

*Insert Facility/Institute Logo Here*

**CHEMICAL HYGIENE PLAN** ***TEMPLATE***

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| Facility: |
| Manual Title: Chemical Hygiene Plan |
| Document Number:  | Version Number:  |
| Process Leader: | Effective Date:  |
| Other documents cross-referenced in this Manual (e.g., manuals, SOPs, forms, records):* Biorisk Management Manual
* Waste Management SOP
* Procurement Request Form
* *[Insert Other Facility Documents]*
* *[Insert Training courses]*
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| Revision Number | Sections Changed | Description of Change | Date | Approved By |
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INSTRUCTIONS: The Chemical Hygiene Plan and supporting Standard Operating Procedure (SOP) templates provide general requirements and guidance that should be addressed within a chemical lab operation system and program. These templates are not exhaustive and facilities must customize each document to ensure it is locally applicable and relevant.

* **Black text** can be considered generic text that may be appropriate for inclusion in a facility’s Chemical Hygiene Plan and SOPs.
* ***Red text*** should be considered guidance or examples and must be reviewed and replaced with facility-specific information.

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1. Purpose and Scope

The purpose of this Chemical Hygiene Plan (CHP) is to provide requirements and guidance that are applicable to and implemented at the *[Insert Facility Name]*. This manual contains institutional policies, general information about facility operations and references to applicable international and national regulations and guidelines that protect the safety and security of facility personnel and the surrounding environment from routine chemical operations. This CHP is supported by a set of SOPs, manuals and attachments that describe the facility operations and detailed work processes related to the principles described in this CHP.

It is the policy of the *[Insert Facility Name]* to provide a safe and secure work environment. By following the guidelines and recommendations herein, the safety of the work environment should be improved by minimizing and/or eliminating, where possible, chemical hazards in this facility and ensuring that routine chemical operations are conducted in such a way as to minimize the risk to personnel, threat to the environment, and the generation of hazardous waste. These policies are applicable to all facility directors, managers, investigators, technicians and staff who conduct or are engaged in biological and chemical work.

The scope of *[Insert Facility Name]*‘s Chemical Hygiene Plan is to set requirements necessary to control risks associated with the handling, storage and disposal of chemical agents in workspaces and facilities. The facility Chemical Hygiene Plan described herein will enable *[Insert Facility Name]* to:

* Establish and maintain a Chemical Hygiene Plan to control or minimize risk to acceptable levels in relation to employees, visitors, the community and others as well as the environment which could be directly or indirectly exposed to chemical agents.
* Provide assurance that the requirements are in place and implemented effectively.
* Provide a framework for training and raising awareness of facility chemical safety and chemical security guidelines and best practices for personnel.

The Chemical Hygiene Plan enables *[Insert Facility Name]* to effectively identify, monitor and control the facility chemical safety and chemical security aspects of its activities. An effective Chemical Hygiene Plan should be built on the concept of continual improvement through a cycle of planning, implementing, reviewing and improving the processes and actions that an organization undertakes to meet goals. This is known as the PDCA (Plan-Do-Check-Act) principle which also compliments the AMP (Assessment-Mitigation-Performance) Model approach to chemical risk management (**Figure 1**).

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| Figure 1. Illustration of Plan-Do-Check-Act Cycle aligned with AMP Model for risk management [Adapted from ISO 35001:2019, Biorisk management for laboratories and other related organisations] |
| Plan | Planning, identification of hazard and risk and establishing goals |
| Do | Implementing training and operational issues |
| Check | Checking, monitoring and corrective action |
| Act | Reviewing, process innovation and acting to make needed changes to the management system |

1. Roles and Responsibilities (*include additional roles relevant to your facility*)
* The safe handling of hazardous materials is an individual responsibility. Every employee, contractor, and visitor working with chemicals in *[Insert Facility Name]* must understand that chemical safety in the organization is an integral part of the job and not an optional function.
* During any operation, anyone may question the safety of any aspect of an activity and may at any time request the immediate cessation of the activity. Such requests should be made to the Scientific Manager, person conducting the operation at that time, or the *[Insert Facility Name]* Safety Officer. The Scientific Manager or the Safety Officer has the authority to make an initial evaluation and decision to stop or to continue the operation.
	+ - * + If the operation is immediately dangerous to life or health, the individual questioning the safety of the operation is authorized to immediately terminate the operation in a manner that eliminates or reduces the hazard and does not introduce new hazards that are immediately dangerous to life or health.

NO JOB IS MORE IMPORTANT THAN YOUR HEALTH, YOUR SAFETY, AND THE PROTECTION OF OUR ENVIRONMENT.

These responsibilities are described generally below. More specific duties are outlined within the *[Insert Facility Name]’s* Standard Operating Procedures.



*[Insert your facility’s organizational chart here]*

1. **Top and Senior Management** shall ensure:

• Enforcement of the safe performance of experimental and support activities.

• All chemical operations within their department(s) and other department(s) that interface with chemical operations are critically examined for management of health, safety and security risks associated with all activities and materials.

• *[Insert Facility Name]* managementshould decide whether a particular operation needs a Policy or Program level document in addition to a Standard Operating Procedure.

• Personnel who perform operations involving chemicals in *[Insert Facility Name]* facilities receive the appropriate health and safety-related training as specified in this Chemical Hygiene Plan.

• That new operations or hazards introduced into a facility are identified and evaluated through the risk assessment process by technical staff that are knowledgeable about the operations to be performed. Management will provide the resources to conduct a complete risk assessment prior to the initiation of work with new chemicals or new operations involving chemicals.

