glassware prior to use. Sharps, including razors and cutting blades, should be disposed of in a special sharps container or another glass disposal container. Sharps contaminated with a biohazardous substance must be disposed of in a biosafety sharps container. Broken glass or spilled sharps must be collected using mechanical means (e.g., broom and dustpan) and never with bare hands. To avoid injection injuries to those that pick-up the waste, collect and place the broken glass pieces into a cardboard glass disposal box, and label the box before disposal.

3.8. Exposure Assessment and Monitoring

The Chemical Hygiene Officer may be required to perform an exposure assessment of some laboratory work. An exposure assessment takes into consideration any hazardous materials in use, the task being performed and the work environment including engineering controls, administrative controls and PPE. Monitoring may be necessary to assess exposure levels to hazards.

Laboratory workers should contact their manager, PI or the Chemical Hygiene Officer to discuss exposure concerns and request an assessment.

Exposure Limits

Exposure limits have been established to reduce exposure to "acceptable" levels. OSHA sets regulatory exposure limits called permissible exposure limits (PELs). The American Conference of Governmental Industrial Hygienists (ACGIH) has developed recommended exposure limits called Threshold Limit Values (TLVs). The National Institute for Occupational Safety and Health (NIOSH) has developed Recommended Exposure Limits (RELs). Quite often, TLV and REL values are less than OSHA-specified PELs.

Frequency

Initial monitoring will be performed if there is reason to believe exposure levels for a substance could exceed the action level (see Appendix A: Definitions and Abbreviations) or PEL. Monitoring may be necessary after equipment or process changes, or an unanticipated chemical release.

Periodic monitoring will be performed if the initial monitoring exceeds applicable action levels or PELs. Monitoring frequency will be established by the Chemical Hygiene Officer based on exposure levels (current and previous monitoring) and any additional requirements outlined in applicable standards. Monitoring may be terminated in accordance with the applicable standard.

Records

Laboratory workers will be notified of monitoring results in writing within 15 days of receipt of any laboratory results either individually or by posting in an appropriate location.

The Chemical Hygiene Officer shall maintain records in accordance with the record keeping requirements of applicable OSHA standards.

3.9. Medical Surveillance

The Idaho State University shall coordinate an offer for medical consultation or examination under the following circumstances:

A laboratory worker develops signs or symptoms potentially associated with a hazardous chemical that they may have been exposed to in the laboratory;

Exposure monitoring reveals an exposure level above OSHA permissible exposure limits, ACGIH action levels or where the applicable standard requires such medical surveillance; or

An event occurs such as a chemical spill, leak or explosion that results in the likelihood of a hazardous exposure.

Reporting Exposure

Laboratory workers who believe they have had an exposure or injury should seek medical attention immediately and contact their PI/supervisor, Risk Management and EHS.

4. CONTROLLING HAZARDS

4.1. Hierarchy of Controls

The control of exposure to chemicals in the laboratory should be accomplished through a hierarchy of controls, which begins with hazard elimination, substitution and engineering controls. then administrative controls and finally the proper personal protective equipment. After hazard substitution/minimization, engineering and administrative controls are the major control methods for protecting laboratory workers from hazardous materials exposures at Idaho State University.

4.2. Hazard Substitution and Minimization

Using smaller quantities of hazardous chemicals or substituting a less hazardous chemical reduces the risk of serious exposure or spill. Consider the following possibilities:

- Substitute less hazardous chemicals;
- Work on a smaller scale;
- Order only what is needed; and/or
- Share chemicals when possible.

4.3. Engineering Controls

Engineering controls eliminate or minimize exposure by removing a hazard or acting as barrier between a hazard and a worker. Engineering controls are typically more effective at controlling hazards than administrative control practices or personal protective equipment. They often require a higher cost upfront; however, they may be more cost effective in the long run. Engineering controls range in complexity and cost from something as simple as using sharps containers to minimize needle sticks to an interlocking mechanism on an x-ray unit to minimize radiation exposure. In a laboratory, they are often used to minimize contact with a hazard due to chemical splash, explosion or inhalation.

