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Manual of Operating Procedures
for
704 BioSafety Level 3 Laboratory Facility

Mark S. Ennen, MA, MPH
Acting Director, Office of Safety and Radiation Protection

1.0 **Intent and Use of Manual**

This manual provides instructions for the management of microbiological research in the BioSafety Level 3 (BSL-3) facility. These instructions are intended to optimize research activities in a strictly controlled laboratory environment and minimize potential biological, chemical, and radiation hazards to researchers, building occupants, and the local community.

This manual is the basic information and training document for all those who enter the facility. As research activities define the scope of work in this facility, this manual will be amended to reflect changes in hazardous research agents, manipulation of these agents, and operational lessons learned to date.

The primary reference for the design of the BSL-3 facility and agent hazard assessment is *Biosafety in Microbiological and Biomedical Laboratories*, (BMBL) 3rd edition, CDC/NIH, May 1993. The BMBL does not address chemical and radioactive hazards; those hazards are addressed in sections 3.6 and 8.0 respectively. The full text of this document is contained in the Health and Safety Manual.

2.0 BioSafety Level - 3 Laboratory: Definition

A BSL-3 laboratory is designed and operated for the safe conduct of microbiological research with pathogenic or toxic agents with a potential for respiratory transmission and which may cause serious health effects. BSL-3 research is made safe through a combination of good microbiological techniques, primary barriers: biosafety cabinets (BSC), chemical fume hoods (CFH), centrifuges, and personal protective equipment (PPE) and secondary barriers: directional air flow, air filtration, restricted access through airlocks, autoclave, and shower and hand washing facilities.

The determination of the appropriate BSL for an agent, in a given research design, develops from a risk assessment based on BMBL, Section VII, Agent Summary Statements. The Agent Summary Statements consist of Laboratory Hazards (identification of pathogenic material, likely routes of transmission, and health outcomes) and Recommended Precautions (recommended BSL and PPE). The next step in this process is the review and approval of the research protocol by the Ross Hall Safety

Committee (RHSC).

The RHSC assesses the agent's viability, most effective means of destruction, modes of transmission, and means of attenuation within the context of the manipulations of the agent as specified in the protocol. The RHSC may require the principal investigator to make changes in the protocol regarding agent manipulation, storage, and disposal/destruction, use of PPE, and medical surveillance.

The Ross Hall BSL-3 facility contains six laboratories. In each lab is a Class II, Type A/B3 BSC with a thimble connection to the facility exhaust system. There is CFH and an ultra-centrifuge in a Type I BSC in the common area. All laboratory manipulations of research agents are to be performed in a BSC, CFH, hi-speed or ultracentrifuge.

2.1 Management Authority

The BSL-3 facility is operated by the authority of the Director of Research through the RHSC and the Biological Safety Officer (BSO). The facility is managed by the Office of Safety and Radiation Protection (OSRP).

2.2 Researchers: Requirements for Use of the Facility

Researchers must have a research protocol approved by the RHSC and complete the orientation and training for use of the BSL-3 facility. The researchers continued use of the facility depends on compliance to procedures detailed in this manual, institutional policies, and local and federal regulations.

2.3 Research Activity: Approval Process

With the approval of the Office of Sponsored Research a research protocol is submitted to the Chair of the RHSC with a cover letter stipulating the proposed time line for the research and any other considerations which may impact the approval process. Once the protocol is approved by the RHSC, the investigator completes the orientation and training process with the BSO. [INFORMAL RESEARCH?]

3.0 Operational Procedures

3.1 Entering the Facility

The facility is open 7 days a week, 24 hours a day, except for scheduled maintenance, repair, or unsafe working conditions. Enter through the entrance airlock using an assigned code. Your key will operate the electronic lock override at the entrance and to an assigned lab. However, **the key is for emergency use only**. Keys are not for routine access to the facility or an assigned lab. In the event that you do not remember your code use the key. The key override switch is located in the closet adjacent to the entrance. If the system does not work, contact the BSO.

The inside door will not open unless the outside door is closed. Once inside you may exit through the entrance door by pushing the green Exit Access button located to the right of the entrance door. In the event of an emergency, the entrance may be used as an exit. Activity at the facility entrance and exit is monitored by a real-time security camera and video-tape log.

Anything brought inside the facility may become contaminated and will be decontaminated and/or disposed. Therefore, carefully consider bringing in equipment, supplies, research material, brief cases, journals, books, and files.

Hazardous research agents brought into the facility must be transported in a safety container or double container that will not break or open if dropped.

To enter the facility, the minimum PPE requirements are disposable shoe covers and gloves. PPE is put on in the entrance airlock before entering the common area. Disposable lab coats are required for researchers or anyone **working** in the facility. Non-disposable lab coats may be worn in the facility and in the labs when covered with a disposable lab coat.

Direct handling or manipulation of BSL-3 agents is only to be conducted inside a BSC or centrifuge. Inside a BSC the PPE requirement is double gloving and a barrier gown. Centrifuge containers are to be loaded inside a BSC. Additional PPE may be required, depending on the agent and research activity; as specified in the approved research protocol.

When infectious agents are moved outside a lab to the warm room, cold room, freezer, or centrifuge the agents are to be carried in a double container that will not break if dropped. The outside of the container is to be disinfected before it is moved. If an agent is to be autoclaved, it is to be chemically disinfected before it is removed from the lab.