1. **Scientific Managers** shall:
* Ensure that all facility personnel comply with the contents of the Chemical Hygiene Plan and relevant SOPs, and do not operate equipment or handle hazardous chemicals without proper training and authorization.
* Provides training and/or ensures that training is provided to facility personnel on the safe procedures involving chemicals, use of safety equipment, interpretation and use of SDSs (formerly called MSDSs, see page 9 for more information), proper use of personal protective equipment (PPE), incident response procedures in the event of a chemical spill or release, and chemical specific information related to the chemicals in use in the facility.
* Ensure that all safety equipment and engineering controls required based on the risk assessment are installed, maintained, and operated correctly.
* Ensure that PPE is required based on the risk assessment available and properly donned, worn, and doffed by facility staff.
* Follows and ensure that safety rules for working in the facility are followed by all facility personnel.
* Ensures that visitors follow the facility safety rules and assigns escort responsibility for the visitor to a staff member.
* Monitors compliance of facility personnel with rules, use of PPE, proper operation and maintenance of equipment, and condition of the work area(s).
* Reviews requests for chemical procurements and grants approval based on current facility hazards, and after ensuring appropriate safety and security measures are in place.
1. **Facility personnel** shall:

*•* Read the contents of and conduct facility operations according to the Chemical Hygiene Plan and relevant SOPs.

• Review and understand the risk assessments and be familiar with hazards associated with the chemicals and equipment with which they are working, as well as appropriate mitigations of these hazards.

• Take all reasonable precautions to avoid endangering the environment and to prevent personal injury to themselves and to associates.

* Be trained in the interpretation and use of Safety Data Sheets SDSs, the meaning of pictograms used in labelling chemicals, and appropriate actions to be taken in response to the chemical hazards.

• Know where and how copies of SDSs are maintained for the facility and how to obtain a copy of safety data sheet(s) (SDS) for the chemicals they will work with.

• Understand and follow approved safety and operational procedures and practices.

• Take training as deemed appropriate by their Scientific Manager.

• Dispose of waste generated according to procedures in the *[Insert Facility Name]* Waste ManagementSOP(s).

• Inform management and appropriate safety personnel prior to using a hazardous chemical in an application for which a potential exposure exists that has not previously been evaluated.

* Inform management and appropriate safety personnel prior to any changes to SOPs, differences in SOPs and equipment SOPs, and new chemical arrivals.
1. **Safety Officer or Occupational Hygienist** shall:

• Assist in risk assessment activities.

• Provide advice on PPE requirements.

• Perform periodic safety walk-throughs, including ensuring safety equipment is maintained and operational (i.e. eye washes, safety showers, PPE) periodically.

• Be available as a resource to management and facility personnel on safety related issues.

• Conduct and revise training for all personnel.

• Approve chemical procurements.

• Ensure proper disposal methods are available and used for chemicals used in the facility.

• Respond to emergencies and incidents involving chemicals to ensure safety of personnel and environment in coordination with other first responders.

1. Labelling
	1. Do not remove manufacturer provided labels on incoming containers of hazardous chemicals or deface them so that they cannot be read.
	2. Label portable containers with a minimum of: the chemical name, product identifiers, and the same pictograms as the original container. In the event that the container is too small, label with the product identifiers and refer user to SDS for the product.
	3. Pictograms specified by the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) as shown in **Figure 2** will be used for labelling of chemical containers and areas of chemical storage and use.
	4. Labels may be removed from containers only after the container is empty and has been cleaned, if required.
	5. Create labels as needed for new samples or solutions/sample containers or waste containers.

Guidance

It is the *[Insert Facility Name]’s* responsibility to specify whether the following types of containers are subject to labeling and to specify any additional labelling requirements that may be needed as these materials may fall under other facility plans:

• Ionizing and non-ionizing radiation; and

• Biological hazards. (See Biorisk Management Manual and associated SOPs)



**Figure 2:** Globally Harmonized System of Classification and Labelling of Chemicals (GHS) pictograms and the chemical hazards they represent.

1. Posting and Signage
	1. The chemical hazards of an area are to be indicated on a Hazard Information Placard/Emergency Information sign at the entrance(s) to the areas using GHS pictograms (**Figure 2**).
	2. Pictograms are also used during the designation of areas for work involving Particularly Hazardous Substances (PHS). PHSs include those chemicals that are strongly implicated as a potential cause of cancer in humans, reproductive toxins, and compounds with a high degree of acute toxicity.
2. Safety Data Sheets

A Safety Data Sheet (SDS) is an informational document prepared by the manufacturer or importer of a hazardous chemical that describes its physical and chemical properties, its physical and health hazards, and recommended precautions for handling, storage and disposal. A SDS provides safety and health related information such as known hazards of the material, its physical and chemical properties, exposure limits, precautionary measures, and emergency and first aid procedures.

Required Procedure:

1. Safety Data Sheets (SDSs) must be available to workers for all chemicals in use or in storage in their work area.
2. Facility personnel have access to the SDSs for chemicals *[Insert how SDSs are maintained at the facility]*

Guidance

* + - *[Insert Facility Name]* maintains all SDSs received in the SDS Database. This database serves as the official site for SDS at *[Insert Facility Name]* and ensures that the most current version is available to *[Insert Facility Name]* workers. The *[Insert Facility Name]’s* system maintains all current and previous copies of SDSs that *[Insert Facility Name]* has previously been in the database.
		- Backup Copies of SDSs are kept in a central location should the online system fail. Contact the central location for an SDS when the online database is not available.
		- If an SDS is not available for a chemical in your workplace, contact the central location. They will locate the appropriate SDS and ensure that the SDS is put into the system as soon as possible.
		- If you obtain an SDS that is not in the SDS database, email or send a copy via regular mail to the central location so that the database can be updated.
		- If a central database is not available, then copies of SDSs for any chemical used in the facility are maintained in the SDS binder/notebook located in the work area for worker use. A copy of the SDS is also sent to the Safety Office where a master binder/notebook of all SDSs for the facility is maintained.
		- It is the responsibility of the individual receiving the chemical in the facility to ensure that the SDS is received, that it is added to the facility’s SDS binder, and a copy forwarded to the Safety Officer.
		- When adding the new SDS, it is found that an existing SDS is present, retain the most recent version of the SDS in the facility’s binder, marking the older SDS with “archive” and forward the archive copy and a copy of the new version to the Safety Officer.
1. Training on Chemical Hazards

Personnel are trained, knowledgeable, and proficient in appropriate work practices, operation and use of safety equipment, emergency reporting and response, and understand the hazards associated with chemicals in their work area prior to performing work involving the use of these chemicals.