Local Exhaust Ventilation

Local exhaust ventilation is an engineering control used to reduce inhalation exposure. Common laboratory examples include glove boxes, extraction arms (snorkels) and fume hoods.

Glove Box

Glove boxes are complete enclosures used to perform work in a separate environment. A different environment may be necessary to control worker exposure or to protect the chemical itself (e.g., an inert atmosphere). Gloves secured to ports allow manipulation inside the unit. Requirements for use are training and SOPs, and depending on the manufacturer's recommendations, sensor calibration and integrity testing of the unit and gloves.

Biosafety Cabinet

Biosafety cabinets (BSCs) are used to control exposure to biological aerosols and protect work materials from contamination using a High Efficiency Particulate Air (HEPA) filter. HEPA filters do not capture chemical vapors. A BSC where the treated exhaust is returned to the laboratory cannot be used for procedures involving flammable liquids or volatile, toxic or odorous chemicals except for small quantities of alcohols used for decontamination. BSCs are inspected annually by an outside vendor. Contact the university's Biosafety Officer for more information.

Extraction Arm (Snorkel)

Extraction arms, or snorkels, are typically constructed of flexible ducting and connected to the exhaust ventilation system. They are useful for capturing vapors, fumes and dust at the source of generation. Extraction arms work well when designed properly for a given process with an adequate flow rate. They are typically ineffective for any source beyond the distance of the ducting's radius.

Fume Hood

The fume hood is the most common method of controlling inhalation exposures to hazardous substances in the laboratory. They are useful against fumes, mists, dusts and vapors. Their use is recommended whenever handling hazardous materials and may be required to reduce exposure to levels below applicable exposure limits. Consideration of the types and quantities of chemicals used will determine the effectiveness of the fume hood.

Alarm

Some fume hoods are equipped with a low flow alarm. The alarm is an indication the face velocity may be inadequate and not providing proper protection. Contact EHS and Facilities Services when a fume hood alarm sounds.

Emergency Shut-Off

Some buildings are equipped with emergency shut-offs for the fume hood exhaust system and differ from the alarm control mentioned above. The emergency shut-offs are only to be used by Facilities Services or the fire department.

Certification and Maintenance

Fume hood certification is maintained by EHS and completed on an annual basis as indicated by a sticker on the fume hood. The sticker is typically found on the side of the sash indicating the height at which the hood was certified.

The certification process ensures the fume hood is functioning properly and maintaining a minimum face velocity of 80 feet per minute when measured at the sash threshold.

Any suspected fume hood malfunctions or issues must be reported to the PI and EHS or Facilities Services. Alterations must be coordinated and approved by EHS and Facilities. Any repair, relocation or alteration requires recertification of the fume hood by EHS.

Minimizing Materials in the Fume Hood

In order for a fume hood to operate properly, adequate airflow is essential. An easy way to accomplish this is by minimizing the number and size of materials in a fume hood. Materials such as large equipment, supplies or chemical containers, cannot be used in a fume hood if it prevents the fume hood from functioning properly. The most common issue stems from blocking the lower baffle, which reduces adequate flow at the sash and can disrupt airflow patterns. It may be possible to elevate the materials to maintain flow to the lower baffle. For large equipment, it is generally more effective to install a specially designed enclosure so the chemical fume hood can be used for the intended purpose. Contact EHS for assistance and assessment.

Sash Height

When working at the chemical fume hood, open the sash only as far as necessary to access the work area. The lowered sash helps contain contaminants in the hood and the smaller hood opening makes the hood less susceptible to room drafts and other external air disturbances. Open sashes can result in an inadequate face velocity and

reduce hood effectiveness. The certification sticker indicates the height at which the hood was tested and is the maximum working height for the sash.

When a fume hood is not in use, the sash should be closed.

The sash can also help protect against splashes or projectiles from chemical spills or reactions. A lowered sash does not eliminate the necessity for appropriate personal protective equipment.

Additional Work Practices

- Work at least six inches behind the sash threshold.
- Never put your head (or face) inside an operating chemical fume hood to check on an experiment.
- Move slowly in and around fume hoods. Be aware that opening/closing doors can disturb the airflow.
- Unless instructed otherwise, fume hoods shall remain on at all times.