3.2 **Safe Laboratory Practices - Mandatory**

- No eating, drinking, smoking, handling of contact lenses, applying cosmetics, or storing food.
- Do not touch anything unless it is necessary.
- Do not operate any equipment without training and experience.
- In the event that a respirator must be worn, those with beards or mustaches that break the seal between the respirator and the face, must wear a Powered Air Purifying Respirator (PAPR).
- All manipulations of research agents are to be conducted in BSCs, CFHs, or centrifuges.
- All procedures or manipulations of agents must be designed to eliminate or minimize the production of aerosols or splashes.
- Laboratories are not offices.
- All work surfaces are to be decontaminated after use, at the end of any work

period, and after any spill.

- Any spill or release of a hazardous biological or chemical agent is to be reported to the BSO.
- Any equipment failure is to be reported to the BSO.
- Needles (subject to an exception) and glassware are prohibited.
- Any cut or abrasion is to receive immediate medical attention and be reported to the BSO.
- Hands are to be washed on entering individual labs and on exiting the facility.

3.3 Exiting the Facility

The interior of BSCs, CFHs, centrifuges, countertops are to be decontaminated at the end of each work period with _____. It is assumed that any work, area not in use, is free from biological, chemical, or radioactive contamination. Research materials are to be capped, stoppered or otherwise contained. BSCs and the CFH are not to be used for the routine storage of research materials.

Barrier gowns, gloves, and respirators used in the labs are to be discarded in the infectious waste containers inside the labs. Lab coats worn in the labs can be hung outside the lab door. In the exit airlock: 1) shoe covers are discarded with gloved hands and 2) hands washed after removing the gloves and before exiting the facility.

The exit doors are interlocked, so that the outer door may be opened only after the inner door is closed. There are two electronic lock override switches at the exit; one is located just to the right of the interior exit door and the other is located inside the exit airlock. The override switches is key activated and

disengages the locks at both exit doors. There is a real time security camera and video tape of all activity at the entrance and exit of the facility.

3.4 Emergency Procedures - See Section 4.0

Emergency Instructions

During normal business hours (8:00 AM to 5:00 PM) call the Office of Safety and Radiation Protection at 4.2630 or page the on-call Safety Specialist at 4.3321.

Outside of normal business hours page the on-call Safety Specialist **and** call the University Police Department at 4.6111.

Do Not Enter the Facility Unless Authorized
by the Biological Safety Officer or Safety Specialist.

For more specific Emergency Procedures, see Section 4.0.

3.5 Movement of Research Materials In and Out (includes paperwork)

It is the obligation of the principal investigator and researchers to follow the federal regulations and institutional procedures for the transporting of chemical, biological, or radioactive research materials in the Medical Center. These procedures are most critical concerning the transport of BSL-3 research agents. Agents are risk identified as BSL-3 because aerosolization increases the hazard of personal or environmental contamination. Incidents involving the transport of research agents usually means a container break, a spill, a leak --- the release of the agent as an aerosol.

Research agents are to be transported in unbreakable containers or double containers. Gloves are not to be worn when transporting containers, since the outside of the container is disinfected or decontaminated before being moved. If

the container is heavy, bulky, or is to be transported with other materials then a cart is to be used. Containers carrying biohazardous agents are to be labeled with a biohazard sticker. The same rules apply for agents being removed from the facility.

3.6 **Use of Radioactive Materials**

TO BE SUBMITTED by RSO.

3.7 **Use of Chemicals**

The Chemical Hygiene Plan, Appendix A, details the regulations and procedures for the use and disposal of chemicals in the laboratory. In addition to the following guidelines:

- Supplies of chemicals are to be brought into the facility as needed. Space is at a premium and excess storage of chemicals is hazardous and often wasteful.
- Chemicals are to be clearly labeled as to contents, name of investigator, lab designation, and date brought into the facility.
- Waste chemicals are to be clearly labeled as to contents. Mixed solutions should identify all chemicals in the solution. Notify the BSO for the removal of waste chemicals.

3.8 **Computers, Telephones, and Fax Machines**

3.9 **BioSafety Cabinets**

Do not use the BSCs without experience or instruction with these specific cabinets. Read section 8.2, Operating Guidelines, from the NUAIRE Operations and Maintenance Manual [PUT in APPENDIX?]. **These BSCs are for microbiological research in the absence of combustible/flammable or highly toxic/carcinogenic chemicals and radionuclides.** These restrictions are necessary because 70% of the cabinet air is recirculated and 30% is exhausted through the HEPA filter.

Each laboratory has a NUAIRE Class II, Type A/B3 BSC, configured as a Type B3, with thimble exhaust transitions (connections). Exhaust air from this BSC is HEPA filtered. The thimble connection is an air gap in the duct connection between the BSC and the duct leading to the facility exhaust unit (E-20). This air gap means the BSC is not hard-ducted to the exhaust unit. In the event that the air exhaust unit E-20 fails, the HEPA filtered air from the BSC exhaust, directly to the lab. In the event of such a failure, there is no back pressure that could cause a “hiccup” of air back out through the work access opening. The facility system would go into alarm and the researcher would have time to safely discontinue work in the BSC, secure research agents, and exit the facility.