Required Procedure:

• Scientific Managers are responsible for identifying required training and ensuring that facility personnel complete training prior to performing work with chemicals.

The minimum chemical training requirements at *[Insert Facility Name]* includes the following*:*

*[Insert chemical training required for personnel]*

Guidance

Site-specific training shall be provided by the Scientific Manager (or their delegate) on the specific chemicals present in the workspace(s). (This shall be provided at the time of the initial assignment, whenever a new physical hazard or health hazard is introduced into their work area and personnel who have not previously been trained on the new hazard and prior to assignments involving new exposure situations).

* All facility personnel need to know the location of and proper use of emergency eyewash, safety shower, fire alarm pull-box, telephone, fire extinguisher, and spill control materials before beginning work.
* All facility personnel shall be trained on how to respond to spills or releases of chemicals in their facility, reporting of incidents involving chemical spills or exposures, and how and when to perform spill cleanup.
1. Chemical Risk Assessment

Risk assessments identify the hazards and necessary controls for chemicals used in work area, shop, and field work environments. These evaluations are vital for the safety of personnel and the environment. The Safety Officer may conduct monitoring to evaluate the airborne or dermal exposures facility staff may be exposed to in order to evaluate how well control measures implemented are working and how effective the selected controls are in reducing exposure to an acceptable level.

1. Prior to the start of any work:

Scientific Manager’s responsibility:

* Potential [chemical](http://info.sandia.gov/cps/environmental_safety_health/policy/processes/procedures/ESH100.2.IH.4.html) hazards are identified, evaluated and controlled.
* The facility Safety Officer is contacted to perform a risk assessment of potential chemical hazards (e.g., use of chemicals or chemical containing materials in the workplace).
* Any [control measures](http://info.sandia.gov/cps/environmental_safety_health/policy/processes/procedures/ESH100.2.IH.4.html) specified as a result of the risk assessment are implemented and maintained.
* The facility Safety Officer is contacted to re-evaluate potential chemical hazards when changes in workplace conditions indicate a new or increased hazard exists.
* Implement and maintain any control measures identified during the risk assessment to mitigate chemical exposures.

Facility personnel’s responsibility:

* Inform your manager of any potential workplace chemical hazards which have not been identified or assessed.
* Correctly use PPE, engineering controls, and follow SOPs related to the activities performed in the facility.
* Ensure you are trained, knowledgeable, and proficient in appropriate work practices, safety procedures, and hazards associated with chemicals.
1. The hazards covered by this Chemical Hygiene Plan:

The hazards covered by this Chemical Hygiene Planinclude those likely to be encountered when personnel engage in the use of hazardous chemicals. Site-specific physical and health hazards shall be identified prior to commencing work with hazardous chemicals.

* + 1. Physical Hazards

 The following are terms used in SDSs to describe the types of physical hazards:

* Combustible
* Flammable
* Compressed Gas (as a chemical, pressure hazard not covered by this CHP)
* Explosive
* Perchloric Acid: Activities involving heating perchloric acid are only performed in specially designed fume hoods with water wash-down systems, which prevent the formation of shock-sensitive perchlorates.
* Oxidizer
* Pyrophoric
* Unstable
* Water Reactive

b) Health Hazards

The following is a target organ categorization of effects which may occur, including examples of signs and symptoms of exposure to chemicals which have been found to cause such effects. Examples are presented to illustrate the range and diversity of effects and hazards found in the workplace, but are not intended to be all-inclusive:

|  |  |
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| 1. Hepatotoxins

 Signs and Symptoms Chemicals | Chemicals which produce liver damageJaundice, liver enlargementCarbon tetrachloride, nitrosamines |
| b. Nephrotoxins  Signs and Symptoms Chemicals | Chemicals which produce kidney damageEdema, proteinuriaHalogenated hydrocarbons, uranium |
| C Neurotoxins Signs and symptoms Chemicals  | Chemicals which produce their primary toxic effects on the nervous systemNarcosis, behavioral changes, decrease in motor functionsMercury, carbon disulfide |
| d. Agents which act on the blood or hematopoietic system Signs and Symptoms Chemicals | Decrease hemoglobin function, deprive the body tissues of oxygenCyanosis, loss of consciousnessCarbon monoxide, cyanides |
| 1. Agents which damage the lung

Signs and SymptomsChemicals | Chemicals which irritate or damage the pulmonary tissueCough, tightness in chest, shortness of breathSilica, asbestos |
| 1. Reproductive toxins

(including teratogens)Signs and SymptomsChemicals | Chemicals which affect the reproductive capabilities, including chromosomal damage (mutations) and effects on fetuses (teratogenesis)Birth defects, sterilityLead, DBCP (1,2 Dibromo 3-Chloropropane) |
| 1. Cutaneous hazards

Signs and SymptomsChemicals | Chemicals which affect the dermal layer of the bodyDefatting of the skin, rashes, irritationKetones, chlorinated compounds |
| 1. Eye hazards

Signs and SymptomsChemicals | Chemicals which affect the eye or visual capacityConjunctivitis, corneal damageOrganic solvents, acids |

c). Cryogenic liquids and solids

Cryogens such as liquid nitrogen and dry ice are frequently utilized in biological facilities. Contact with cryogens or extremely cold surfaces that these materials have been in contact with can result in frostbite and destroy tissue. Adequate protection of exposed skin and the use of personal protective equipment (PPE) is required at all times when handling, transferring or operating near cryogenic liquids or solids.

