



Biological Safety Manual

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Introduction:

Policy Statement and Scope of This Manual

It is the policy of the University of Central Florida (UCF) to provide a safe environment for research and study. This manual has been developed for faculty, staff, students, and the greater community in order to minimize their risk of exposure or harm from biohazardous agents and materials from UCF research and teaching facilities. The guidelines and recommendations laid out in this manual are applicable to all personnel working with biohazardous agents and materials and may not be deviated from without prior approval from [Environmental Health and Safety](#) (EHS). This policy has been developed using the mandates, guidelines, and recommendations laid out in the 5th edition of the [Center for Disease Control's](#) (CDC) [Biosafety in Microbiological and Biomedical Laboratories](#) (BMBL, 5th ed.), and by the [American Biological Safety Association](#) (ABSA), [National Institute of Health](#) (NIH), the [Occupational Health and Safety Administration](#) (OSHA), the [World Health Organization](#) (WHO), and the [Florida Department of Health](#). Links to these sources can be found in Appendix F of this manual. By adhering to the procedures and policies laid out in this manual, UCF is creating a standardized metric for the proper usage, storage, and disposal of biological agents and the biohazardous materials and wastes associated with them.

If researchers or staff have questions about the policies in this manual, or are uncertain how its mandate to properly handle, store, treat, or dispose of any biologically derived material is best implemented, they must contact EHS for assistance. The mishandling of biohazardous agents and materials could have serious health consequences for researchers, their staff, the environment, or the greater community. Failure to comply with the procedures and policies laid out in this manual can result in disciplinary actions against the university.

Common Definitions Used in This Manual

Biosafety

The combination of principles and practices employed to protect laboratory personnel and the environment from exposure while working with biological agents and contaminated materials (biohazards). An important part of this concept is the proper use of engineering controls along with the appropriate personal protective equipment (PPE), which will be addressed extensively in this manual.

Biosafety Level

Established guidelines based upon the type of safety equipment required, the laboratory practices and procedures that are needed to work with an agent safely, and the requirements of the physical facility to handle the agent of concern with minimal risk to the personnel and the environment.

Biohazards

Organisms or contaminated materials posing a risk to humans, animals, plants, and/or the environment. Some examples of these organisms include, but are not limited to:

- Bacterial, Viral, Fungal, Parasitic, and Algal Agents

- Various Mycoplasma spp.
- Immortalized Cell Cultures, i.e. 293T, CHO, MDCK Cell Lines
- Biological Toxins Derived from Animal, Plant, Fungal, and Bacterial Origins
- Human and Non-Human Primate Blood, Blood Products, Bodily Secretions, Tissues, and Cell Lines
- [Recombinant DNA](#) of Biological and Synthetic Origin
- Genetically Modified Organisms, Especially Those Modified with Properties of Antibiotic Resistance, Increased Virulence, or Novel Functions
- Biological Waste Generated in UCF Laboratories

Risk Assessment

A process used to identify the hazardous characteristics of a known infectious or potentially infectious agent or material; the activities that can result in a person's exposure to an agent; the likelihood that such exposure will cause a laboratory-acquired infection (LAI); and the probable consequences of such an infection. (BMBL, 5th ed.)

Risk Group

Systems of classification established by the National Institute of Health (NIH) and the World Health Organization (WHO), which organize biological agents by severity and ability to cause harm, using metrics such as the ability to infect susceptible organisms and virulence of disease, available controls and treatments, and the characteristics of transmission. An agent's risk group is not to be confused with the recommend biosafety level at which that organism should be handled.

Before Research Begins

Before any research involving biohazardous agents or materials may be conducted in UCF facilities, or before any alterations to approved experimental procedures are implemented, principal investigators (PI) must seek approval from the Institutional Biosafety Committee (IBC). This committee consists of research faculty, members of EHS, and community health representatives who will conduct a risk assessment of the proposed research, and offer corrections and/or recommendations to ensure the research is conducted responsibly and within all applicable guidelines. To begin this process, the PI must complete the [Biological Agent Registration Application](#) located on the EHS website and submit it before the quarterly meeting. In most cases, the proposal will be assigned reviewers and discussed at the next IBC general meeting before being considered for approval. Research may not begin until this approval is given, and violations of the IBC guidelines or approvals may be subject to disciplinary action.

Additionally, it is the responsibility of the PI to ensure that all lab members are registered with EHS, read and sign off on this manual, and complete all required training. Lists of personnel must be kept current and updated with EHS at least annually. Researchers are also reminded that they are responsible for completing and remaining up to date on all additional applicable training material and official manuals, including the [Laboratory Safety Manual](#). Researchers are responsible for seeking approval and remaining in close contact with other committees and regulatory bodies that their research may fall under, i.e. the Institutional Review Board (IRB),

Radiation Safety Committee (RSC), and Institutional Animal Care and Use Committee (IACUC).

In the Event of an Accident Resulting in Injury or Exposure

UCF takes workplace safety very seriously. In the event of an accident or biohazardous exposure, the PI must be notified and EHS must be contacted through UCF's Work Control (407-823-5223). Students who are injured in UCF research or teaching laboratories should seek treatment at [UCF Health Services](#). Staff or university employees who are injured should notify Human Resources as soon as possible to begin the process of submitting a workers' compensation claim. Additionally, they should contact the current UCF Medical Case Management Workers' Compensation vendor as soon as possible to initiate post-exposure evaluations and seek treatment (see Appendix F.) EHS also requires the incident be documented using the [Incident Report Form](#) available on the EHS website. The Incident Report Form must be completed and submitted within 24 hours of an incident. EHS will contact the submitter and a follow-up of the incident will be conducted.

UCF offers first aid and wilderness first aid classes through Human Resources free of charge to university personnel. Researchers are encouraged to take advantage of this opportunity to be better prepared in the event a non-life threatening accident.

IN THE EVENT OF A LIFE THREATNING EMERGENCY, IMMEDIATELY CALL 911. DO NOT ATTEMPT TO MOVE AN INJURED PERSON AT THE SCENE OF AN ACCIDENT UNLESS A DANGEROUS SITUATION CALLS FOR YOU TO DO SO. INFORM FIRST RESPONDERS OF ANY POTENTIAL THREATS TO THEIR SAFETY, INCLUDING THE PRESENCE OF HAZARDOUS MATERIALS OR ANY BIOHAZARD(S) OR AGENTS.

Roles and Responsibilities:

Environmental Health and Safety:

- Administer and update the Biosafety Program at UCF, including the Biosafety Manual and institutional Standard Operating Procedures (SOPs) for biohazardous materials
- Register and monitor research utilizing biohazardous agents and materials through the Institutional Biosafety Committee
- Provide training to PIs and their staff regarding safe work practices with biohazardous agents and materials
- Evaluate and provide guidance on the proper work practices for PIs and their staff working with biohazardous agents and materials
- Facilitate emergency response through the UCF Police Department and Work Control
- Conduct annual assessments of work groups falling under the scope of the Biosafety Program
- Administer the Occupational Health Program (OHP) and retain non-medical records for enrolled personnel
- Implement deadline-enforced improvement plans for work spaces demonstrating issues with repeat non-compliance, repeat incident reports, or for failure to make necessary improvements identified during inspections
- In the event of willful non-compliance with university policy and/or the directives of the Institutional Biosafety Committee, and in situations immediately dangerous to life and health, enforce the suspension of research and denial of access to the laboratory space

Institutional Biosafety Committee:

- Approve and monitor all research activity at UCF involving the use of biohazardous agents and materials and communicate back recommendations and guidelines (example: infectious agents used in IACUC protocols).
- Conduct a thorough risk assessment of all proposed research activities with biohazardous agents and materials, offering recommendations and alterations to proposed work practices in order to minimize risk of exposure or harm
- Assist UCF police and EHS with emergency response
- Advise EHS to meet the necessary Occupational Health Program requirements of proposed research projects
- Enforce its directives through the suspension of access privileges or research projects for violations of its policies, procedures, or recommendations

Principal Investigators:

- Supervise staff and ensure compliance with the policies and procedures in this manual
- Comply with all federal, state, and local regulations applicable to their research
- Register and gain approval for research projects and amendments with the IBC