Perchloric Acid Use

Perchloric acid digestions and other procedures performed at elevated temperatures must be conducted in a specifically designed and dedicated fume hood with a wash-down system due to potential formation and build-up of explosive perchloric acid salts. The fume hood cannot be used for any other purpose.

4.4. Administrative Controls

Administrative controls consist of policies, programs and procedures which guide work practices to minimize exposure. Programs, such as the CHP, provide guidance on specific topics typically applying to multiple laboratories to guide compliance with regulatory requirements.

Laboratory Hazard Assessment

A laboratory hazard assessment assists PIs and laboratory managers in identifying hazards unique to a specific laboratory.

Safety Information and Standard Operating Procedures (SOPs)

Laboratories must establish and maintain standard operating procedures for equipment, processes and procedures performed in the laboratory. An SOP can be used to:

Communicate to the laboratory worker the potential hazards, required hazard controls and steps to complete a task safely and correctly.

Satisfy regulatory requirements documenting required safe use of hazardous materials, including required PPE.

Train laboratory workers in proper procedure and maintain consistency between laboratory workers.

For the safety and health of personnel, compliance with the OSHA Laboratory Standard, and as determined by the lab hazard assessment, some laboratory operations may require the need to create SOPs specific to the work performed.

Work Practices

The information in this section applies to the majority of laboratory work or work areas. Information regarding specific chemicals, chemical hazard classes and additional hazards may be obtained from the Chemical Hygiene Officer.

Prepare for Work with Hazardous Chemicals:

- Take the time to read and familiarize yourself with the CHP and all appendices before handling any hazardous chemical.
- Read the university's waste management procedures on the EHS website that contains information covering safe and proper disposal of hazardous chemicals.
- Follow applicable laboratory protocols or SOPs, which outline requirements for handling hazardous chemicals.
- Know the nearest location of all safety equipment as well as evacuation routes and assembly location.
- Become familiar with the health and physical hazards of the chemicals you will be handling.
- For extremely hazardous chemicals or procedures, consider performing a "dry" run with a manager to become familiar with the steps.

Minimize Routine Exposure

The following are general work practices designed to minimize exposure from routine procedures:

- Activities involving hazardous chemicals should be conducted in a chemical fume hood whenever possible.
- Always mark chemical containers for identification. Do not smell chemicals to determine their identity.
- Change gloves regularly.
- Inspect gloves for tears, cracks, discoloration, and holes before and during use.
- Exhaust of an apparatus that may discharge toxic chemicals should be vented into a chemical fume hood, exhaust ventilation system or filter.
- Storing, handling or consuming food or beverages in laboratories, storage areas, refrigerators, environmental rooms or laboratory glassware is prohibited.

Personal Hygiene

Personal hygiene in the laboratory can minimize exposure to hazardous chemicals. Some general requirements for personal hygiene in the laboratory include:

- Long pants and closed-toed shoes are required in chemical laboratories.
- Eating, drinking, smoking, or applying cosmetics in laboratory areas is prohibited.
- Mouth pipetting of any substance is prohibited.
- Hands must always be washed before leaving the laboratory. Solvents must never be used to wash hands.
- Required appropriate PPE (e.g., laboratory coat, eye protection, gloves) must be worn in the laboratory whenever there is a potential for exposure to chemical or physical hazards. Open toed footwear and shorts are prohibited in laboratory work areas. Please refer to Laboratory Specific Safety Plan, Appendix D.
- PPE must be removed before leaving and not be worn in public areas such as bathrooms, offices, conference rooms, eating areas and outdoors.

- Gloves must not be worn while touching doorknobs, light switches, telephones or other common items unless required by the laboratory-specific or standard operating procedures.

Housekeeping

General guidelines for good housekeeping include:

- Keeping areas and pathways around emergency equipment, showers, eyewashes and exits clear;
- Keeping areas around all circuit panels clear;
- Keeping all aisles, hallways and stairs clear;
- Keeping all work areas clear of clutter;
- Returning all chemicals to the proper storage area at the end of the day;
- Cleaning up spills promptly; and
- Cleaning benchtops and fume hoods regularly.