* For dermal protection, contact with cryogens, with boil-off gases, and with cold surfaces will be avoided by wearing a lab coat with an apron and using cryo-gloves (which are insulated and impervious to the liquid). Cryo-gloves need to be loose fitting so that they can be rapidly removed if cryogenic liquid becomes trapped close to the skin.
* Gloved hands shall not be immersed in the liquid cryogen nor shall gloved hands be used to retrieve any object from a cryogenic liquid; tongs are required.
* Chemical splash goggles and a face shield are required when filling, pouring, or handling containers with cryogens.
* Cryogenic liquids are very prone to splash because of the large volume expansion ratio when the liquid warms up. In addition to the use of PPE, liquids should be poured slowly when transferring to minimize the potential for boiling and splash.
* Cryogenic liquids or solids shall not be placed into closed containers since this will result in an explosion due to the high pressure generated during the rapid expansion of the gas during vaporization of the liquid. Vented containers shall be used during handling of cryogens.
* Pressure relief devices must be included on each and every part of a cryogenic system to prevent over pressurization of systems. Satisfactory operation of these devices must be checked periodically and must not be defeated or modified at any time.
* Cryogens typically used in the biological work areas (such as liquid nitrogen or carbon dioxide) also have the potential to displace oxygen in the area of use resulting in asphyxiation and death. Displacement of oxygen by the cryogen as it vaporizes cannot be detected by personnel without the use of an oxygen monitor. Cryogenic liquids shall not be stored or used in a closed room since any release (including routine dispensing) can rapidly result in an unsafe environment. Cryogenics must be dispensed, handled, and poured in well ventilated rooms in order to reduce the potential for this hazard (displacement of oxygen by inert gas). Whenever possible, handling of cryogenic fluids where release into the atmosphere is possible should be done in open, well ventilated areas.
* Contact facility safety personnel to determine additional controls that may be needed if large quantities of cryogens are to be stored or used in the facility.
1. General Chemical Safety Risk Mitigation and Control Practices

Work Planning is designed to minimize worker exposure to hazards by utilizing the hierarchy of controls when controlling workplace hazards. Work practice controls include pre-planning work, practicing good housekeeping and personal hygiene to minimize exposure to hazardous materials, and using common sense. Work practice controls must be used regardless of the type of hazardous material handled.

1. The best controls are those that eliminate the hazard. Next are those that control the source or shield the worker from the source. Next is work planning that limits workers’ exposure to the source. Finally, the least desirable approach for controlling exposure is the use of protective equipment worn by the worker. Determine controls based on the following hierarchy of controls and implement them accordingly:
* Elimination of hazardous chemicals: elimination of hazard source, such as removing a hazard in the design process; or elimination of exposure by design, such as eliminating exposure to a source in the design
* Substitution of a chemical to a less hazardous chemical
* Reduction of a chemical’s hazard, such as reducing a source’s potential to expose worker by concentration, pressure, or temperature
* Engineering controls: controlling a hazard with a mechanical device, as in a ventilation system (such as a lab hood or local exhaust)
* Warning Systems: audible and visual signals
* Administrative controls: procedures, rules, and training
* Personal protective equipment worn/used by a worker, such as glasses/face shields; respirators; head/body/hand protection (lab coats, hard hats, coveralls, gloves); etc. (See the “Personal Protective Equipment” Section)
1. Contact the Safety Officer for assistance.

Guidance

Working Alone:

* Working alone (outside of regular operating hours and on weekends) is strongly discouraged. If unavoidable, obtain Supervisor approval and verify that someone else is in the general area and is aware of your work with chemical activities, including the location and duration of the work.
* Notify the *[Insert Facility Name]*’s Security Division of location, duration of work, and estimated time of departure.

Work areas:

* Do not eat, drink, smoke, or chew gum or tobacco in the work area(s).
* Keep work areas clean and free of obstructions. Clean the work area at the completion of an operation or at the end of the day. Reducing clutter reduces the chances for an accident and minimizes the effects if an accident does occur.
* Wipe drips and residues from containers of hazardous materials. Skin contact with residues may cause dermal absorption, chemical burns, skin irritation, and possible accidental ingestion as a result of hand-to-mouth transfer.
* Clean spilled chemicals immediately and dispose of all wastes properly.
* Do not use stairways and hallways as storage areas. Store equipment and chemicals properly and avoid clutter.
* Keep working quantities of all hazardous materials to a minimum. Procure, use, and store the minimum amount of material necessary.
* Use a containment area to minimize spills (spill placemats or trays).

Personal Hygiene:

* When leaving the work/shop area remove all PPE and wash hands with soap and water.
* Always remove gloves before touching common use items such as phones, doorknobs, and computers to prevent contamination.
* Confine long hair and loose clothing when working in the work area/shop.
* Remove jewelry to prevent contact with electrical sources and chemicals and from catching on equipment.
* Avoid wearing certain clothing material when working with an open flame (e.g. Nylon, Rayon, Polyester, other flammable cloth).

Workplace Controls:

* Nonhazardous chemical operations may be done on work benches. These types of operations are those that have negligible risk to eye, skin, or inhalation exposure (no potential to create airborne levels of chemicals above ambient levels).
* Limit work with hazardous chemicals on work benches to operations such as opening packing boxes, preparing labels for containers, handling closed containers of chemicals, and preparing non-hazardous test media or equipment (i.e., operations that do not have the potential to result in worker exposure to hazardous levels of chemicals).
* Use glove boxes or gas cabinets for operations involving alkali metals and pyrophoric materials. The need for ventilation and monitoring of highly toxic and toxic gases are described in the “Compressed Gas Cylinders and Related Systems” Section.
* Use plastic or metal connectors on gas tubing whenever possible.
* Refer to relevant sections of the chemical hygiene plan or SOPs regarding use of compressed gas cylinders and related systems, pressure safety, fire safety, cryogenics safety for requirements and guidance for operations with these items.
* Some organizations may require approval for purchase of chemicals. Contact your Safety Officer.
1. Chemical Procurement, Storage, and Use

 *[Insert Facility Name]* should have a way to account for chemicals in *[Insert Facility Name]’s facilities. [Insert Facility Name]* can have its own system to provide chemical inventory. Suggest the development of a chemical management system which provides a site-wide chemical inventory to chemical owners, safety personnel, and emergency responders (e.g., fire, police, EMS).