- Inform staff and visitors of potential hazards and practice situational awareness to minimize risk of exposure or harm
- Conduct risk assessments with EHS and the IBC to determine best working practices
- Notify authorities and EHS of exposure, injuries, and medical emergencies
- Ensure that they, their staff, and their students remain compliant with all required trainings, and demonstrate competence at working with the agents and materials in their facilities
- Purchase and maintain personal protective equipment (PPE) and contamination control supplies approved by EHS for use in UCF facilities, providing this equipment to staff and visitors
- As needed, develop specific SOPs governing the proper operation of the laboratory and ensure safe working conditions
- Comply with EHS assessments of workplace safety, and implement EHS recommendations and corrective actions to reduce risk in their work spaces

Laboratory Personnel:

- Read and sign this biosafety manual, agreeing to follow its guidelines
- Remain compliant with all required trainings and prerequisites to work in their assigned laboratory spaces
- Participate in the Occupational Health Program if required to do so
- Conduct themselves professionally at all times, adhere to all established SOPs, and practice good situational awareness to minimize risk while working with biohazardous agents and materials
- Report major spills, accidents, injuries, exposures, releases, safety hazards, near misses, or loss/theft of materials to their PI and to EHS through UCF Work Control (407-823-5223)

Additional Training & Responsibilities

Laboratory Safety and Biological Safety

All UCF personnel and visitors who work in laboratory spaces are required to take the Laboratory Safety Orientation and Biological Safety Orientation online training series prior to beginning their work. These courses consist of online learning modules found in the online UCF Canvas system designed to inform you of the risks you may encounter while working with biohazardous agents and materials and the steps you must take to minimize your risk. New PIs and researchers are automatically registered for these courses upon beginning work at UCF. Additionally, you may be required to register for an additional practical session to demonstrate competency in these subjects. Completion of this training must be documented with EHS. Upon completion, refresher training is required annually.

Bloodborne Pathogens and Biomedical Waste

All UCF personnel working with human blood, bodily fluids, tissues, human cell lines, other potentially infectious materials of human or veterinary origin (OPIM), and the non-human primate variants of these products are at a higher risk of encountering bloodborne pathogens (BBP) in their

work. Special safety training is required in these circumstances and will be provided by EHS along with the annual refresher training. Additionally, all personnel falling under this category must read and sign UCF's [Bloodborne Pathogen Exposure Control Plan](#). No personnel falling under this category may begin their work without completing training and signing off on this manual, documenting compliance with EHS upon completion.

Respiratory Protection Usage

All UCF personnel using respirators as part of their PPE requirements for working safely with biohazardous agents and materials are required to undergo medical clearance and fit testing before using this equipment in their work or implementing any substantial change to their work procedures or environment. Additional training steps along with the annual refresher training are required by EHS, and all personnel utilizing respirators must be [documented with EHS](#).

Packaging and Shipping Biohazardous Materials

All UCF personnel shipping or transporting biohazardous agents and materials are required by federal mandate to complete the Hazardous Materials Shipping and Transportation Training provided by UCF before shipping these materials. These materials fall under the regulation of the US [Department of Transportation](#) (DoT) and the [International Air Transport Association](#) (IATA). The online training modules clearly explain the requirements and regulations for shipping these kinds of materials, and completion of this training must be documented with EHS. For more information regarding the rules and regulations of shipping hazardous materials, refer to the [UCF Laboratory Safety Manual](#). **Personnel are reminded that dry ice constitutes a hazardous material when shipping biologicals.** EHS provides additional training on the proper methods for shipping dry ice with samples, and under no circumstances should personnel who have not received the proper training be permitted to ship dry ice. Biologicals may fall under the jurisdiction of the USDA, FDA, or other governmental agencies, and may require special United States Department of Agriculture Animal and Plant Health Inspection Service ([APHIS](#)) documentation and permits. It is the responsibility of the researcher to know these requirements and seek assistance from EHS if needed.

Controlled Substances

University research may require the possession of restricted or experimental materials that fall under the [Controlled Substances Act](#). UCF requires all researchers to adhere strictly to all applicable federal, state, and local regulations regarding these substances and their use in research. EHS has [specific procedures](#) for research falling under these policies, and it is the responsibility of PIs and research personnel to ensure that they are in compliance at all times. Non-compliance can incur severe institutional, state, or federal penalties including fines and criminal prosecution.

Signage

All UCF facilities where biohazardous agents and materials are manipulated or stored must have hazard signage at their entrances with biohazard labeling, the biosafety level, agents and hazards present, and emergency contact information. [EHS issues this signage](#) and must be contacted for new issuance or updates to existing placards.

The Occupational Health Program:

UCF has instituted an Occupational Health Program (OHP) as a preventive measure for the early identification of conditions that could pose a risk for adverse health effects related to certain tasks. This program is coordinated through EHS, and PIs who wish to enroll personnel in the program should contact EHS to begin the process. For the services provided by the OHP, EHS partners with [UCF Health](#), located on University Blvd. This facility is available for consultation with physicians, to perform diagnostic testing, provide necessary immunizations, and to have monitoring done as needed. Participation in this program is a job requirement for certain types of work. Although some personnel may not be required to participate in this program, it is highly recommended that they enroll. It is the responsibility of the PI to ensure strict compliance with this program for all personnel. In most cases, these services are provided free of charge when offered as part of occupational health. EHS is available to discuss any concerns about cost. *Please note that UCF Health **is not** the same institution as UCF Health Services located on the main campus.*

Animal Exposure Program

All personnel whose job requirements bring them into contact with animals, either in UCF facilities or as part of their field research, are required to enroll in the UCF Animal Exposure Program before their research tasks begin. It is the responsibility of the PI to ensure that all staff required to enroll in this program do so. Contact EHS to begin the enrollment process.

Immunizations

All personnel working in laboratory facilities at UCF where there is a risk of encountering a bloodborne pathogen, or another pathogenic organism for which effective vaccination is available, are encouraged to take these vaccinations. In some instances, the internal bodies governing the scope of research at UCF may require that the relevant personnel receive these vaccinations before they are allowed to work in these spaces, or as a prerequisite to approving research projects.

Obtaining Immunizations at UCF

To request immunizations for personnel in UCF facilities, PIs should request an Occupational Health Exam Request Form from EHS and instruct staff to complete it. UCF's occupational health services provider will be contacted to set up immunizations and speak with staff who may have health concerns or questions regarding immunizations.

Hepatitis B Vaccination Series

All personnel working in facilities where bloodborne pathogens are present should be current on the hepatitis B vaccination series. If any personnel wish to decline this vaccination series, they are free to do so but must sign required documentation stating it is their wish to decline vaccination. This form must remain on file with both the PI and EHS.

Additional OHP Services

Additional OHP services include: Respirator Program Evaluation, Spirometry/Pulmonary function testing, audiometry, and evaluation for occupational exposure to certain chemical contaminants.

Establishing a Laboratory for Biological Work:

Environmental Health and Safety is available to assist any PI establishing a laboratory for biological work at UCF. New PIs moving to the university must first register their spaces and personnel with EHS before work begins. A more detailed explanation of this process is found in the [Laboratory Safety Manual](#). In addition to submitting a [completed chemical inventory](#), emergency contact information, and a Laboratory Hazard Assessment Tool (LHAT), PIs working with biologicals should complete the following additional items:

- The [Biological Agent Registration Application](#) for the IBC
- Application for any import/export permits falling under [APHIS](#)
- Licensing and applications for use with any controlled substances
- Registration with [EHSA](#).
- [Initial safety orientations](#) with the Laboratory Safety Coordinator
- All [applicable additional trainings and practical sessions](#)
- Required applications and documentation for other governing bodies related to research, specifically the Institutional Review Board (IRB), Radiation Safety Committee (RSC), and the Institutional Animal Care and Use Committee (IACUC)
- An established laboratory-specific decontamination protocol

Finalizing Registration with EHS

As part of registering new laboratory space at UCF, EHS will schedule a visit to the space with the PI to survey the area and ensure that it is suited to the nature of the work being proposed. EHS will also evaluate any concerns raised during the hazard assessment and check the location of equipment. During this time it may be necessary to submit work order requests, either minor or major, to bring the space into compliance with the PI's needs, or perform maintenance in the space if any areas need attention. Upon ensuring that the area is ready to begin operations, EHS will have the PI complete the [signage request form](#) for all rooms requiring registration.