Disposal of Chemical Waste

Hazardous chemical wastes must be stored and managed in the laboratory in compliance with the ISU Hazardous Waste Management Plan. The University EHS Department is responsible for removing hazardous chemical waste from all laboratories. A request for disposal must be made through the EHS web site.

Personal Protective Equipment (PPE)

Engineering controls such as chemical fume hoods and glove boxes can be used to control hazards, and further minimize the extent of required PPE. Use of PPE shall only be considered after exercising all other options for reducing hazards. Eliminating unnecessary processes and substances should be the first method used to control hazards.

In addition to engineering controls, PPE is very often utilized to minimize exposure to potential hazards and must be worn when handling hazardous materials or performing potentially hazardous activities in the laboratory. Appropriate PPE is based on the potential hazards and associated risks of the types and quantities of chemicals in use, location of use and how the chemicals are used.

The PI is responsible for determining PPE requirements for each project. The PI must ensure that appropriate types and sizes of PPE are readily available, laboratory workers are properly trained in use and maintenance and laboratory workers comply with PPE requirements. Common laboratory PPE is discussed below. Keep in mind different or additional PPE may be required based upon the hazards and associated risks. See the Chemical Glove Compatibility chart for assistance in choosing appropriate gloves. PPE guidance is also available from EHS.

It should be noted that laboratory hazards and risks can also arise from temperatures, pressures or mechanical actions.

Hand and Forearm

Gloves

Gloves are required when handling hazardous chemicals or for protection from physical hazards such as cuts, extreme temperatures and abrasion. There is no glove currently available that will protect against all chemicals or all types of tasks. Many glove manufacturers have charts available to help determine the most appropriate glove material. Gloves come in a variety of materials, thicknesses and cuff lengths.

Selection must consider the chemicals in use, potential contact time, splash potential and dexterity needs.

It is recommended to change thin disposable gloves once they become contaminated or on a regular interval. In some applications, thicker gloves may be reused, but they must be inspected regularly for nicks, punctures or signs of degradation and discarded when necessary.

Laboratory workers must remove at least one glove before leaving the immediate work site to prevent contamination of public areas (e.g., doorknobs, light switches, telephones, etc.).

Latex gloves

Disposable latex gloves are not to be used for chemical protection. Latex has been shown to be a sensitizer to some individuals. Sensitization occurs over time with increased symptoms. Exposure to the latex protein is greatly increased through the use of powdered latex. The use of powdered latex is highly discouraged. If a powdered glove is desired, a powdered nitrile glove is recommended.

Tyvek sleeves/Gauntlet gloves

Tyvek sleeves and gauntlet gloves provide greater forearm protection than a laboratory coat. Uncoated sleeves are fluid resistant and coated sleeves provide increased fluid protection. The sleeves must be worn over a laboratory coat or paired with other necessary body protection. Gauntlet gloves that reach to or extend above the elbow are readily available.

Body

Body protection may be necessary to protect against chemical splash or particulates which could cause injury or contamination of an individual or clothing. It may be necessary to protect a work area from outside contamination (e.g., clean room).

Laboratory Coat

A long-sleeved laboratory coat must be worn whenever infectious, chemical or radioactive hazards exist assuming a similar or more protective level of PPE is not required. A laboratory coat, though not impervious, provides some protection against contact and contamination. Tyvek laboratory coats or coveralls may also be a suitable option and offer added convenience since they are disposable.

Flame retardant lab coats must be used when handling pyrophoric or water reactive compounds (or highly exothermic reactions) and large volumes of flammable liquids, (greater than 4 liters).

Contaminated laboratory coats must be immediately removed and laundered or disposed of properly. Laundering must be done through a commercial laundry service. Home laundering is prohibited. Disposable lab coats are an option. In the case of academic laboratory activities, where smaller volumes, lower concentrations and lower hazard chemicals are used, this requirement may be waived.

Chemical Resistant Apron

Some chemicals or activities may require protection beyond a laboratory coat's capabilities due to splash potential and the hazardous chemical properties. It is important to select an apron compatible with the chemical in use and an appropriate thickness for adequate protection.