This Class II, Type B3 BSC provides protection for the researcher, the research material, and the laboratory environment. The inward flow of air at the face of the BSC protects the researcher, the HEPA filtered laminar flow inside the cabinet protects the research material, and the HEPA filtered exhaust protects the environment. *Only touch plate gas burners are allowed and alcohol and flame sterilization can only be done with a minimum amount of alcohol* – the HEPA filter is made of combustible material. Consult the BSC Health and Safety Bulletin in the Health and Safety Manual for rules and procedures.

- These BSCs are to be decontaminated at the end of each work period. Spills are to be cleaned up and decontaminated immediately.
- In the event of a BSC alarm, immediately secure research agents and discontinue work until the alarm event is resolved.
- When working with BSL-3 research agents in the BSC, the minimum PPE requirement is double gloves, disposable lab coat, barrier gown, and shoe covers.
- In the event of gross contamination of gloves or gown, remove the PPE while arms are inside of the cabinet.
- Vacuum lines must go through an exhaust flask or a micron filter must be in line.
- Plan research procedures so as to minimize the number of times that the air curtain is disrupted.
- When work is completed allow the cabinet to be purged for 2-3 minutes, then

lower the sliding window until the blower shuts off. In normal circumstances the BSC is turned off when work is completed. The BSC can stay on if the BSL-3 agent is a unique hazard, when there is concern about contamination in the cabinet, or when research materials must be maintained in a contaminant free air flow.

3.10 Chemical Fume Hood

3.11 Warm and Cold Rooms

The Warm room (704H) temperature is set at ___ within a range of ___ to ___. The system alarm is _____. In the event of a system alarm take the following actions:

The Warm room vents to the common area, so any releases in the Warm room will contaminate the common area where the air is exhausted to the filters in E-20. It is the responsibility of those using the Warm to identify all research agents or materials placed in the Warm room, use biohazard stickers as needed, store materials and agents in safe, unbreakable, no-spill containers. Remove materials that are no longer being used. The Warm room is not a waste storage site.

The Cold room (704H) temperature is set at ___ within a range of ___ to ___. The system alarm is _____. In the event of a system alarm take the following actions:

The Cold room vents to the _____. It is the responsibility of those using the Cold room to identify all research agents or materials placed in the Cold room, use biohazard stickers as needed, store materials and agents in safe, unbreakable, no-spill containers. Remove materials that no longer used. The Cold room is not a waste storage site.

3.12 Superspeed Centrifuge

3.13 Ultra Centrifuge

3.14 -80 Freezer

3.15 Inverted Microscope

3.16 Phosphor Imager

3.17 Epifluorescent Microscope w/Camera

3.18 Countertop Centrifuge

3.19 Microfuge

3.20 Undercounter Refrigerator

3.21 Tissue Culture Incubator

3.22 Sinks and Drains

Sinks are to be used for the disposal of small amounts of non-hazardous biological materials, non-hazardous liquids, and small quantities of chemicals, except those that are combustible or flammable. If in doubt, ask the BSO. The sinks in the facility drain to an acid neutralization tank, but any chemical disposed of in a sink should be flushed with running water. Sinks are not to be used as active baths (water running over equipment), since this often results in **flooding**.

3.23 Waste and Disposal

Aside from staff, everything that leaves, through the facility exit, is decontaminated, sterilized, or placed in an infectious waste box. All infectious waste boxes are burned. There is no routine, regular, non-hazardous trash in 704. Contact the BSO for the disposal of non-hazardous trash such as boxes, large glass bottles, outdated supplies, wrapped lab supplies, and similar bulky or heavy materials. Radioactive waste management is specified in section 3.6.

Uniquely hazardous biological material or quantities of hazardous biological material *are to be killed three times*. First in the BSC or bench top with a bleach solution, second in the autoclave, and third by disposal in an infectious waste box (for incineration).

Each active lab is to have an infectious waste box in the lab for disposal of all lab trash, except for chemical waste, materials to be autoclaved and radioactive waste. Waste chemicals are to be labeled as to the mix and lab identification.

3.24 Decontamination and Sterilization

3.25 CO₂ Compressed Gas Cylinders

CO₂ is piped to each lab from a central tank room located adjacent to 702. The gas is piped at 10 PSI. Each investigator is responsible for the responsible management of CO₂ use.

3.26 Reagent Grade Water

The water treatment system, located in the penthouse over the 704 facility, treats water through softening -- replacing calcium and magnesium ions with sodium ions by reverse osmosis, deionizing -- removing soluble minerals by using two resins and a filter membrane), and disinfecting -- killing bacteria and microorganisms by ultraviolet light. The water is stored in two, 1000 gallon tanks and piped to each laboratory. Each lab is responsible for any additional redistilling or filtering.

3.27 Storage of Chemical and Biological Materials

The 704 facility is not intended as a bulk storage facility for chemical and biological materials. The materials should be brought into the facility as needed, and are to be clearly labeled as to contents and ownership (lab identification, investigator's name) critical use date if appropriate.

3.28 Storage of Laboratory Supplies

Lab supplies are to be stored in each lab. The storage available in the common area is limited and shared. All lab supplies are to be marked with the lab identification.