Maintaining Proper Documentation

It is required by EHS that researchers maintain certain documentation not only for reference, but to provide to EHS, inspectors and regulators, or emergency responders upon request. This documentation may consist of physical copies as well as digital information. Keeping this documentation centrally located also allows laboratory personnel to easily access it when needed. Some of this documentation includes, but may not be limited to, the following items:

- A physical copy of the [Laboratory Safety Manual](#) and the Biological Safety Manual, signed by personnel working in the space
- Training records for personnel
- A [completed chemical inventory](#) for the work space
- Laboratory-specific SOPs (see below)
- Safety Data Sheets (SDSs) for Hazardous Materials
- Copies of permits and licenses
- Equipment maintenance records
- Shipping invoices

Developing Laboratory Standard Operating Procedures (SOPs)

PIs are responsible for developing laboratory-specific SOPs using the guidelines laid out in this manual for acceptable use of equipment, engineering controls, and PPE in UCF facilities. Many of these guidelines were developed using the *5th edition of Biosafety in Microbiological and Biomedical Laboratories*. The relevant sections of this manual are included in Appendix C and D. Laboratory-specific SOPs should contain the following information:

- The PI's name and work spaces where this SOP applies
- PPE required for this SOP
- Potential hazards and risk mitigation strategies
- Justification for any proposed deviation from required PPE or engineering controls, with approval granted by EHS

In addition to the information that should be contained in laboratory-specific SOPs, each laboratory group should have the following SOPs on file:

- A laboratory-specific decontamination plan
- A detailed plan for the management of (bio)hazardous waste
- An SOP detailing the location of safety supplies and devices
- A laboratory evacuation plan, posted at the exit to the work space (see the [Departmental Emergency Evacuation Plan](#))

Laboratory Inspections

[EHS regularly inspects laboratories](#) on UCF property to ensure compliance with federal, state, and local regulations. These inspections follow a standardized set of focus areas, and upon completion of the inspection, the PI is sent a copy of the inspection report detailing areas of workplace safety or practice needing improvement. EHS is available to consult with the PI whose inspections show the need for improvement in work practices. As stated in the "Roles and Responsibilities" section of this manual, PIs and research personnel are required to comply with EHS inspections and implement recommended changes. Failure to do so may result in disciplinary actions against the university. A list of scheduled inspections can be found on the [EHS website](#).

Laboratory inspections are divided into the following categories:

- [CBRL \(Chemical, Biology, Radiation, and Laser\)](#), performed annually
- [RGS \(Radiation and General Safety\)](#), performed quarterly
- Fume hood Inspection, performed biannually
- Chemical Inventory Inspection, as needed

In addition to the above inspections covered by EHS, certain pieces of equipment such as biosafety cabinets require annual re-certification, which can only be performed by licensed technicians who work for the equipment manufacturer. These types of inspections must be completed by placing a purchase order through EHS, whereas the PI or the department is responsible for the cost. It is the responsibility of the PI to ensure that equipment to be inspected on a regular basis is serviced accordingly and that records of this service are kept.

Statement on the Use of Select Agents and Toxins:

The [Federal Select Agent Program](#) was created to provide guidance and oversight to entities utilizing particularly high risk agents and toxins. It is a joint effort of the [Centers for Disease Control and Prevention](#) (CDC) and the [US Department of Agriculture](#) (USDA) [Animal and Plant Health Inspection Services](#) (APHIS). It is the goal of this program to promote laboratory safety and ensure the integrity of these agents. This program regularly inspects approved entities and works closely with the Federal Bureau of Investigation (FBI) to ensure that unauthorized individuals do not gain access to these materials. The agents and toxins falling under this program are reviewed every two years.

The University of Central Florida does not have current approval for a program where researchers may use [Select Agents and Toxins](#). EHS is available to assist any PI whose scope of research may expand into this area. Establishing an approved Federal Select Agent Program at UCF is a lengthy but rewarding process, and there should be proper planning on the part of the PI regarding the nature of the approval process and the operation of a select agent program.

Exempt quantities of select agents and toxins require registration with and approval through the IBC, an SOP for use and inactivation of the toxin, and inventory records.

Security in UCF Facilities:

UCF takes the security of its facilities seriously. Personnel working in laboratory spaces should take the following precautions to safeguard their work spaces and research from theft, loss, or misuse:

- Keep laboratory spaces locked and do not leave them open when workers are not present.
- Do not prop open locking doors or emergency exits. Do not tamper with security enhancements to buildings such as alarms or surveillance equipment.
- Never leave electronic equipment unsecured or bring it outside designated work spaces.
- Do not grant unauthorized access to any individuals seeking to enter UCF facilities or leave visitors unescorted in work areas.
- Keep an inventory of biohazardous agents and toxins used in the laboratory.
- Avoid working after hours. If necessary, utilize the buddy system.
- Report missing equipment, electronics, notebooks, biological stocks, controlled or hazardous substances, and materials with the potential for misuse (i.e. needles, syringes, etc.) to the PI immediately.
- Utilize good situational awareness. Report suspicious persons or activity immediately to UCF Police at 407-823-5555. **Do not attempt to confront any unauthorized person caught attempting to break into UCF facilities and laboratory spaces.**
- For emergency situations, refer to the [EHS Policies](#) page and the section of this manual titled “Emergency Procedures”.

Laboratory Safety Equipment:

This section of the manual provides guidelines for what constitute approved safety equipment when working with biohazardous agents or materials at UCF. In any laboratory working with these materials, the primary means utilized to minimize risks are engineering controls and the proper use of personal protective equipment. These types of safety equipment shall be used properly and at all times when working in areas where biohazards are present. Researchers are reminded that the use of engineering controls is not a substitute for the proper use of PPE and vice versa. Rather, the use of PPE is meant to supplement the use of proper engineering controls to minimize risks. If a researcher has developed any SOPs requiring a variation or exception to the accepted use of engineering controls or PPE, EHS must be contacted and approve this variance before it is implemented.

Commonly Utilized Engineering Controls

Biological Safety Cabinets (BSC) aka Biosafety Cabinets

The BSC is designed to provide personal, environmental, and product protection (Class II & III) when used correctly and according to the manufacturer’s instructions. All BSCs in use at UCF must be certified by a licensed technician before they are put into active use and recertified at least annually thereafter. If moved to a new location, the BSC must be recertified before it can return to service. For information on the different types of BSCs and the protections they offer, and which type of BSC is appropriate for a particular application, consult [Appendix A](#) of the BMBL. It is the

responsibility of the PI to ensure that the BSCs in the laboratory space are functioning adequately and are approved for their particular needs in research, and that all staff are trained and competent in their proper usage. The following practices shall be observed when using BSCs at UCF:

- The BSC will only be used according to the manufacturer's instructions.
- Use of open flame is not permitted.
- Hazardous materials may not be used in BSCs where the air recirculates into the laboratory space.
- The BSC will be kept free of clutter and unnecessary materials when not in use.
- The metal gratings shall remain unobstructed to ensure the proper flow of air through the cabinet.
- The BSC shall be kept clean and properly decontaminated after each use. Spills must be cleaned and not allowed to dry on the surface of or under the metal grille. The space underneath the metal grille must not be obstructed with any materials.
- Chlorinated disinfectants are a corrosion hazard to the BSC. When using these compounds, surfaces must be washed with a 70% ethanol solution or equivalent immediately thereafter to prevent damage to units.
- The BSC will never be used for storage of any kind or as a replacement for a chemical fume hood.
- The ultraviolet (UV) light in the BSC shall be kept clean and used properly. It is the responsibility of the PI to ensure that the UV light maintains the proper intensity needed to properly decontaminate the work space inside the BSC.

Laminar Flow Hoods

Laminar flow hoods are used only in specific instances to protect the product being used, such as pouring agar plates or creating clonal cuttings of plant tissue. They do not protect researchers or the environment from biohazards, and for this reason are rarely utilized at UCF. At no time shall a laminar flow hood be used for manipulating or storing any infectious agents or biohazardous materials.

Safety Sharps and Needleless Systems

The use of sharps such as needles, intravenous delivery devices, scalpels and surgical tools, and other materials such as razor blades present a high risk for exposure when misused or mishandled in any laboratory where biohazardous agents and materials are present. Researchers are strongly recommended to utilize safety sharps, such as devices with retractable needles or sheathing, whenever possible. Sharps must always be disposed of in the properly designated sharps containers, and sharps not in use must always be properly sheathed or remain in their original packaging.

Fume Hoods

Fume hoods present in the laboratory are not to be used for the manipulation or storage of any biohazardous agents or materials whatsoever.

Vacuum Lines

In some laboratories vacuum suction may be utilized for certain procedures, such as aspiration. To prevent contamination of the work space or inhalation of hazardous aerosols, vacuum lines should be equipped with a liquid waste trap containing bleach or agent-appropriate disinfectant and a HEPA filter to protect the vacuum line.