Procurement

1. Before procuring any chemical, facility personnel shall:
* Request Scientific Manager approval. (e.g., a Procurement Request Form)
* Consult with Scientific Manager and Safety Officer to conduct a risk assessment. If a risk assessment has not been previously performed or if conditions or chemical use has changed, a new risk assessment will be performed to determine the necessary control measures that may be needed for its use.
* Become familiar with the hazards associated with that material by consulting all of the following:
1. SDS.
2. Other current references for hazardous materials.
3. *[Insert Facility Name]* Safety Officer.
* Attempt to substitute a less hazardous chemical if experimentally possible.
* Ensure that appropriate receiving, storage, transportation, and operational facilities and equipment are available.
* Ensure that there is an appropriate disposal path for the chemical.
1. When procuring chemicals:
* Personnel shall order only quantities necessary for the work to be performed and avoid ordering excess quantities. This prevents the required disposal of excess quantities of chemicals at a later date.
* Chemical quantities on hand should be limited to the quantities necessary for immediate needs.
1. When receiving chemicals:
* No chemicals shall be accepted from suppliers if they are incorrectly labeled or “out-of-date”.
* All chemicals will be inspected on receipt to ensure that it is in good condition and dated.
* Chemical stocks will be rotated to ensure the use of older chemicals first.
	+ Ensure a risk assessment was performed and all mitigation measures are in place.
	+ Ensure any updates to CHP, SOP, and other documents are finalized.

Storage

* 1. All chemicals shall be stored in approved chemical storage areas that are suited for the specific hazard(s) of the chemicals.

General Guidance:

* Minimize risk to personnel and the environment.
* Chemical storage is not allowed inside a chemical fume hood or Biosafety Cabinet, on benchtops, aisles, floors, hallways, or route of egress from the work area.
* Chemicals will be stored according to hazard category and compatibility.
* Incompatible materials shall be stored separately, with the level of separation based on the severity of the incompatibility (e.g., acids and bases may be placed in separate secondary containers and on separate shelves). Refer to SDS for storage incompatibilities.
* Avoid exposure to heat, direct sunlight, and exposed electrical sources.
* Keep all containers closed and inspect container/seals for signs of deterioration or degradation. Secondary containment will be used where appropriate.
* Keep all storage areas clean, closed (and locked), and free of excess materials.
* Do not store containers on the floor.
* Store flammables and reactive chemicals in approved flammable cabinets, away from any ignition source.
* If flammable and requiring refrigeration, use an explosion-proof refrigerator designated for chemical storage only.
	1. All storage areas should be appropriately labelled with GHS pictograms (See **Figure 2**).
	2. Stored chemicals should be examined at least annually for expiration and signs of deterioration or degradation of container integrity. Some chemicals are subject to degradation with time (refer to SDS) and the condition of these materials shall be regularly reviewed. Some chemicals, such as ethers, are susceptible to oxidation and can form explosive peroxides. Consult the SDS as these chemicals should be examined more frequently.
	3. All refrigerators should be labeled properly with GHS pictograms and include signage for “No Food”
	4. Consult with Safety Officer for additional assistance with determining storage requirements.
	5. Flammable Chemicals
* Flammable chemicals shall be stored in a flammable storage cabinet.
* Flammable gases should not be stored in non-vented cabinets.
* Do not place flammable storage cabinets near an egress route.
* Flammable storage cabinets are normally not vented, and where appropriate vent bungs should be in place.
* Flammable solids shall be stored in a flammable storage cabinet that has been labeled "Flammable Solids”.
	1. Sensitive Chemicals
* “Sensitive Chemicals” are defined as chemicals which are most likely to be used for the clandestine manufacture of illicit drugs. These chemicals may be controlled drugs or precursors that could be illegally used for the manufacture of such drugs. See Appendix for a partial list of sensitive chemicals.
* Sensitive chemicals shall be stored in a separate, locked storage cabinet.
* Labels should indicate the specific hazards of the contents and that the contents are "controlled."

Working with Hazardous Chemicals (Use)

1. Personnel working with chemicals in *[Insert Facility Name]*facilities should:

• Be familiar with the physical and health hazards and the signs and symptoms of exposure associated with the chemicals they use.

• Review associated SDS documents.

• Review other reference material as needed to determine safe operational procedures.

• Contact the *[Insert Facility Name]* Safety Officer for additional information as needed.

1. Personnel shall follow these general procedures for their personal safety:

• Perform a risk assessment prior to working with any chemical.

* Personnel shall understand and implement procedures for proper handling, storage, and disposal of hazardous chemicals and equipment they use.

• Personnel shall avoid underestimation of risk.

• Exposure shall be minimized, even for substances of no known significant hazard.

• Shoes that expose toes, or any portion of the foot, shall not be worn in chemical work areas.

• Lab coats are required when working with chemicals; splash aprons may be recommended in addition to a lab coat when using large volumes of chemicals.

* Eye protection and gloves are required when handling any chemical.
* PPE used in the work area shall remain in that area and will not be worn in public areas.

• No one shall intentionally taste or smell chemicals.

• Chemicals will not be pipetted by mouth; a bulb or automatic pipetting device shall be used.

• Exposure to any chemical shall be minimized since few chemicals are without hazards.

• Skin contact with chemicals should be avoided.

• Personnel should avoid:

a) Working alone with hazardous materials.

b) Performing hazardous operations in a locked area.

c) Performing hazardous operations after normal working hours.

1. Personnel shall follow these general procedures for protection of the environment:

• Chemical operations should be conducted in such a way as to minimize generation of hazardous waste.

• Chemicals shall be disposed of properly. *[Reference relevant Waste Management SOP]*

• Chemicals shall never be poured into sinks without first obtaining permission from the Safety Officer.

• Chemicals shall never be allowed to evaporate as a means of disposal.

• Personnel should properly dispose of experimental samples unless required for archival purposes.

1. Gases
* The use of compressed gases introduces additional pressure safety hazards. Compressed gases may present physical hazards due to pressure or as a cryogen in addition to a chemical hazard due to the composition of the gas.
* Use of gases that are toxic or corrosive requires a detailed SOP – contact *[Insert Facility Name]* Safety Officer for help with generating the SOP.
* Flammable gases should not be stored in a flammables cabinet unless the cabinet is mechanically vented.

Guidance:

Considerations are needed for gas safety hazards including:

* Securing gas cylinders, for example using straps, to prevent tipping and becoming a projectile if pressure vents suddenly, and for security of the item
* Separating incompatible gases
* Pressure release valves
* Appropriate regulators (chemically compatible)
* Temperature
1. Medical Consultation

Personnel should have the opportunity to receive medical consultation if:

• They develop signs and symptoms associated with a possible exposure to a hazardous chemical.