3.29 Visitors

Casual visitors to the inside of the facility are discouraged. The interior of the facility can be seen from the windows into the labs and common area. Visitors entering the facility must be accompanied by a Research Administrator, the BSO, the RSO, staff from OSRP, the Facility Coordinator, or researchers authorized to use the facility. Each visit must sign the visitors log in the entrance and wear the minimum PPE. Visitors must read the sign on the entrance door and be cautioned to not touch anything.

3.30 Windows

The facility windows are intended to improve the lab environment and allow observation of the labs from the corridor. The windows in lab have blinds, which

should be left open when the lab is unoccupied. Whether or not researchers have the blinds open during active lab research is their decision. The external facility windows are not to be covered or used as bulletin boards. The door windows to each lab must remain substantially clear.

3.31 Facility and Laboratory Signage

There are information signs at the entrance and exit to the facility. Both entrance and exit doors have emergency instruction signs. These instructions are in section 3.4. Each room in the facility has a unique identifier. At the entrance to each lab is a Lab Hazard Information Sign with information on the PI, researchers, emergency phone numbers, and research agent (s) (being used in the lab); **those using the lab are responsible for keeping this information current.** The area below the required information is for use by the lab staff (notes, reminders, and announcements). Only dry erase markers are to be used on this sign. Posting other signs must be approved by the BSO.

3.32 Laboratory Close Out

Laboratory close out procedures are detailed in a Health and Safety Bulletin in the Health and Safety Manual. In a BSL-3 facility, these procedures are even more critical because of the potentially unique hazards of the research materials. If the those working in the labs follow the daily decon procedures and label all containers then a lab close out can be accomplished quickly and safely.

4.0 Emergency Procedures - 1st page to list If-Then emergency phone numbers

4.1 Exposure to Research Materials

Report all incidents, however minor, to the BSO. All Medical Center employees are to complete a Workers' Compensation form for submission to OSRP.

Needle stick and other sharps injuries should not occur because needles and glassware are prohibited; with a possible exception for needles. If, however, a sharps injury does occur the wound should be immediately cleaned and

disinfected and the individual is to report to Employee Health Services (EHS) (MFA 4-134) or ER outside of normal working hours. Immediate medical attention is critical.

Dermal or mucous membrane exposure to a chemical or biological agent requires immediate flushing of the exposed area at the eye wash station or in the lab sink. Continue flushing for at least five minutes and then immediately report to EHS or ER --- be certain to accurately identify the chemical or biological agent. Inhalation of an agent requires leaving the area of exposure and immediate medical attention.

Researchers are expected to monitor their health for signs and symptoms indicative of infection or contamination from a known or suspected chemical, biological, or radioactive agent. This information is part of the risk assessment in the research protocol. In the event of any medical treatment, medical personnel should be informed of potentially related research activities. An acute or chronic illness can compromise the immune systems ability to ward off an opportunistic infection from research material. Researchers must take special precautions to protect cuts, abrasions, and skin lesions in the lab environment.

4.2 Shower

The deluge shower is located at the exit to the facility. This shower is to be used when there is a gross biological, chemical or radioactive contamination. Contaminated clothing should be stripped at the shower and left in the common area.

4.3 Spill / Release of Biological or Chemical Materials

- Immediately evacuate the area and shut the door (if one is there) and allow 15 minutes for the aerosols to settle or be exhausted from the room. Seek immediate medical attention if there was an exposure.
- Notify the BSO or Safety Specialist on-call.
- Reenter the spill area only with proper PPE and materials for containing or cleaning up the spill or release.

- Document the occurrence and identify procedures to be corrected.
- Consult with the BSO before continuing research activities.

4.4 Failure of a BioSafety Cabinet

In the event that the BSC alarm sounds, immediately discontinue procedures in the BSC, secure biological agents, decontaminate working surface, and cease work in the BSC until the alarm is resolved.

4.5 Failure of Chemical Fume Hood

In the event that the CFH alarm sounds, immediately discontinue procedures in the CFH, secure chemical agents, decontaminate working surface, and cease work in the CFH until the alarm is resolved.

4.6 Failure of Air Supply and/or Exhaust System

In the event that the air supply and/or exhaust system fails the alarm will sound, the red lights on the status boards will light up and the alarm on the top of the BSC will go red. Silence the alarm by pushing the Silence Alarm button on either status board. The BSCs and CFH will continue in safe operation, but research procedures must be discontinued until the alarm is resolved. If research procedures are a critical moment or time sensitive then the research may continue until there is an opportunity to discontinue the operation.

4.6 Fire in Laboratory

- Discontinue research and secure all research materials.
- Evacuate the immediate area and close the door.
- Call OSRP @ 4.2630 and UPD @ 4.6111

4.8 Fire Emergency in Building

- Discontinue research and secure research materials.
- Evacuate the building using the stairs.
- Congregate on the plaza in front of Ross Hall not in the courtyard.
- Renter the building only when an all clear is sounded.

4.9 Building Power Failure

In the event of a building power failure the power to the 704 facility should be restored, from an emergency generator, within _____. Until building power is restored discontinue all research and secure research materials.