Centrifuges

At all times shall centrifuge rotors on UCF campuses be properly balanced and used according to the manufacturer's instructions to minimize the risk of mechanical failures and generation of biohazardous aerosols. It is highly recommended that personnel utilize safety bucket lids with centrifuge rotors and properly load/unload these buckets inside of BSCs to ensure containment of any biohazardous materials. In the event an accidental spill or breakage occurs in a centrifuge, consult the section of this manual titled "Management of Biohazardous Spills".

Equipment with a Potential to Generate Biohazardous Aerosols

Certain types of laboratory equipment such as blenders, ultrasonic disrupters, tissue grinders, and lyophilizers have the potential to generate significant amounts of aerosols. It is the responsibility of all research personnel to limit the use of this equipment to specific tasks, and not to use them outside of containment when there is a risk of generating biohazardous aerosols, especially biohazardous aerosols that may contain infectious material. These devices should only be used according to the manufacturer's instructions for their intended purposes. **Research personnel are reminded to refine their work practices to minimize the overall generation of aerosols in laboratory spaces, and to keep all biohazardous aerosols contained inside a biosafety cabinet.**

Autoclaves

There are many different types of autoclaves in use at UCF. Each working group must have specific SOPs in place for their usage and access to the manufacturer-specific operating manual. It is the responsibility of PIs to ensure that their staff are properly trained and can demonstrate competence in the use of these devices. Autoclaves shall never be used for purposes contrary to the manufacturer's instructions. For the autoclaving of biohazardous materials for the purpose of decontamination, consult the section of this manual titled "Decontamination of Biohazardous and Biomedical Waste".

Proper Use of Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) is an important part of working in any laboratory where potential biohazards are present, and is designed to keep personnel from coming into contact with biohazardous materials or these materials from contaminating other areas in the work space. Using PPE effectively minimizes the risk of harm due to biohazards present in your work space, but they are only effective provided personnel dress properly for work in the laboratory environment. The UCF Laboratory Personal Protective Equipment Policy can be found in Appendix Z of the [UCF Laboratory Safety Manual](#). At all times, personnel working in any laboratory environment at UCF where biohazardous agents and materials may be present shall observe the following dress code:

Eye Protection

Safety glasses with side shields conforming to ANSI standard Z87.1 must be worn at all times in UCF laboratories. Splash goggles shall be worn when the risk of splash with biohazardous materials is significant. Wearers of contact lenses shall wear appropriate eye covering and face protective devices in a hazardous environment. In certain situations, chin-length face shields may substitute for safety glasses or splash goggles. This is at the discretion of the supervising researcher.

Facial (Nose and Mouth) Protection

In the event that small splashing or splattering may occur during work, surgical masks must be worn along with the approved eye protection. Surgical masks are not an appropriate substitution for work in a BSC, and do not protect against infectious or other hazardous aerosols. At the discretion of the research supervisor, chin-length face shields may substitute for surgical masks in certain situations.

Laboratory Clothing

Laboratory clothing includes such items as lab coats, smocks, scrub suits, and tissue culture gowns. These articles of clothing should have sleeves long enough to cover the skin and prevent contamination. The following guidelines shall be observed for laboratory clothing:

- Laboratory clothing must not leave the laboratory work space.
- Sleeveless shirts, shorts, and open-toed shoes are prohibited in the work areas.
- If work involves liquids or splashing is anticipated, the laboratory clothing worn must be water-resistant.
- Laboratory clothing that is not disposable must be capable of withstanding sterilization by autoclaving. Laboratory clothing that becomes contaminated must be immediately removed and disposed of, or replaced if it can be sterilized and laundered.
- Any personal clothing that becomes contaminated must remain in the laboratory and be laundered by trained UCF staff. Personnel and students must never take contaminated clothing home with them to launder personally.
- For PPE designed to prevent penetration, researchers should consult the manufacturer's recommendation on ASTM results for blood penetration (ASTM-21) and virus penetration (ASTM-22) on gowns used as PPE.

Gloves

Gloves are a requirement when working in any space where biohazardous agents and materials may be present. To prevent penetration or exposure, the kind of glove worn must be appropriate to the circumstances of the work being carried out in the laboratory space. The PI is responsible for ensuring that staff are using the appropriate gloves for their work and that gloves are being used correctly. PIs are responsible to provide adequate substitutions for personnel who are unable to wear certain types of gloves due to medical issues such as latex allergies. Questions about which gloves are appropriate to which task can be found in Appendix N of the [Laboratory Safety Manual](#).

Gloves should never be worn outside the designated work space and disposable gloves shall never be washed and reused. When wearing gloves, the following guidelines apply:

- Only wear gloves of the appropriate size. Gloves that are too big or too small may constrain the motion of work or may fail unexpectedly while working with biohazardous agents or materials.
- Wounds or cuts on hands must be bandaged properly before donning gloves. Jewelry must not be worn under gloves to avoid stretching or cutting into the material.
- Gloves must be disposed of properly and replaced as soon as they become contaminated.
- Gloves must be donned/doffed using proper techniques.
- Hand washing is required after doffing gloves and before leaving the laboratory.

Respirators

For some work procedures or in certain situations where biohazardous aerosols are a particular risk of concern, personnel are required to wear respirators when engineering controls do not sufficiently mitigate potential hazards. All personnel who require respirators must be on file in EHS as participants in the [UCF Respiratory Protection Program](#). Participation in this program may require personnel to undergo a medical evaluation and fit testing. Respirators should not be used before approval is given to do so. More information about the use of respirators in UCF facilities can be found in the [Laboratory Safety Manual](#).

Management of Biohazardous Spills:

In the event of a biohazardous spill large enough to require the use of a spill kit, or spills too large for spill kits to treat, the PI of the work group must be notified as soon as possible, and EHS must be contacted immediately through UCF Work Control at 407-823-5223. Each laboratory group must have group-specific SOPs in place to deal with the decontamination of biohazardous spills specific to their work. The following are suggestions for preparing spill kits. Each work group is encouraged to tailor spill kits to their needs with agent-appropriate disinfectants and additional supplies that may be required.

Biological Spill Kits

Biohazardous spills occurring in UCF facilities must be immediately treated and cleaned. Each group working with biohazardous agents and materials is supplied with a Biological Spill Kit for this purpose. A well-stocked spill kit might contain the following:

- 1 container of undiluted bleach (less than six months old) or an agent-specific disinfectant
- Several pairs of disposable gloves
- 1 lab coat or disposable gown

- 1 pair of disposable booties (shoe covers)
- 1 pair of safety glasses
- 1 N95 respirator (if applicable)
- Absorbent Materials
- Autoclavable biohazardous waste bags
- Tongs or dust pan for scooping broken glass
- 1 sharps container

Bloodborne Pathogen Spill Kits

In the event of a biohazardous spill involving any human bodily fluids including blood, blood products, or other potentially infectious material (OPIM), refer to the [Bloodborne Pathogen Exposure Control Plan](#) for proper cleanup. These types of spills have special requirements, and there are spill kits available specifically for this purpose. A well-stocked spill kit should contain the following:

- 1 16oz. container of Conflikt disinfectant
- Absorbent Powder
- 1 Zip-Top containing:
 - 2 pairs of safety glasses
 - 4 sets of safety gloves
 - 2 face masks
 - 4 sanitary towels
- Dust pan and broom
- 1 small red biomedical waste bag
- 1 large red biomedical waste bag

For Spills Occurring Outside A Biological Safety Cabinet

For biohazardous spills occurring outside a BSC, the spill kit provided to the work space must be used in cleanup, and EHS must be contacted through UCF Work Control at 407-823-5223. The PI of the work group must be notified as soon as possible, and an [Incident Report must be](#) filed with EHS within 24 hours. Should such a spill occur, take the following steps:

- Notify others of the spill and instruct the people in the area to leave while keeping clear of the spill. Doff PPE properly and wash hands before leaving the area as long as it is safe to do so. If the spill blocks access to handwashing, use hand sanitizer and perform handwashing at another sink as quickly as possible.
- **Do not bring any contaminated clothing outside the lab.** Any articles of clothing that become contaminated must be removed and remain in the space until they can be laundered by the facility, or they must be disposed of as contaminated waste. Wash exposed skin or shower if necessary. If exposure was significant or involved spilled materials in open wounds or mucous membranes, medical evaluation may be required.