• An event (spill, leak, explosion, or other occurrence) in the work area results in the likelihood of a hazardous exposure.

• Exposure monitoring reveals exposure levels that routinely exceed an allowable level based on the published occupational exposure limits.

* If they have concerns about the potential impact of chemicals they work with on their reproductive health.
1. Personal Protective Equipment

Personal protective equipment (PPE) is used to supplement but not substitute for engineering and administrative controls. PPE includes chemically resistant gloves, eye wear, footwear, lab coats, aprons, coveralls and respiratory protection. PPE may be used as a sole means of control if the use of other controls is not feasible. Scientific Managers shall provide PPE at no personal expense to the staff. To be effective, workers must understand the proper selection, use, and limitations of PPE. The minimum PPE required for work in workspaces containing chemicals includes chemically resistant gloves, eye wear, and closed-toe shoes. Additional PPE will be required with large volumes of chemicals or work with more hazardous chemicals.

Required Procedure:

* + Review the associated SDS and/or contact the *[Insert Facility Name]* Safety Officer for aid in determining the appropriate type of PPE.
* Review PPE requirements in other sections of this Chemical Hygiene Plan, or Specific SOPs.
	+ Inspect all PPE for faults or deterioration before each use.

Guidance

* If not addressed in any of the above sources of PPE requirements, have a workplace hazard assessment performed by the Safety Officer with written certification that evaluates the prevention of injury or impairment of any part of the body through absorption, inhalation, or physical contact. Document the workplace evaluation on the risk assessment, or other appropriate document.
* Scientific Manager or supervisor communicates PPE requirements to each affected worker and ensures that each worker is knowledgeable in the PPE they use (what PPE is necessary; its limitation; how to properly put on, take off, adjust, and wear it; and the proper care, maintenance, useful life, and disposal of the PPE).
* Workers are responsible to maintain PPE for eyes, face, head, and extremities in a sanitary and reliable condition and report problems with PPE to the Scientific Manager or Supervisor immediately. Keep lab coats free of chemical contamination by laundering or frequent replacement.
* Remove contaminated lab coats, coveralls and gloves prior to going to common areas such as lunchrooms, conference rooms, offices, rest rooms, cafeteria, and entering personal vehicles to avoid transferring any potential contamination. Remove gloves before touching common use items such as phones, computers, light switches, and doorknobs.
* Ensure that contaminated PPE is properly disposed of. Review the “Waste Management” SOP for information on disposal of PPE with known chemical contamination.
1. Decontamination of Equipment, Buildings, and Workspaces

All surfaces and equipment should be cleaned and put into a safe condition prior to vacating, transferring, or relocating a work area. Clearing work areas of debris and contamination prior to transfer of ownership safeguards the personnel who work in these areas during space or building demolition, renovation, and construction activities. It also prevents delays in renovation and demolition schedules.

Required Procedure:

A. Scientific managers and work area staff are responsible for removing cleaning and decontamination floors, bench tops, shelves, inside drawers, cabinets, refrigerators, surfaces of local exhaust enclosures (e.g., chemical fume hoods and glove boxes), any other potentially contaminated surfaces, and any equipment that is to be moved or transferred.

B. Remove and/or properly dispose of equipment, supplies, products, and materials such as apparatuses, thermometers, gas cylinders, medical waste containers, sharps containers, sharps (needles and razor blades), trash, absorbent material, and other miscellaneous work space or shop material prior to vacating the space.

C. If toxic chemicals (either solid or liquid) have been used, contact *[Insert Facility Name]’s* Safety Officer to determine ifsurface wipe samples need to be taken before removing designated area postings.

D. If perchloric acid has been used, contact *[Insert Facility Name]’s* Safety Officer to have surface wipe samples taken before removing area postings.

E. For construction, renovation or building demolition projects, the Project Manager is responsible for ensuring that chemical hazards have been removed by line managers, PIs, and Supervisors of work and shop spaces prior to turning the building or space over to the demolition/construction subcontractor.

Guidance

* Scientific Managers, PIs, and work area staff are the most familiar with the hazards, historical spills, contamination, etc., in their space and are therefore responsible for ensuring that chemical, physical, biological, and radiological hazards have been removed prior to releasing these spaces to new occupants.
* Contact a Safety Officer if assistance is needed with identifying hazards. In some cases, a separate hazard evaluation may be necessary.
* It is recommended that surfaces be wiped down with mild detergents such as soap and water.
* Contact *[Insert Facility Name]’s* Safety Officer if mercury droplets from historical spills are found to determine the appropriate spill-response actions.
1. Emergency Procedures and Equipment

Even the most well-prepared facility may experience accidental or intentional incidents or emergencies such as fire, biological release, chemical spill, or minor workplace injuries despite existing prevention or mitigation measures. Effective incident response is a mitigation strategy that may reduce the consequences from these unknown events through planning, and preparing for potential incidents, as well as detecting, communicating, assessing, responding to and recovering from actual events. Facilities should have a documented contingency plan for incident or emergency identification and response. Plans should be developed at a senior management level and incorporate feedback from frontline staff.

Planning considers the potential incidents and designates resources to respond effectively and mitigate adverse effects. These potential incidents should take into account the risk assessment for an individual work area and the facility as a whole.

Required Procedure:

A. Ensure workers know the location of emergency eyewash, safety shower, fire alarm pull-box, telephone, fire extinguisher, and spill control materials before beginning work.

B. In the event of a major spill, evacuate the area and from a safe location call *[Insert Facility Name]’s emergency line* for emergency response.

C. Ensure that all personnel receive a medical evaluation by *[Insert Facility Name]’s emergency service* when they exhibit signs or symptoms associated with chemical exposure or receive significant exposure from a chemical spill or leak.

D. Provide plumbed emergency eyewashes and safety showers in areas where a splash hazard to corrosives, formaldehyde, eye irritants, or chemicals that are toxic via skin and/or eye contact exist. Install shower/eyewashes in the immediate work area at a location that can be reached by a contaminated worker in an unimpeded path within 10 seconds (approximately 4.5 meters).