4.10 Flood

In the event of a flood discontinue all research, secure research materials, decontaminate work area, remove all materials or equipment from the floor, move any equipment likely to get wet, and exit the facility. At the first sign of flooding call OSRP and UPD. The facility entrance and exit are ramped to contain approximately 1.5 inches of water inside the facility. There are no floor drains and penetrations between the 7th and 6th floor have been aggressively sealed. Management of a flood in this facility presumes that water is not contaminated since all research materials are secured --- if this is not the case then the BSO, Safety Specialist, or UPD Officer must be informed. No one is to enter the flooded facility without direction from the BSO of Safety Specialist. No one is to enter the facility without waterproof boots and gloves.

5.0 Facility Maintenance and Repair

Facility Management staff will be requested to work only on mechanical, electrical, plumbing, or other utility systems that are not contaminated or have been decontaminated. **Facility Management staff will not work any contaminated 704 systems.** All 704 utility systems, ductwork, pipes, communication and electrical lines are labeled 704 and will be identified as contaminated or not contaminated by the BSO.

The BSO in cooperation with designated Facilities Manager and Supervisors will establish periodic and emergency maintenance and repair procedures. Support staff should not initiate any work on any 704 system without explicit direction from a Supervisor or clearance from the BSO. Shutting down or shutting off any 704 system without prior notice is a serious safety violation. The BSO will provide training to Facilities staff on the operation of the 704 facility.

6.0 Housekeeping

Housekeeping staff will only be requested to clean floor areas that are free from any known gross biological contamination and at a time when research is not being conducted. Once a month (?) the entrance airlock, the commons area, rooms 704A through 704I, and the exit airlock will be wet mopped using a two bucket method. One bucket contains Sanimaster III diluted to_____ for mopping. The second bucket is for the wring out of the mop. The mop head is autoclaved before it can leave the facility.

Housekeeping staff are not to touch or clean equipment, countertop, cabinet, or walls without specific direction from a Supervisor or the BSO. Individual labs will be wet mopped at a time scheduled by the BSO and the Housekeeping Supervisor or Manager. Housekeeping staff will wear non-skid boots, gloves, and goggles for mop operations.

The BSO will provide training to the Housekeeping staff on the operation of 704 facility and will be available for any questions, comments, or concerns.

7.0 University Police Department

In the event that UPD responds to an air supply or air exhaust system alarm, there is no need, for UPD to enter the facility. All staff should leave the facility once research materials are secured. Staff inside the facility, can be contacted by the phone located outside the exit to the facility. The responding UPD officer should push the silence alarm button on the status panel at the entrance to the facility and contact the BSO or Safety Specialist on-call. Research in the facility cannot resume until the alarm status is resolved – the red alarm lights will stay off when the air system is back in line and the reset button is pushed on the status board.

In the event that a UPD officer needs to enter (HOW?) the facility, the officer must put on shoes covers, a disposable lab coat, and gloves if anything or anyone inside must be touched. When exiting the facility PPE is discarded in the exit airlock and hands washed.

8.0 Description of Facility and Equipment Inventory

8.1 Physical Layout / Floor Plan

8.2 Communications

8.3 Construction Materials

8.4 HVAC System [TO BE REVISED]

The air supply unit is AHU-23 and the exhaust unit is E-20. The HVAC system is dedicated to 704. The supply and exhaust units are integrated so that both must be in operation or both are shut down. The integrated air supply and exhaust system will shut down due to an activation of a smoke detector (SD-1 is where?), low air temperature (<40F), or low electrical current.

Both supply air (AHU-23) and exhaust air (E-20) are filtered. AHU-23 contains four pre-filters and four HEPA filters. The HEPA supply filters are rated at 95% efficiency to particles of 0.3 micron. E-20 contains four pre-filters and four HEPA filters. The four HEPA exhaust filters are rated at 99% efficiency to particles of 0.3 microns. The filter pressure for both AHU-23 and E-20 is monitored with set pre-alarm and alarm values. These values are specified in the Sequence of Operations sheets in appendix _____. The pre-alarm and alarm signal are set to indicate increased resistance in the filters which could indicate a loading of the filters or some other problem with supply or exhaust system. The pre-alarm and alarm signals sound _____ and the response protocol is to discontinue all work, secure all biological agents, decontaminate work surfaces, and contact the BSO. Although there is no hazard from materials inside of BSC, that operate independently from the HVAC system, a reasonable course of action requires discontinuing all work until the problem is resolved.

The air ducted to E-20 from each of the six BSC is HEPA filtered before it leaves the BSC, then it is pre and HEPA filtered in the E-20 unit located in the penthouse. The E-20 filters are located before the fan system; all potential contamination is between 704, the BSCs and the filters.

8.5 Electrical System

8.6 Plumbing and Gases

9.0 Guidelines, Policies, and Regulations

A full listing of guidelines, policies, and regulations is contained in section 2 of the Health and Safety Manual.

10.0 Location of Facility Construction Documentation

Appendix A

Chemical Hygiene Plan

Regulatory Reference and Statement of Purpose

This Chemical Hygiene Plan (CHP) is required by the Occupational Safety and Health Administration's (OSHA) "Occupational Exposure to Hazardous Chemicals in Laboratories" 29 CFR 1910.1450. The intent of this plan is to require those who work in the facility to identify hazardous chemicals in each laboratory and to specify that engineering controls, work practices, and personal protective equipment are capable of protecting laboratory staff and the building environment.