- Place the Biohazardous Spill Warning on the door to the work area. This sign is found in Appendix B of this manual. Allow 30 minutes to elapse for any potential aerosols to settle in the room. Ensure that no injuries are present, and use this time to alert the PI of the work group of the incident.
- After 30 minutes have elapsed and your supervisor approves, don new PPE and enter the affected area with the spill kit.
- Cover the spill with absorbent material and saturate the spill with the appropriate disinfectant, starting from the outside of the spill and moving inwards. Allow for 20 minutes of contact time.
- **If broken glass or sharps are present, do not clean the spill with your hands.** Using the tongs or dustpan provided, dispose of these sharps into an appropriate container. Discard the absorbent material into the autoclavable biohazardous waste bag. Wet a paper towel with more of the disinfectant and wipe the area down again. Dry with additional material and dispose of these and your gloves in the biohazardous waste bag.
- Store the biohazardous waste properly until it can be decontaminated and disposed according to UCF policies.
- File an [incident report](#) with EHS within 24 hours of the accident.

For Spills Occurring Inside A Biosafety Cabinet

For spills within a BSC, the spill is considered contained as long as no fluid leaves the cabinet. Before cleanup begins, the cabinet should be allowed to operate for a minimum of 10 minutes to filter out any potentially hazardous aerosols that may have been generated by the spill. The type of BSC in use in your workplace may have different requirements and air flow rates. It is the responsibility of the researcher to be aware of these different requirements and adjust the aerosol clearance time accordingly.

For Small Spills Inside The BSC (Spills Less Than 100 mL)

In the event a small volume of biohazardous material is spilled in the BSC, use the following procedures:

- Do not continue working in the BSC and leave it running. Leave contaminated gloves in the cabinet and allow the air flow to operate normally for the time required to clear the space of hazardous aerosols (usually about 10 minutes.)
- Don new PPE. Place absorbent material on the spill and saturate the material with the agent-appropriate disinfectant, working from the outside of the spill inwards. Allow for the appropriate amount of contact time as stated in the manufacturer's instructions. For freshly prepared 10% bleach, the contact time is 20 minutes.
- **If any broken glass or potential sharps are present, do not attempt to clean up the spill with your hands.** Use tongs or forceps to place all sharps materials into the appropriate disposal box.
- Place absorbent materials into a biohazardous waste bag inside the BSC. Wipe the spill again with absorbent material and dispose of this in the biohazardous waste bag.

- Remove gloves and dispose of them in the biohazardous waste bag.
- Allow the BSC to run for another 10 minutes.
- Don new PPE and close the bag. Remove the biohazardous waste bag and store it properly until it will be decontaminated.
- Inspect the hood for any sharps or unattended areas of the spill that may be left behind before returning to work.

For Large Spills Inside the BSC (Spill Greater Than 100 mL)

Large spills or spills in which biohazardous material spills through the grating and into the underside of the BSC require more care and attention to detail to properly clean. In the event of a large spill inside a BSC, the following procedures shall be used:

- Do not continue working in the BSC and leave it running. Leave contaminated gloves in the cabinet and allow the flow of air inside to clear any infectious aerosols present, usually about 10 minutes.
- Place the Biohazardous Spill Warning sign located in Appendix B at the entrance to the work space to alert personnel not to enter the room and risk exposure during the cleanup of the spill.
- Don new PPE and decontaminate the working area of the BSC as outlined in the procedures above. Remove all items from the inside of the BSC.
- Pour agent-appropriate disinfectant down the grating of the BSC and allow for 30 minutes of contact time. Remove the top grille of the BSC and soak up the spill with absorbent material. Discard this material into a biohazardous waste bag.
- Using additional absorbent material soaked with disinfectant, then clean and dry the area. Doff gloves and dispose of these as biohazardous waste.
- Inspect and ensure that the spill has been completely cleaned.
- Replace the top grille in the BSC and allow the air flow to continue uninterrupted for at least 10 minutes.

For Biohazardous Spills Inside A Centrifuge

- Do not continue working and do not perform actions that could further generate any biohazardous aerosols (opening safety buckets, etc.).
- Notify personnel working in the room a spill has occurred inside the centrifuge and instruct them to doff PPE and exit the laboratory following exit procedures.
- Place the biohazardous spill sign located in Appendix B on the door as you leave and allow a minimum of 30 minutes to elapse before re-entering the room in order for aerosols to settle. If the PI is not aware of the spill, alert the PI of the incident and contact EHS through UCF Work Control at 407-823-5223.
- After 30 minutes have elapsed, don new PPE and enter the room. Use a spill kit and clean up the spill as if it had occurred outside a BSC, as outlined in the procedure above. Do not open safety buckets at this time. Place them inside a BSC along with the rotor.
Be careful not to spread the spill. Use secondary containment in transport so

potentially biohazardous liquids do not spill on the floor. Be aware of any sharps that may be present in the centrifuge and do not reach with hands if sharps present.

- After the centrifuge has been properly cleaned, don new PPE and begin cleaning the buckets and rotor inside a BSC. Open the buckets carefully and use tongs or forceps to remove any broken glass or sharps, placing them in the appropriate waste container.
- Inspect and verify that all sharps materials have been removed. Soak the buckets, bucket lids, and rotors in the agent-appropriate disinfectant for a minimum contact time of 30 minutes.
- Rinse the rotor and buckets with a mild detergent and clean with 70% ethanol. Allow these components to air dry.
- Verify that the centrifuge and its components are fully dry before beginning operation. Arrange for an equipment inspection if uncertain that the centrifuge can safely return to service.
- An [incident report](#) must be filled out and submitted to the EHS within 24 hours of the incident.

For Spills Inside A Tissue Culture Incubator

Tissue culture incubators are particularly sensitive to corrosive damage from chemical treatment because the stainless steel plating inside them is constantly exposed to a warm and humid environment. It is not recommended to clean with bleach or other disinfectants, which present a corrosion hazard to steel. Rather, select an agent-appropriate disinfectant designed for use on these kinds of surfaces. When a spill occurs inside a tissue culture incubator, the following procedures should be used:

- Do not continue working in the area. Turn off the incubator and do not perform further actions that will generate additional biohazardous aerosols. Alert personnel in the workplace to the spill. All personnel should leave the area while properly doffing PPE and washing hands.
- On the way out, attach the biohazardous spill sign found in Appendix B to the door of the area. Allow a minimum of 30 minutes to elapse to settle potential aerosols. If the PI is not aware of the spill, alert the PI of the incident and contact EHS through UCF Work Control at 407-823-5223. This spill must be treated as if it occurred outside a BSC.
- After 30 minutes have elapsed, don new PPE and re-enter the area. Add an appropriate amount of agent-appropriate disinfectant to the water tray. If there are any flasks or plates in the incubator that can be transferred, remove them and wipe them with absorbent material soaked with disinfectant before transfer. **Do not allow potentially biohazardous materials to drip onto the floor. Do not touch any broken glass or sharps with your hands.**

- Inspect the incubator during the initial contact time. If biohazardous spills or dried spills are observed on the incubator grating, place absorbent material on these areas and soak in the agent-appropriate disinfectant. Allow for 20 minutes of contact time.
- Clean up the absorbent material and dispose of it in a biohazardous waste bag. If broken glass or sharps are present, use tongs or forceps to dispose of this material into the appropriate container. Soak additional absorbent material in disinfectant and wipe down the incubator. Dry the surfaces and dispose of this material along with gloves as biohazardous waste.
- Some incubators have their own decontamination cycles using distilled water and heat. If the incubator in question has this option, it should be performed after cleanup and the incubator started normally the following day.
An [incident report](#) should be filled out and submitted to the EHS no later than 24 hours after the occurrence.

For Packages Damaged in Transit

Packages containing biohazardous materials that arrive damaged and/or leaking should not be opened under any circumstances. Place the package in secondary containment and contact EHS through UCF Work Control immediately at 407-823-5223.

For Spills in Public Areas

It is a UCF policy that all biological materials be transported in sturdy, leak-proof secondary containment, to which a clearly visible orange red sticker is attached containing the international symbol for biohazardous materials and the word “BIOHAZARD”. Material should be transported using reliable carts with raised edges to contain any potential spills or leaks. Prevent accidents by planning transport ahead of time and being aware of any difficulties that may be encountered. Should a spill occur in any public area while transporting biologicals at UCF:

- Keep the affected area clear of the public and, if possible, cordon off the spill.
- Contact EHS through UCF Work Control immediately at 407-823-5223.
- Under no circumstances shall anyone attempt to clean the spill without the proper PPE.
- Be available to inform any responders of potential hazards they may encounter.
- An [incident report](#) must be submitted to EHS within 24 hours of the incident.