Eye/Face Protection

The most common types of eye and face protection include safety glasses, safety goggles and

face shields. Each serve their own purpose, but all must meet requirements outlined in American National Standards Institute (ANSI) Z87.1. "Z87" must be imprinted on the equipment indicating it meets proper specifications. If an individual chooses to wear contact lenses in the laboratory, chemical splash goggles must be worn.

Safety Glasses

Safety glasses must be worn when handling hazardous materials or where there is the potential of flying particulate. They must have side shields for added protection. Safety glasses are adequate for handling small quantities of moderately hazardous materials with limited splash potential or materials of low hazard and flying particulate.

Regular prescription glasses have not been determined to meet the Z87.1 requirements. Over-the-glasses (OTG) safety glasses are available and fit over most prescription lenses and frames. A number of retailers offer prescription safety glasses. The frames are marked with Z87 and are fitted with polycarbonate lenses. Side shields are required and typically snap on the bows.

Safety Goggles

Safety goggles must be worn when handling liquid hazardous materials with the potential for splash, volatile hazardous materials and concentrated acids or bases. Goggles fit tightly to the face, minimizing liquid and vapor contacting the eye area. Vented and non-vented models are available. Vented goggles have openings which reduce fogging but increase contact potential. Non-vented goggles have a greater tendency to fog but provide greater protection. An anti-fog coating is an important feature. Most prescription glasses fit under standard safety goggles.

Goggles provide better protection against large amounts of particulates and liquids when compared to safety glasses.

Face Shield

A face shield helps protect the face from splashes and flying particulates. A face shield is only considered supplementary eye protection. Safety glasses or goggles must be worn underneath.

Leg and Foot

Close-toed shoes and long pants are required in all chemical use laboratories. Leg protection beyond regular clothing may be required for protection from hazards such as molten metal, heat and cutting hazards. Foot protection, at a minimum, must consist of closed-toed shoes covering the top and sides of the foot. Sandals and open-toed shoes are prohibited. Additional foot protection including steel-toe shoes, leather, or slip-resistant shoes may be required.

Respiratory Protection

Respirator use requires training, medical approval and fit testing as outlined in the ISU Respiratory Protection Plan. Respirators are not to be used in any area without prior approval by EHS. Contact EHS for additional information on respirator use.

Additional Considerations

Additional or different types of PPE may be necessary dependent upon the laboratory and associated activities. Each laboratory shall designate minimum PPE for entry to work areas and include the requirements in the Laboratory Safety Plan.

Contaminated PPE must be decontaminated or properly disposed. Contaminated PPE may require classification as hazardous waste. Please refer to the EHS website or contact EHS.

5. EMERGENCY RESPONSE

Emergency response policies and procedures are outlined in the ISU Emergency Response Plan.
Emergency Equipment

In any emergency, it is critical that all staff members are familiar with the use and location of all emergency equipment. This includes fire extinguishers, fire alarms, safety showers, eyewash stations, first aid kits and chemical spill kits.

Dial 911 in the event of an emergency. All incidents, accidents and emergency response activities must be reported to your supervisor.

All emergency equipment shall be on a preventive maintenance schedule. Fire alarms are tested periodically, and extinguishers are inspected monthly. Laboratories are responsible for activating their eyewashes weekly and recording the checks on EHS pr0vided tag. Departments are responsible for checking emergency showers monthly and recording checks on EHS provided tags.

5.1. Seeking Medical Treatment

Call 911

911 should be contacted for a serious medical emergency. If you are unsure of the seriousness of the situation, make the call. If emergency responders are deemed necessary, they will respond to the scene and assess the situation.

Emergency Room or Additional Care

Any person seeking medical attention, but not needing emergency transport or response, should notify their PI and obtain care.

5.2. Chemical Exposure

The treatment of a chemical exposure takes precedent over spill cleanup, spill containment or property damage including water damage from the use of an eyewash or safety shower.

If the material is dry or in powder form, brush off all visible contaminant before flushing with water. When possible, obtain assistance to remove contaminated PPE and clothing and contact emergency responders if necessary. If medical attention is sought, provide medical care personnel with copies of the applicable Safety Data Sheets.