Scope of Application

This CHP applies to all investigators, researchers, lab assistants, and students working in the Ross Hall 704 BSL-3 facility.

Assigned Responsibilities and Implementation

Ross Hall Safety Committee

This committee provides professional scientific and medical judgment on issues affecting the health and safety of laboratory staff and building occupants. Research protocols for this facility must be reviewed and approved by the committee.

Office of Safety and Radiation Protection (OSRP)

The Director of OSRP is charged with developing, implementing, and updating this CHP. The OSRP will provide investigators with information, consultation, and assistance required to implement the CHP in the BSL-3 facility.

Principal Investigators, Researchers, and Chemical Hygiene Officer

Each principal investigator or researcher working in the BSL-3 facility shall designate and empower a Chemical Hygiene Officer (CHO), qualified by training, experience, and interest, to provide technical guidance in the implementation of the CHP provisions for each laboratory in the facility. The CHO will be the primary contact with OSRP in regard to the location of the CHP, updating the CHP, and scheduling annual laboratory audits. The CHO is empowered to advise and enforce laboratory safety procedures.

Principal Investigator / Researcher

Each principal investigator or researcher with primary responsibility for the management and oversight of a laboratory is required under this CHP to:

- Ensure compliance by all laboratory personnel with the provisions of this CHP, and all other applicable policies and procedures.
- Ensure that this CHP is amended, if necessary, to reflect the hazardous chemicals and research procedures that may be unique to the laboratory, i.e., a lab working with an unusual number of chemical carcinogens should have some explicit reference to managing the hazard.
- Ensure that laboratory staff, their representatives, OSRP, and OSHA inspectors have access to this CHP.
- Ensure that all laboratory staff have read the CHP and are trained in the safe work practices designed to protect them, their co-workers, and the building environment from exposure to hazardous chemicals. This training should include the proper use and maintenance of engineering controls and personal protective equipment, and other procedures specified in this document to control the exposure to hazardous chemicals.

- Request the monitoring of laboratory personnel if there is reason to believe that the exposure levels for a regulated hazardous chemical routinely exceed the action level or Permissible Exposure Level (PEL). The results of such monitoring are to be reported to employees within 15 days of monitoring.
- Maintain a current list of all hazardous chemicals used in the lab. The Material Safety Data Sheets (*MSDS*) for these chemicals may be stored in the lab or obtained from DEHSM 24 hours a day, seven days a week. OSHA requires that MSDS be available to any employee at any time.

Laboratory Personnel

Investigators and researchers are responsible for complying with the provisions of this CHP in regard to all research activities.

Support Staff

Support staff are not covered under the CHP. Housekeeping, University Police Department, Facility, skilled trade, and contractor personnel are informed of hazards through Hazard Communication training, Health and Safety Bulletins, and Laboratory Hazard Information signs. See section 6, Training and Education, "Training Matrix" in the HSM.

Action Levels and Permissible Exposure Limits

An action level is an airborne concentration of a chemical listed in 29 CFR 1000, Subpart Z, calculated as an eight-hour-time-weighted average that initiates exposure monitoring and medical surveillance. A permissible exposure level (PEL) is the level of exposure that shall not be exceeded in an eight-hour-time-weighted average.

The proper use and maintenance of engineering controls (storage, fume hoods, biosafety cabinets, spark-proof refrigerators, etc.), compliance with safe laboratory procedures, and

PPE will ensure that laboratory personnel are not exposed to hazardous chemicals that meet or exceed either a specific action level or PEL. In the event that a new research project or procedure could result in an unknown level of exposure, it is necessary to conduct monitoring before the procedure is routine.

Exposure Monitoring and Notification of Results

In the event of a spill, leak, or explosion, or if there is any question about the level of chemical exposure in the lab, or if an employee develops signs or symptoms associated with a chemical exposure, contact OSRP (See section 11.0, "Emergency Response Procedures"). If monitoring is conducted, employees will be informed of the results within 15 days of the monitoring. If monitoring confirms that employees were routinely exposed above the action level or PEL, the employee will be provided with a medical examination. In the event of any acute exposure of consequence, the employee will be provided with an immediate medical treatment.

Controls for Chemical Exposure: Substitution, Elimination, and Minimization

It is the responsibility of researchers to use the least hazardous chemicals available and to eliminate hazardous chemicals whenever possible. Research procedures must be designed to minimize the use of hazardous chemicals.

Engineering Controls

These are the primary mechanisms to stop or control the release of hazardous chemicals. These controls include proper storage (ventilation, temperature control, location, quantity, and compatibility), appropriate containers, use of chemical fume hoods and biosafety cabinets, and proper use of equipment such as centrifuges, spark-proof refrigerators, autoclaves, pipettes, blenders, ultrasonic disruptors, grinders, and other devices for mixing, manipulating, or potentially producing aerosols.

It is critical that laboratory staff is trained in the use of the equipment; it should not be assumed that they are familiar with the operation and maintenance of all laboratory

equipment. All laboratory equipment should be on a schedule for routine or periodic maintenance and certification. Fume hoods and biosafety cabinets are tested yearly for airflow velocity, leaks, and filter replacement; this testing and certification is directed by OSRP.