Managing Biohazardous and Biomedical Waste:

Work spaces dealing with biohazardous agents and materials inevitably generate biohazardous waste. This section of the manual creates a university-wide metric by which all researchers working with biohazardous agents and materials must label, store, and dispose of waste. As stated in the definitions section of this manual, this type of waste is referred to as biomedical waste if it contains human or non-human primate products or materials infectious to humans. Biomedical waste must be treated differently than conventional biohazardous waste. When

dealing with biomedical waste, UCF falls under the scope of the [State of Florida Department of Health](#) (FDH) regulations Chapter 64E-16. These regulations outline the way biomedical waste must be labeled and stored in addition to the acceptable methods of disposal. Personnel are encouraged to take steps to minimize the amount of biohazardous and biomedical waste generated in their spaces at all times and never to dispose of these wastes improperly.

Storage and Labeling of Solid Biohazardous Waste

UCF requires that all biohazardous waste always be segregated from regular trash at its point of origin and properly labeled as soon as it is generated. Biohazardous waste includes the actual biological materials in addition to disposable laboratory items used to contain or handle them. This may include such items as tissue culture flasks, plastic serological pipettes, and gloves worn while handling potential biohazards. All solid biohazardous waste must be double-bagged only in the approved red bags labeled with the international symbol for biohazards and the words “BIOHAZARD” clearly visible. In addition to this label, each bag of biohazardous waste must be labeled legibly with the following:

- University of Central Florida or “UCF”
- Building # and Room # of Origin
- Phone Number of The Appropriate Contact

These bags must never be overfilled or filled with liquid or chemically hazardous products. Store in sturdy secondary containment labeled properly with a clearly visible sticker containing the international symbol for biohazards on a red or orange-red background along with the word “BIOHAZARD”. Biohazardous waste should be stored where it cannot be accessed by unauthorized personnel and stored for a period no longer than 30 days before disposal. When not in use, secondary waste containers for all biohazardous wastes must be covered.

Sharps generated as part of biohazardous or biomedical waste must never be placed in these bags or any other trash in the work space. These must be placed only in the approved and properly labeled sharps receptacles. Needles should never be recapped before disposal in these containers nor items such as disposable scalpels re-sheathed unless these are part of the item’s safety features.

Storage and Labeling of Solid Biomedical Waste

As defined in the Florida Department of Health, biomedical waste is referred to as:

“Any solid or liquid waste which may present a threat of infection to humans, including non-liquid tissue, body parts, blood, blood products, and body fluids from humans and other primates; laboratory and veterinary wastes which contain human disease-causing agents; and discarded sharps.”

This definition is also extended to absorbent materials and disposable materials contaminated with these products.

For collection and disposal, UCF contracts with a licensed transporter to haul away biomedical waste. This contractor supplies appropriately labeled bags and secondary storage containers to work facilities at UCF. As with the above guidelines, these bags must not be overfilled or filled with liquid or chemically hazardous products. They must be stored in an area inaccessible to unauthorized personnel, and they may not be stored for more than 30 days from the point at which they begin collecting material. When not in use, these receptacles must remain covered at all times. There are spaces on these bags and containers for the appropriate contact information to be included as outlined above.

If the provided containment is not adequate to store all the waste generated in a work area in a given time, researchers may store additional biomedical waste as outlined, only in the bag types approved by the Department of Health Chapter 64E-16.004. Biomedical waste bags are available through many research supply vendors and already conform to these specifications, but it is the responsibility of the researcher to ensure that they are in compliance. Additionally, secondary containment must be labeled visibly and legibly with the international symbol for biohazards and “BIOHAZARD”. As of 2016, the color of this label must be red and must be at least 6 inches in diameter on bags larger than 19” x 14” or one inch in diameter on bags smaller than this size. For questions on how to properly contain biomedical waste, refer directly to [FDH regulations](#) or contact EHS for assistance.

Remember that sharps are never to be disposed of in any container except the approved, red puncture-proof containers that have been appropriately labeled. Do not dispose in regular trash or non-approved biomedical waste containers.

Decontamination of Biohazardous and Biomedical Waste:

There is no safe level of biohazardous waste that may be released from any UCF facility. It is the policy of UCF that all biohazardous waste not hauled away by a licensed transporter be rendered harmless for disposal through disinfection or autoclaving. Each lab group must have group-specific SOPs in place dealing with the decontamination of biohazardous materials specific to their work.

Disinfection of Liquid Biohazardous Material or Biomedical Waste

Liquid wastes must be rendered harmless through chemical disinfection before disposal. There are a variety of commercial disinfectants, including freshly prepared 10% bleach solution, which can be used for this purpose. It is the responsibility of the researcher to ensure that the type of disinfectant used is appropriate for the type of waste being disposed and that this disinfectant is used exactly according to the manufacturer’s instructions. Any questions regarding the proper use of chemical disinfectants should be directly addressed to the manufacturer. **At no time shall any disinfected biohazardous waste containing additional hazardous or radioactive materials be disposed down the drains.** Disinfected biohazardous waste may require additional pH balancing

before disposal. Consult the [Laboratory Safety Manual](#) for any questions regarding hazardous material disposal and the [Bloodborne Pathogens Exposure Control Plan](#) for questions regarding material infectious to humans.

Decontamination of Solid Biohazardous Waste

Biohazardous waste must never be disposed before it has been properly decontaminated. The preferred method for properly decontaminating biohazardous waste is through autoclaving on a liquid cycle. There are a variety of different autoclaves throughout UCF from a number of different manufacturers. It is the responsibility of the researcher to know which type of autoclave can be used for this purpose. PIs are responsible for ensuring that their staff know which autoclaves their work spaces utilize, the types of autoclaves available to the work space, and that staff are trained and can demonstrate competency when using the autoclave. A copy of the autoclave's operational manual should always be available. When using any autoclave at UCF, the following guidelines shall be observed:

- **Autoclaving hazardous materials is strictly prohibited and highly dangerous. The explosion risk and resulting exposure to (bio)hazardous materials could seriously harm you, your colleagues, or the surrounding community. Always refer to the Safety Data Sheet (SDS) to know the potential hazards of any chemical or material before you autoclave it.**
- **Researchers are prohibited from autoclaving radioactive material or any biohazardous waste contaminated with radioactivity.**
- **Verify that the autoclave being used is appropriate for biohazardous waste.**
- Each autoclave unit will have its own written SOP detailing its proper operation and necessary exposure times and temperatures to achieve decontamination of the specified materials.
- Personnel must wear proper PPE when using autoclaves. In addition to eye protection and lab coats, personnel must use heat resistant gloves.
- All biohazardous waste shall be placed in secondary containment before autoclaving. This containment must be able to withstand the autoclaving process.
- Biohazardous waste must not be in sealed bags. Bags should be closed in such a way that steam can penetrate the bags during the cycle.
- All biohazardous waste must include a temperature indicator to ensure that the proper decontamination temperature was reached.
- Bottles and tubes must be loosely sealed or unsealed to prevent explosions of the material.
- Check on the autoclave periodically during use to ensure that it is recording the proper temperature and pressure.
- Do not jolt or move any material that is bubbling or boiling.
- Maintain a log of autoclaved biohazardous waste. Be sure to include the date, name of the operator, number of containers, and whether the indicator showed that the proper temperature was reached.

- Autoclaves must be verified monthly through the use of a biological indicator. If personnel are unfamiliar with the proper use of biological indicators for autoclaves, contact EHS for assistance.
- Maintenance logs on autoclaves shall be kept for a minimum of one year.
- If an autoclave is malfunctioning or does not achieve the appropriate temperature/pressure, do not continue to use the unit. The unit must be tagged out of service to alert others. A work ticket to the building's facilities personnel must be submitted as soon as possible. Do not resume using the unit until it is cleared to return to service.

Other Methods of Decontamination for Contaminated Equipment

Vapors and Gases

Vapors and gases are primarily used to decontaminate biological safety cabinets and associated systems, bulky or stationary equipment not suited to liquid disinfectants, instruments, electronics, or optics, which might be damaged by other decontamination methods. Rooms, buildings and associated air-handling systems can be decontaminated by this method as well. Examples of gases used for this purpose are vaporized hydrogen peroxide and ethylene oxide. Special precautions must be taken during use because of the hazardous nature of many of these compounds. **PIs and laboratory personnel may not use these methods themselves.** Many are vendor specific services and use outside contractors. Contact EHS for assistance.

Radiation

Ultraviolet radiation (UV) can be used for the disinfection of BSCs when used according to the manufacturer's instructions. It is the responsibility of the researchers to ensure that UV bulbs are kept clean and inspected regularly to maintain the intensity needed to work properly.