Eye Contact

Eyes must be promptly flushed with water using an eyewash for 15 minutes following contact with any chemical. The eyes should be held open. Medical help should be sought immediately after flushing.

Skin Contact

The affected areas must be immediately flushed with water for 15 minutes. Once the flushing has started, contaminated PPE and clothing must be removed. Medical attention should be sought immediately after flushing.

Inhalation/Ingestion

Move to a clean environment or seek assistance to get away from the contamination and immediately contact emergency responders for guidance (Poison Control Center 1-800-222-1222).

Contaminated Sharps Injury

The affected areas must be immediately flushed with water for 15 minutes. Once the flushing has started, contaminated PPE and clothing must be removed. Medical attention should be sought immediately after flushing.

Chemical Spill

Laboratory personnel can clean up small spills if trained and equipped to do so. Small spills include chemical spills that are up to 1-liter liquids or 0.5 kilograms solids and of limited toxicity and reactivity. Small spills of metallic mercury from broken thermometers (about 1.5 grams) can be cleaned up by laboratory personnel. If respiratory protection is needed for a spill clean-up, the spill is too large to be handled by laboratory personnel – dial 911 or call EHS at 208-282-2310 during normal business hours. See Appendix C for additional spill clean-up procedures.

6. CHEMICAL STORAGE

6.1. Segregation

Materials should always be segregated and stored according to their chemical family or hazard classifications. Do not store chemicals alphabetically unless they are compatible. The most common hazard classes include:

- Flammables/combustibles
- Corrosive acids
- Corrosive bases/ caustics
- Toxic
- Highly toxic
- Oxidizers
- Compressed gases
- Cryogens
- Pyrophoric
- Water reactive
- Explosives

Accidental contact between incompatible chemicals can result in a reaction causing fire, explosions, the formation of highly toxic and/or flammable substances or other potentially harmful situations.

Each chemical family should be separated from all other chemical families. Ideally, each hazard class would be kept in a cabinet or on a shelf segregated from other hazard classes. Incompatible chemicals within the same hazard class should be separated from one another. Chemical storage guidelines are available on the EHS webpage.

Most laboratories have limited space. The following priorities may help you decide how to store chemicals.

- Limit the amount of chemicals on hand to just what is needed to complete work.
- Do not store chemicals alphabetically unless they are compatible.
- Store flammable liquids in approved safety containers in flammable storage cabinets. Do not store anything but flammable or combustible liquids in these cabinets.
- Segregate acids from bases.
- Segregate most organic acids from oxidizing mineral acids.
- Keep oxidizers away from other chemicals, especially flammables, combustibles and toxic materials.

- Keep corrosives away from substances that may react with and release corrosive, toxic or flammable vapors.

6.2. Basic Storage Requirements

The following basic storage requirements apply to all hazardous chemicals. Refer to appendix C for more detailed information on ISU chemical storage procedures.

Storage Area Requirements:

- Label storage areas according to the type of chemical family or hazard classification.
- Inspect storage areas annually or at the end of projects.
- Keep storage areas well-lit and appropriately ventilated.
- Eliminate ignition sources such as open flames, heat sources, or direct sunlight.
- Confine chemical storage areas so that leaks or spills are controlled. Prevent chemicals from running into sinks or floor drains. Clean up spills and drips immediately.
- Do not store chemicals in sinks or fume hoods. Chemicals must not be stored on the floor or window ledges.

Storage Cabinets

Use only UL-approved storage cabinets. Never alter a flammable storage cabinet unless directed to do so by EHS.

Label cabinets with the hazard class of the chemicals.

Storage Shelves

Shelves should be level, stable and secured to the wall or other stable surface. Shelves should have stable raised edges or lips to prevent containers from falling. Containers should not protrude over edges. Storage of materials must not be above eye level.

Shelves should be kept free of chemical contamination and dust and be located away from direct sun, flame, or heat sources.

Storage Containers

Keep containers closed unless you are dispensing a chemical or adding to the container. Never store a container open or with a funnel in it.