Safe Laboratory Practices

Although the CHP is addressed to chemical hazards in the laboratory, it is apparent that any lab in the medical center presents a range of potential physical, mechanical, and biological hazards. It is also evident that potential hazards may be unique to a given research project. Therefore, any list of safe laboratory practices is incomplete without additions or emphasis added by those working in the lab. Minimally, all labs must post the list of "Safe Lab Procedures and Practices" contained in Appendix B

Personal Protective Equipment

Personal protective equipment (PPE) is the secondary line of defense for protection from hazardous chemicals. If this line of defense is challenged, it means that engineering controls have failed or procedures are being used that can seriously compromise the health and safety of laboratory personnel and other building occupants. PPE is inherently less reliable than engineering controls.

PPE includes gloves, splash aprons, safety glasses, face shields, lab coats, and shoe covers, and respirators. Laboratory personnel who are required to wear PPE shall be trained in its use, fit tested when appropriate, and informed of PPE appropriate to the chemicals in use. The use of PPE in each lab is determined by laboratory procedures, the hazard of chemicals in use, and instructions contained in the chemical's Material Safety Data Sheet (MSDS). If there are any questions about the need to use PPE or fit-testing, Contact OSRP(4.6320).

Chemical Hazard Information

The principal investigator, laboratory supervisor, or CHO is responsible for maintaining a list of hazardous chemicals used in the laboratory. This list must be updated when new procedures or research is started, and a hard copy must be available at all times for inspection by OSHA, during routine lab audits by OSRP, or when requested by an employee. The Laboratory Hazard Information sign, at the entrance to each lab, must identify the BSL-3 agent in use. The critical principle is that an employer is responsible for informing the employee of any hazards associated with potential exposure to a chemical. This responsibility accomplished by identifying the chemicals, determining the hazard(s), labeling the chemicals, establishing safe work practices, and enforcing the use of PPE when required.

The category of hazard(s) a chemical presents is identified on the manufacturers' label or in the MSDS. Laboratory personnel are expected to understand the hazard categories as a minimum qualification to work in a laboratory. A hazardous chemical will fall in one or more of the following hazard categories:

- Flammable
- Corrosive
- Carcinogenic
- Oxidizer
- Reactive
- Toxic
- Mutagenic
- Teratogenic

Material Safety Data Sheets

Chemical manufacturers and suppliers are required by OSHA to supply customers with a MSDS for each chemical. These safety sheets follow a standardized format, provide the following detailed information about a chemical:

- Chemical Identity
- Physical and Chemical Characteristics
- Reactivity
- Personal Protection Required
- Storage, Spill, and Leak Procedures
- Hazardous Ingredients
- Fire and Explosion
- Health Hazards
- Disposal Procedures

Both the Hazard Communication (1910.1200) and the Laboratory Standard (1910.1450) regulations require that MSDSs be available to employees at any time. *Each lab may have*

its own set of MSDSs. The MSDS file at OSRP is available 7 days x 24 hours, Ross Hall B-33 @ 4.2630 or page the on-call Safety Specialist through the Page Operator @4.3321.

Labels

Chemical container labels cannot be defaced, covered, or removed. Labels often contain information on health, fire and reactivity hazards, and first aid.

Laboratory Hazard Information Sign

Each laboratory is posted with a Laboratory Hazard Information sign at the entrance. The information on this sign must be current and complete. Each lab is responsible for Keeping the sign current.

Unique Hazards and High Risk Procedures

OSRP and the Ross Hall Safety Committee are responsible for reviewing and approving the use of hazardous chemicals and materials in sponsored academic and informal research projects in Ross Hall. The chemicals/materials of concern are those that present a *unique hazard* such that access to the laboratory would be restricted and the protocol would *emphasize* strict laboratory practices for the manipulation and containment of the material.

The review process is conducted through the submission of the form, *Identification of Hazardous Materials in Research Projects* to OSRP. The form is available from the Office of Sponsored Projects and OSRP.

Training

Mandatory health and safety training for those working in or around laboratories is specified in the Health and Safety Training Bulletin (See Section 6). *For assistance in providing training, contact OSRP.*

CHP training is mandatory for all laboratory personnel. This training can only be provided by someone skilled in the research of each specific lab; CHP training is not general lab safety training. At a minimum, such training requires reading the CHP, being given an opportunity to ask questions based on the CHP, and filing documentation that such training has occurred and will be updated when there is a change in significant research activities or operations in the lab. Documentation of annual CHP training should be stored in this manual.

Medical Consultation and Medical Examinations

Laboratory employees who work with hazardous chemicals shall have an opportunity to receive medical attention, including medical examinations or tests, under the following circumstances:

- Whenever an employee develops signs or symptoms associated with exposure to a hazardous chemical.
- Whenever exposure monitoring shows evidence that an exposure level is routinely above the action level or PEL for the chemical.
- Whenever there is a hazardous chemical spill, leak, or explosion.

In the event of one of these circumstances, contact OSRP and Employee Health Services immediately for specific instructions in compliance with the regulation covering medical consultations and medical examinations. The laboratory director, supervisor, or principal investigator must provide the examining physician with the identity of the chemicals and a description of the exposure event.

Storage of Hazardous Chemicals

The following list of precautions addresses only the most hazardous and/or common problems in laboratories. The list is not inclusive of all safety procedures applicable to other chemicals or other conditions.