Emergency Procedures:

In the event of an emergency at UCF facilities where building evacuations are required, each working group will have a designated site away from the facility where all personnel are required to report for a head count. **All work groups are required to have a completed [Departmental Emergency Evacuation Plan.](#)**

Fire Procedures

In the event of a fire, alerting others to the danger as quickly as possible and knowing what do could save lives. All personnel who work in UCF facilities should be aware of their surroundings, noting the location of fire alarm pulls and fire extinguishers.

Fire Alarm And Basic Evacuation Procedures

In the event of a fire alarm, all personnel must evacuate the building immediately in an orderly manner using stairs if they reside in upper levels of the building. During a fire alarm, elevators are never to be used. The official EHS policy covering [building evacuation](#) can be found on the [EHS Policies page](#). The following procedures should be followed:

- As soon as the fire alarm goes off, immediately stop working and secure work. Quickly shut off electrical equipment and hazardous processes. Cover lids on open cultures or containers in use, but leave BSCs running to secure biologicals.
- Use normal procedures for doffing any PPE and exit the laboratory in an orderly manner as long as it is safe to do so.
- Evacuate the building in a calm and orderly manner, taking stairs to the ground floor and avoiding elevators.
- Proceed to designated meeting location for your work group outlined in the [Departmental Emergency Evacuation Plan](#). Follow all instructions from first responders and be available to answer any questions about potential hazards. Be precise about where these hazards are located. Alert emergency crews to any missing persons from your group who did not report to the meeting area.
- Do not re-enter the building under any circumstances until emergency first responders announce that it is safe to reenter.

In The Event of Fire or Explosion

If encountering a fire or if smoke is smelled or seen in the laboratory, quickly secure work and begin evacuating the building according to the evacuation plan.

- Notify people in the area who may be in immediate danger as long as there is no immediate life-threatening risk to yourself.
 - Perform the minimal number of necessary exiting procedures that can be executed safely.
 - If your clothing catches fire, remain calm and do not run. STOP, DROP, and ROLL. If there is a drench hose or safety shower nearby, attempt to use it and immediately exit the building.
- Activate the fire alarm using the pull stations or alert somebody to do so while proceeding to the exit. **Never attempt to fight any fire if you are untrained, if the fire is large or uncontained, or if your exit is at risk.** Pull stations for fire alarms are located in the interior of each corridor and at all exits throughout the building.
- If you have successfully attempted to fight a small, contained fire, exit the laboratory using the minimal number of safety procedures that can be executed safely and proceed immediately to the designated meeting spot determined in your work group's [Departmental Emergency Evacuation Plan](#).
 - If the fire is not successfully contained, exit the laboratory and proceed immediately to the designated meeting spot for your work group. Under no circumstances should you reenter the building for any reason.

- Once you have proceeded to your designated meeting location, call 911. Be sure to alert them to any potential hazards in your work space that may pose a risk to them. Alert them to any missing persons who have not proceeded to the designated meeting site.
- Follow all instructions given to you by first responders and under no circumstances should you re-enter the facility unless first responders have given you the clearance to do so.
- If your PI is not already aware of the situation, you must notify your PI immediately along with EHS of the incident.

In The Event of Natural Gas Leaks

Natural gas is easily detected by a sulfurous or rotten egg odor due to an odorizing agent added to aid in its detection. Symptoms of exposure to natural gas include dizziness, fatigue, nausea, headache, and irregular breathing. Natural gas leaks are a serious explosion hazard and should never be ignored. In the event of a natural gas leak, use the following procedures:

- **Notify UCF's Work Control immediately. Work Control is available 24 hours a day at 407-823-5223.**
- If a gas odor is detected upon entering a building or work space on the UCF campus, do not enter that space. Remain outside and immediately call Work Control.
- If working inside a space and natural gas is detected, stop and secure your work. Do not attempt to use electrical equipment, lights, or open flames.
- Exit the building in a calm and orderly manner, alerting others to evacuate and spreading the message by word of mouth. Do not use fire alarm pulls.
- Proceed to the designated area outlined in your [Departmental Emergency Evacuation Plan](#). Be available to provide information to any first responders regarding hazards that may be present in your work area.
- Follow all instructions given to you by first responders. Do not re-enter the facility under any circumstances unless first responders give you clearance to do so. Alert first responders to any missing persons who did not report to the designated site.
- If your PI is not already aware, notify your PI and EHS immediately.

In the Event of Flooding

If flooding is discovered upon entry into any UCF facility, Work Control must be immediately notified at 407-823-5223 (available 24 hours a day). When encountering flooding, use the following procedures:

- Attempt to locate the source of flooding and if able to do so, stop it.
- If a leak occurs or if flooding begins in a laboratory, secure all work. Biologicals should be covered and secured in BSCs or incubators/freezers, not left on benches where they will present a risk to work crews.
 - Contact Work Control at the number above and report the situation.

- If the water is clean and uncontaminated with biohazardous agents or materials, attempt to locate the source of flooding and stop the leak. The leak can be cleaned up with a mop and bucket. If the leak is not contained, exit the laboratory using standard procedures.
- If the water is dirty, contaminated with sewage or biohazardous agents or materials, do not attempt to locate the source and stop the leak. Immediately exit the work space executing the number of exit procedures reasonably safe to perform. Inform Work Control of these hazards and wait for their instructions before re-entering the work area.
- If the PI of the designated work space is not yet aware of the situation, alert the PI as soon as possible.

In The Event of Power Failure

Power failures can occur in UCF facilities. Most laboratories in UCF facilities run on backup power, and power interruptions should be minimal. However, should any interruption to power occur, take the following steps:

- Stop all work immediately and secure all biologicals. Doff PPE properly and exit the work area.
- Immediately call UCF Work Control at 407-823-5223 and notify the PI for the work space. Do not return to work until instructed that the issue has been resolved.

In The Event of Severe Weather

In the event of severe weather such as hurricanes, consult the UCF [Office of Emergency Management](#) and pay attention to the [UCF Alert](#) system for weather updates. Prepare your work space for the event. For especially severe storms, such as a Category 3 or higher, work groups should prepare for potentially long interruptions to power. Steps should be taken to secure biologicals from loss.

Appendix A: Contact Information

Contacts for UCF Work Control and UCF Police Department:

UCF Work Control
Facilities Operations
407-823-5223
Available 24 hours

UCF Police Department
3610 Libra Drive
Orlando, FL 32816
407-823-5555

In the event of a life-threatening emergency, call 911.

Biosafety Contacts in EHS:

Renee Michel
Director, UCF Environmental Health and Safety
407-823-0863
Renee.Michel@ucf.edu

José Vazquez
Assistant Director, Workplace Safety
407-823-2605
Jose.VazquezPerez@ucf.edu

Brian Butkus
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A complete list of UCF EHS contacts can be found [here](#).

Appendix B: Biological Spill Hazard Sign



Appendix C: Principles of Biosafety

The material in this section is taken directly from the 5th edition of the CDC/NIH's [Biosafety in Microbiological and Biomedical Laboratories](#) (BMBL 5th ed.). The 5th edition of this manual was released by the Dept. of Health and Human Services in 2009 and remains the standard in the application of good biosafety practices. Although not required to do so, it is highly recommended that researchers download this freely available publication and keep it as reference in their laboratory spaces.

A fundamental objective of any biosafety program is the containment of potentially harmful biological agents. The term "containment" is used in describing safe methods, facilities and equipment for managing infectious materials in the laboratory environment where they are being handled or maintained. The purpose of containment is to reduce or eliminate exposure of laboratory workers, other persons, and the outside environment to potentially hazardous agents. The use of vaccines may provide an increased level of personal protection. The risk assessment of the work to be done with a specific agent will determine the appropriate combination of these elements. (BMBL 5th ed.)

Laboratory Practice and Technique

The most important element of containment is strict adherence to standard microbiological practices and techniques. Persons working with infectious agents or potentially infected materials must be aware of potential hazards, and must be trained and proficient in the practices and techniques required for handling such material safely. The director or person in charge of the laboratory is responsible for providing or arranging the appropriate training of personnel.

Each laboratory should develop or adopt a biosafety or operations manual that identifies the hazards that will or may be encountered, and that specifies practices and procedures designed to minimize or eliminate exposures to these hazards. Personnel should be advised of special hazards and should be required to read and follow the required practices and procedures. A scientist, trained and knowledgeable in appropriate laboratory techniques, safety procedures, and hazards associated with handling infectious agents must be responsible for the conduct of work with any infectious agents or materials. This individual should consult with biosafety or other health and safety professionals with regard to risk assessment.