Guidance

* In operations where eyewash and shower are not immediately available (such as in remote locations), provide alternative means of eye and skin protection.
* Visually inspect and check the operation of emergency eyewashes monthly and safety showers twice annually by assigned facility staff to ensure they are maintained in good working condition. Ensure an inspection tag/form is completed on or near the emergency eye wash/safety shower to document this activity. Notify your Safety Officer for maintenance or replacement of any safety equipment not operating correctly.
1. “Activation” means a brief test to verify water flows. All users are permitted and encouraged to activate their equipment regularly. When chemical use is very intermittent, an acceptable practice can be activating the eye wash prior to use of chemicals.
2. “Testing” means measurement of flow, temperature, and spray pattern.

E. As described in your work planning, control and cleanup small spills using Spill Kits and procedures (e.g., seal drains). You can consider cleaning up a small chemical spill when the following conditions are present:

* The spill is less than a liter (or less depending on hazards associated with specific chemicals).
* You have been trained and approved to do spill cleanup by your supervisor.
* There is no potential for release to the environment. Note: Care must be taken to avoid spreading or tracking chemical contamination to other areas.
* There are no personal injuries resulting from the spill.
* You know the chemical, its hazards, and the correct cleanup procedures.
* You have the proper spill cleanup materials and PPE to protect yourself during the cleanup. This may be different PPE than what you wear to work with the chemical.

When a spill exceeds your ability to safely and effectively clean up the spill:

* Notify other personnel in the immediate area and have everyone leave the workspace or immediate area.
* Close the door. Stay close by and control access. Post the entrance with a warning such as “Spill—Do Not Enter”.
* Call (or have someone call) *[Insert Facility Name]’s emergency line* for assistance.
* Keep spill cleanup kits in your work area. There are different types for acids, bases and solvents. These are commercially available. Absorbents and other materials need to be “inert” to the spilled material. Combustible materials such as sawdust and paper towels are generally inappropriate substitutes for the materials contained in spill kits.
* For mixed (i.e., biological and chemical) spills, call *[Insert Facility Name]’s emergency line* and contact your supervisor and your Safety Officer.
* Ensure waste materials are properly contained and labeled and are placed in an approved accumulation area.

F. Personal Injury from or Exposure to Chemicals:

All injury or exposure should be reported to the scientific manager or PI and the Safety Officer. In general, adhere to the following First Aid Measures for accidental exposures:

 Inhalation:

* Leave the area immediately or remove affected co-workers if it is safe for you to do so.
* Make others nearby aware of the emergency.
* Close the area (i.e. room door, sash to hood, etc.).
* Call Scientific Manager and *[Insert Facility Name]’s emergency line* for assistance.

Skin or eye contact:

* Flush exposed skin or irritated eyes with copious amounts of water or saline for at least 15 minutes. While flushing, or as soon as possible, call *[Insert Facility Name]’s emergency line* or have someone drive you to an Occupational Medicine Clinic or Emergency Clinic once sufficient flushing has taken place.
* For small areas of skin contamination: Remove contaminated clothing; wash the skin thoroughly with water.
* For large areas of skin contamination: Remove contaminated clothing; wash the area thoroughly in a safety shower; and call (or have someone else call) *[Insert Facility Name]’s emergency line* for assistance.
* Flush the affected area for at least 15 minutes (with exceptions for phenol and hydrofluoric acid).

Ingestion:

* Call *[Insert Facility Name]’s emergency line* as soon as possible.
* If spontaneous vomiting appears imminent or occurs, help the person keep a clear airway.
* If victims are unconscious or cannot sit up, turn them on their side to help avoid possible aspiration of vomitus.
* Never give liquid to a person showing signs of sleepiness or who may become unconscious.

 Injection:

* Injections can occur from lacerations and punctures when handling sharps (needles, phlebotomy supplies) that are contaminated with chemicals.
* All sharps injuries may be reported to the Safety Officer.
* First stop the bleeding. Minor cuts and scrapes usually stop bleeding on their own. If they don't, apply gentle pressure with a clean cloth or bandage.
* Rinse out the wound with clear water. Soap can irritate the wound.
* Report to the Safety Officer or call *[Insert Facility Name]’s emergency line*.

In all cases, it is important for personnel to identify the chemical involved in order to provide appropriate treatment. Provide the chemical name at a minimum, and SDS if possible, to emergency response personnel and health care professionals.

Fire Extinguishers:

If additional extinguishers are needed for an area or if special extinguishers are needed for materials such as combustible metals, contact *[Insert Facility Name]’s* Safety or Fire Safety Officers for information concerning recommendations and requirements.

* Fire extinguishers are to be used by *[Insert Facility Name]’s* personnel who know how to use extinguishers and are confident that they can fight the fire safely.
* If the fire is too large, spreading rapidly, or you are not comfortable using the fire extinguisher, alert other people in the area, leave the building and pull the fire alarm on your way out. Once at a safe location, call *[Insert Facility Name]’s emergency line* and inform the dispatcher of the fire location (building and room number) and what is burning, if known.

Drills and exercises, annually, can also be used in the planning and preparation stages to test the responses to simulated incidents or emergencies. They can help identify gaps and other improvement opportunities. Emergency plans should be reviewed and updated at least annually incorporating the information garnered through drills and incident reports and investigations. Plans should take into consideration the steps between event occurrence and identification and reporting. A standard reporting chain should exist to facilitate reporting. Incident report forms should be available to provide an opportunity for investigation, root cause analysis, corrective action, and process improvement.

1. Medical consultation and medical surveillance

*[Insert Facility Name]* can develop its own process following the guidance below.