- Minimize the amount of hazardous chemicals stored in the laboratory. This will require more frequent ordering, but it will control the space needed for storage, improve inventory control, and minimize the fire load in the lab. Do not store hazardous chemicals beneath the sink.
- Flammable or combustible chemicals in excess of 10 gallons/42 liters must be stored in a solvent storage room or a flammable storage cabinet in the lab with the permission of OSRP.
- Store separately: Organics and Inorganics, Acids and Solvents, Acids and Bases.
- Peroxidizable compounds (especially ethyl ether) *must* be disposed of within a specific period of time (3 to 12 months) after they have been opened. Once exposed to air, these compounds become heat and shock sensitive --- EXPLOSIVE. These chemicals must be stored separately and the date opened must be marked on the label.
- Toxic, reactive, or flammable/combustible chemicals should never be stored above eye level; containers in excess of one quart/liter should be stored in cabinets or shelves close to the floor.
- The best source of information about the chemicals in your lab is a Material Safety Data Sheet (MSDS), which is available from the manufacturer/supplier or OSRP 4.2630.

Disposal of Hazardous Chemicals

Hazardous chemical wastes are defined as any chemical that is corrosive, reactive, flammable, or toxic (EPA 40 CFR 261). Many lab operations produce these wastes in small quantities that can be diluted or neutralized and disposed in the sink or an Infectious

Waste Box (IWB) (See Health and Safety Bulletin on Chemical Waste Disposal). IWB are sealed, placed outside the lab, and collected by Housekeeping; call 4.6706 to request the pickup and ask for more boxes. For quantities of significantly hazardous chemicals call OSRP and request a pickup. Chemicals collected by OSRP must be labelled as to contents; these chemicals are disposed through a hazardous waste contractor by manifest and follow strict regulations. This is an expensive and potentially dangerous process. Labs are encouraged to minimize the production of this waste by substituting less hazardous chemicals when possible and employing conservative laboratory procedures. The rules for managing the disposal of hazardous chemical waste are:

- Use the original container if possible. The lid, screw top, or cap must be secure and not leak. The outside of the container must be clean and free from contamination.
- The containers must be labeled with the lab number, the contents and approximate percentages of any mixture.
- Call OSRP @ 4.2630 for a pickup.

Emergency Response Procedures

In the event of an uncontrolled release, spill, or leak of a hazardous chemical, follow these procedures:

- Evacuate the immediate area. Secure the leak if possible. If you are uncertain of what actions to take --- *Evacuate* the lab and *Close* the door.
- Do not attempt any spill control or clean up *unless* you know (with confidence) the hazards of the chemical, the spill is of manageable size, you have the materials to clean up/control the spill, and you have the personal protective equipment necessary for the clean-up operation.

- Whether or not you can manage the spill, call OSRP and *give name, location, identity, and quantity of the material spilled, number of people injured, and other pertinent information*. During regular working hours call OSRP, 4.6320 **and** University Police Department (UPD), 4.6111. Other than working hours call UPD, 4.6111 and page the on-call Safety Specialist at 4.3321.

Laboratory Certification

Each laboratory in the Ross Hall completes a laboratory certification process. This process certifies labs for compliance with laboratory safety guidelines, policies and regulations, and provides an opportunity to educate laboratory staff and resolve unique lab safety problems.

The laboratory certification process is detailed in Health and Safety Bulletin. A survey questionnaire is sent to each lab and the results of the survey are used as a basis for an on-site lab audit by a Safety Specialist. The survey would provide as easy checklist of the whole range of safety concerns in a lab, so that the lab audit would only focus on issues where there is a disparity between required practices and current practices in the lab.

The laboratory certification process classifies each lab as either *Pending* or *Certified*. This process stresses a lab's progress in meeting a range of safety compliance requirements in a unique research environment, not on deficiencies or punitive actions.

APPENDIX B

SAFE LABORATORY PROCEDURES AND PRACTICES

1. Minimize all chemical exposures through appropriate engineering controls, safe laboratory procedures, and personal protective equipment.

2. When the specific hazard of a chemical is not known, assume the worst and act accordingly.
3. Whenever possible: **Substitute** less toxic chemicals. **Minimize** the use of toxic chemicals. **Eliminate** the use of toxic chemicals.
4. Minimize chemical storage, promptly discard hazardous waste chemicals, and ensure that incompatible chemicals are stored in separate areas.
5. Combustible or flammable chemicals in excess of 10 gallons/42 liters must be stored in a solvent storage room; more than 7 gallons/29 liters in the lab shall be stored in a flammable storage cabinet.
6. Do not deface, cover, or remove labels from chemical containers unless empty.
7. Do not store chemicals in the fume hood or biosafety cabinet.
8. In the event of a chemical spill, evacuate the lab, clean up the spill *only* if you know the procedures; always report spills to OSRP, 4.6320 and UPD, 4.6111.
9. Wash hands prior to and after research activities. There should be no eating, drinking, smoking, tobacco/gum chewing, applying of cosmetics, or handling of contact lens in the lab.
10. At the end of each work day, decontaminate work surfaces and equipment and return sealed chemical containers to appropriate storage.
11. Laboratory practices and procedures are to be amended whenever there are significant changes in laboratory procedures, equipment, or hazardous materials.