Provide secondary containment for liquids in containers larger than 1 gallon in size.
Use approved containers for flammable solvents.

6.3. Chemical Stability

Stability refers to the susceptibility of the chemical to dangerous decomposition. Ethers and olefins form peroxides on exposure to air and light. Since these chemicals are packaged in an air atmosphere, peroxides can form even though the containers have not been opened. Write the date received and date opened on all containers of peroxide forming chemicals.

See **Appendix B: Chemical Storage and Segregation** for specific guidance on peroxide forming chemicals, including storage time limits for various peroxide forming chemicals.

6.4. Compressed Gases

- Carefully read the label before using or storing compressed gas. The SDS will provide any special hazard information. Always use the minimum size cylinder required to perform the work.
- All cylinders of compressed gases must be handled as high energy sources. When storing or moving a cylinder, secure the cap in place to protect the stem. Use suitable racks, straps, chains or stands to support cylinders. Compressed gas cylinders pose a crush hazard to hands and feet.
- Do not expose cylinders to temperature extremes.
- Do not store cylinders or lecture bottles with the regulator in place. If the regulator fails, the entire contents of the gas cylinder may be discharged.
- Always use the correct regulator. Do not use a regulator adapter. Oil or grease on the high-pressure side of an oxygen cylinder can cause an explosion. Do not lubricate an oxygen regulator.
- A cylinder should never be emptied to a pressure lower than 172 kPa (25 psi) because the residual contents may become contaminated with air if the valve is left open.
- Always wear safety glasses when handling compressed gases.
- The various hazard classes must be segregated and stored in quantities dictated by International Fire Code (IFC). Contact EHS for assistance with compliance. This citation applies to all chemical storage in buildings.

See Appendix B for detailed information on chemical storage and segregation.

6.5. Expired Chemicals

Any expired or out-of-date chemical must be properly disposed if it presents an increased safety risk over time such as peroxide formers and picric acid. (The PI may choose to retain chemicals past their expiration if the chemical has no increased risk and it is properly stored.) EHS strongly recommends disposal of expired chemicals if they are not needed in the foreseeable future.

Time-Sensitive Expired Chemical Disposal

Failure to dispose of time sensitive chemicals prior to their expiration date can result in unnecessary risk, disposal difficulty and increased cost. Depending on the chemical and its age, testing and disposal by an outside vendor may be required. In extreme cases, an explosive ordinance disposal unit (i.e., bomb squad) may be required.

7. Laboratory Closeouts

Researchers are required to follow the ISU procedures prior to vacating any laboratory or other space where chemical, biological or radioactive materials have been used or stored. Events requiring decommissioning of a laboratory include:

- Terminating affiliation with the Idaho State University;
- Relocating to another laboratory space;
- Major laboratory renovation; and
- Retirement from research activities.

8. Appendices

9. References

1. Furr, A.K., Ed, CRC Handbook of Laboratory, 4th ed., CRC Press: Boca Raton, FL., 1995

2. Mahn, W. J. Fundamentals of laboratory safety: physical hazards in the academic laboratory, Van Nostrand Reinhold, New York, 1991

3. Mahn, W. J. Fundamentals of laboratory safety: physical hazards in the academic laboratory, Van Nostrand Reinhold, New York, 1999

4. OSHA Safety and Health Standards (29CFR1910) - United States Department of Labor, OSHA, Government Printing Office: Washington, DC., (latest edition)

5. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, National Research Council, National Academy Press: Washington, D.C., 2011

6. Safety in Academic Chemistry Laboratories- 3rd ed., Committee on Chemical Safety, American Chemical Society: Washington, D.C., 2003

7. UC Center for Laboratory Safety, University of California at Los Angeles, Los Angeles California, 2012, from cls.ucla.edu.

8. University of Illinois, Chicago, Environmental Health and Safety, Laboratory Compliance Documents, 2019

9. Walters, C.C., Ed., Safe Handling of Chemical Carcinogens, Mutagens, Teratogens, and Highly Toxic Substances, Ann Arbor Science Publishers, Inc., Ann Arbor, MI., 1980, Vol. l