**Guidance**

* Medical consultations and examinations related to employee exposure should be provided by the Occupational Medicine Clinic to any employee exposed during work duties; when an employee develops a sign or symptom of exposure to a hazardous material; or when an uncontrolled event such as a spill, leak, or explosion takes place in which there is a likelihood of employee exposure. Anyone with a concern or question may request a medical consultation*.*
* The Occupational Medicine Clinic may also be consulted by women who are pregnant or anyone (male or female) with concerns regarding reproduction.
* Medical surveillance may be requested when there is a possibility of exposure above recommended limits.
* Forms or documentation of assessments or examinations should be included in personnel files and protected as private information.
1. Hazard waste determination and management
2. Hazard waste determination
* All chemicals, including contained gases, liquids, and solids that are toxic, ignitable, corrosive, and/or reactive.
* Metals and waste contaminated with or containing these metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.
* Any waste item that is contaminated with or that contains any of the above chemicals or metals.
1. Waste Management

Satellite Accumulation Areas are locations within the facility near the point of generation, where waste is initially accumulated and is under the control of the generator. These could include collection containers within chemical fume hoods or elsewhere in the facility. The following are guidance for waste collected at Satellite Accumulation Areas and should be modified to reflect national and facility policies related to waste management. *[Refer to the [Insert Facility Name] Waste Handling and Disposal Program Plan for additional details, including disposal of full hazardous waste containers.]*

Guidance:

* Containers must be in good condition, with the proper seal or lid.
* The waste placed in the container must be compatible with the container.
* Mixed waste streams must be of compatible materials.
* Containers must be clearly and legibly labeled “Hazardous Waste”, with the chemical name (no abbreviations or chemical formulas) and quantity (percentage) of the contents listed. The label must be firmly attached to the container. GHS pictograms on labels are recommended (See **Figure 2**).
* Containers must be placed next to or near the process that generates the waste.
* Containers must be kept closed at all times except when adding or removing waste. Do not leave a funnel in the hazardous waste container. Be aware that in some cases hazardous wastes may generate pressures due to gas evolution or heat of mixing. In this case do not close lid tightly on waste container but allow system to depressurize before closing lid and then check periodically to ensure that no pressure build up has occurred.
* Waste and waste containers must be segregated by hazard class.
* Do not store large volumes of flammables in the facility (more than 55 L).
* Removal of a container within 72 hours after it becomes full or is no longer needed.
* All satellite accumulation areas must be under the control of the operator of the process generating waste.
* Containers and area must be inspected at least weekly for leakage.
1. Transporting Hazardous Materials

Required Procedure:

1. Each person who offers transportation of hazardous materials must describe the material on accompanied shipping papers.

The papers must include:

* An identification number
* A proper shipping name, identified in the Safety Data Sheet (SDS)
* The hazard class (**Figure 3**, and per GHS guidance **Figure 2**)
* The total quantity of hazardous materials
* The number and type of packages holding the hazardous contents
1. Marking of package, freight container, and transport vehicle with proper hazard class
* Durable, in English, and printed or affixed on the surface of the shipping package, or on a label, tag, or sign on the package
* Displayed on a background of sharply contrasting color
* Not obscured by labels or attachments
* Located away from any other marking that could reduce its effectiveness



**Figure 3:** Transportation Placards

Packaging

* + - * There will be no identifiable (without the use of instruments) release of hazardous materials to the environment.
			* The effectiveness of the package is not reduced during transportation (can withstand changes in temperature, pressure, humidity, shocks, loadings, vibrations, etc.).
			* The effectiveness of the package is not reduced from the mixture of gases or vapors inside the package that can compromise the packaging material.
			* There will be no hazardous material residue adhering to the outside of the package during transport.
			* Follow GHS guidance regarding outer and inner shells.
			* The contents of the package (the hazardous material) and the material of the package itself must be resistant to significant "chemical or galvanic reaction" that can compromise the integrity of the package. Additionally, hazardous materials may not be mixed together with other hazardous or nonhazardous materials creating a reaction causing:
* Combustion or dangerous evolution of heat;
* Flammable, poisonous, or asphyxiant gases; or
* Formation of unstable or corrosive materials.
1. References

This Chemical Hygiene Plan serves to demonstrate that the *[Insert Facility Name]* recognizes the documents listed below as industry best-practices and informative references and seeks risk management through a systems approach using risk-based and sustainable methods:

* 1. Occupational exposure to hazardous chemicals in Laboratories (Laboratory Standard) 29 CFR 1910.1450. <https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106>
	2. Hazard Communication Standard (HazCom) 29 CFR 1910.1200. <https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10099>
	3. Globally Harmonized System of Classification and Labelling of Chemicals (GHS) (2011). <http://www.unece.org/fileadmin/DAM/trans/danger/publi/ghs/ghs_rev04/English/ST-SG-AC10-30-Rev4e.pdf>
	4. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards (2011).

<http://www.nap.edu/catalog/12654/prudent-practices-in-the-laboratory-handling-and-management-of-chemical>

* 1. *International Chemical Safety Cards* from the International Programme on Chemical Safety (IPCS, 2009). <http://www.inchem.org/pages/icsc.html>
	2. Emergency Response Guidebook (ERG) 2020.
	3. ISO 35001:2019, Biorisk management for laboratories and other related organisations. <https://www.iso.org/standard/71293.html>
	4. *[Insert other national guidelines, regulations, or references]*
1. Appendix

**SENSITIVE CHEMICALS**

|  |
| --- |
| **Chemical Name** |
|
| N-Acetylanthranilic acid |
| Amphetamine |
| Anthranilic acid |
| Barbituric acid |
| Cocaine |
| Diethyl malonate |
| Ephedrine |
| Ergotamine tartrate |
| Ethylamine |
| Ethyl malonate |
| Fentanyl |
| D-Lysergic acid |
| Lysergic acid diethylamide (LSD) |
| Malonic acid |
| Methamphetamine |
| Methaqualone |
| Methaqualude |
| Methylamine |
| 3,4-Methylenedioxyamphetamine |
| 3,4-Methylenedioxymethamphetamine |
| Morpholine |
| Norpseudoephedrine |
| Pentobarbital |
| Phencyclidine (PCP) |
| Phenylacetic acid |
| Phenylpropanolamine |
| 1-Phenyl-2-propanone (P2P) |
| Piperidine |
| Pseudoephidrine |
| Pyrrolidine |
| Secobarbital |

Reference: GN470094 Revision Date: Aug 5,2003