When standard laboratory practices are not sufficient to control the hazards associated with a particular agent or laboratory procedure, additional measures may be needed. The laboratory director is responsible for selecting additional safety practices, which must be in keeping with the hazards associated with the agent or procedure. These additional practices should be noted in the researcher's SOP.

Appropriate facility design and engineering features, safety equipment, and management practices must supplement laboratory personnel, safety practices, and techniques.

Safety Equipment (Primary Barriers and Personal Protective Equipment)

Safety equipment includes BSCs, enclosed containers, and other engineering controls designed to remove or minimize exposures to hazardous biological materials. The BSC is the principal device used to provide containment of infectious splashes or aerosols generated by many microbiological procedures. Three types of BSCs (Class I, II, III) used in microbiological laboratories are described and illustrated in Appendix A of the BMBL. Open-fronted Class I and Class II BSCs are primary barriers that offer significant levels of protection to laboratory personnel and to the environment when used with good microbiological techniques. The Class II biological safety cabinet also provides protection from external contamination of the materials (e.g., cell cultures, microbiological stocks) being manipulated inside the cabinet. The gas-tight Class III biological safety cabinet provides the highest attainable level of protection to personnel and the environment.

An example of another primary barrier is the safety centrifuge cup, an enclosed container designed to prevent aerosols from being released during centrifugation. To minimize aerosol hazards, containment controls such as BSCs or centrifuge cups must be used when handling infectious agents.

Safety equipment also may include items for personal protection, such as gloves, coats, gowns, shoe covers, boots, respirators, face shields, safety glasses, or goggles. Personal protective equipment is often used in combination with BSCs and other devices that contain the agents, animals, or materials being handled. In some situations in which it is impractical to work in BSCs, personal protective equipment may form the primary barrier between personnel and the infectious materials. Examples include certain animal studies, animal necropsy, agent production activities, and activities relating to maintenance, service, or support of the laboratory facility.

Facility Design and Construction (Secondary Barriers)

The design and construction of the facility contributes to the laboratory workers' protection, provides a barrier to protect persons outside the laboratory, and protects persons or animals in the community from infectious agents that may be accidentally released from the laboratory. Laboratory directors are responsible for providing facilities commensurate with the laboratory's function and the recommended biosafety level for the agents being manipulated.

The recommended secondary barrier(s) will depend on the risk of transmission of specific agents. For example, the exposure risks for most laboratory work in BSL-1 and BSL-2 facilities will be direct contact with the agents, or inadvertent contact exposures through contaminated work environments. Secondary barriers in these laboratories may include separation of the laboratory work area from public access, availability of a decontamination facility (e.g., autoclave), and hand washing facilities.

When the risk of infection by exposure to an infectious aerosol is present, higher levels of primary containment and multiple secondary barriers may become necessary to prevent infectious agents from escaping into the environment. Such design features include specialized ventilation systems to ensure directional air flow, air treatment systems to decontaminate or remove agents from exhaust air, controlled access zones, airlocks as laboratory entrances, or separate buildings or modules to isolate the laboratory. Design engineers for laboratories may refer to specific ventilation recommendations as found in the *ASHRAE Laboratory Design Guide* published by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE).

Biosafety Levels

The various Biosafety Levels (BSL) described below consist of combinations of laboratory practices and techniques, safety equipment, and laboratory facilities. Each combination is specifically appropriate for the operations performed, the documented or suspected routes of transmission of the infectious agents, and the laboratory function or activity. The BSLs described in this manual should be differentiated from Risk Groups, as described in the [NIH Guidelines](#) and the [World Health Organization Laboratory Biosafety Manual](#). Risk groups are the result of a classification of microbiological agents based on their association with, and resulting severity of, disease in humans. The risk group of an agent should be one factor, to be considered in association with mode of transmission, procedural protocols, experience of staff, and other factors in determining the BSL in which the work will be conducted.

The recommended biosafety level(s) for the organisms in Section VIII of the BMBL (Agent Summary Statements) represent those conditions under which the agent ordinarily can be safely handled. Of course, not all of the organisms capable of causing disease are included in Section 8 and an institution must be prepared to perform risk assessments for these agents using the best available information. The laboratory director is specifically and primarily responsible for assessing the risks and applying the appropriate biosafety levels. The institution's Biological Safety Officer (BSO) and IBC can be of great assistance in performing and reviewing the required risk assessment. At one point in time, under the *NIH Guidelines*, BSOs were required only when large scale research or production of organisms containing recombinant DNA molecules was performed or when work with recombinant DNA molecules was conducted at BSL-3 or above. IBCs were required only when an institution was performing non-exempt recombinant DNA experiments. Today, however, it is strongly suggested that an institution conducting research or otherwise working with pathogenic agents have a BSO and properly constituted and functioning IBC. The responsibilities of each now extend beyond those described in the *NIH Guidelines* and depend on the size and complexity of the program.

Generally, work with known agents should be conducted at the biosafety level recommended in Section VIII of the BMBL. When information is available to suggest that virulence, pathogenicity, antibiotic resistance patterns, vaccine and treatment availability, or other factors are significantly altered, more (or less) stringent practices may be specified. Often an increased volume or a high concentration of agent may require additional containment practices.

Biosafety Level 1 practices, safety equipment, and facility design and construction are appropriate for undergraduate and secondary educational training and teaching laboratories, and for other laboratories in which work is done with defined and characterized strains of viable microorganisms not known to consistently cause disease in healthy adult humans. *Bacillus subtilis*, *Naegleria gruberi*, infectious canine hepatitis virus, and exempt organisms under the *NIH Guidelines* are representative of microorganisms meeting these criteria. Many agents not ordinarily associated with disease processes in humans are, however, opportunistic pathogens and may cause infection in the young, the aged, and immunodeficient or immunosuppressed individuals. Vaccine strains that have undergone multiple *in vivo* passages should not be considered avirulent simply because they are vaccine strains. BSL-1 represents a basic level of containment that relies on standard microbiological practices with no special practices required.

Biosafety Level 2 practices, equipment, and facility design and construction are applicable to clinical, diagnostic, teaching, and other laboratories in which work is done with the broad spectrum of indigenous moderate-risk agents that are present in the community and associated with human disease of varying severity. With good microbiological techniques, these agents can be used safely in activities conducted on the open bench, provided the potential for producing splashes or aerosols is low. Hepatitis B virus, HIV, the salmonellae, and *Toxoplasma* spp. are representative of microorganisms assigned to this containment level. BSL-2 is appropriate when work is done with any human-derived blood, body fluids, tissues, or primary human cell lines where the presence of an infectious agent may be unknown. (Laboratory personnel working with human-derived materials should refer to the OSHA *Bloodborne Pathogen Standard 2* for specific required precautions).

Primary hazards to personnel working with these agents relate to accidental percutaneous or mucous membrane exposures, or ingestion of infectious materials. Extreme caution should be taken with contaminated needles or sharp instruments. Even though organisms routinely manipulated at BSL-2 are not known to be transmissible by the aerosol route, procedures with aerosol or high splash potential that may increase the risk of such personnel exposure must be conducted in primary containment equipment, or in devices such as a BSC or safety centrifuge cups. Personal protective equipment should be used as appropriate, such as splash shields, face protection, gowns, and gloves.

Secondary barriers such as hand washing sinks and waste decontamination facilities must be available to reduce potential environmental contamination.

Biosafety Level 3 facilities and practices require additional training and are covered in a separate manual, available on the [EHS website](#).

Clinical Laboratories

Clinical laboratories, especially those in health care facilities, receive clinical specimens with requests for a variety of diagnostic and clinical support services. Typically, the infectious nature of clinical material is unknown, and specimens are often submitted with a broad request for microbiological examination for multiple agents (e.g., sputa submitted for "routine," acid-fast, and

fungal cultures). It is the responsibility of the laboratory director to establish standard procedures in the laboratory that realistically address the issue of the infective hazard of clinical specimens.

Except in extraordinary circumstances (e.g., suspected hemorrhagic fever), the initial processing of clinical specimens and serological identification of isolates can be done safely at BSL-2, the recommended level for work with bloodborne pathogens such as HBV and HIV. The containment elements described in BSL-2 are consistent with the OSHA standard, "*Occupational Exposure to Bloodborne Pathogens*." This requires the use of specific precautions with all clinical specimens of blood or other potentially infectious material (Universal or Standard Precautions*). Additionally, other recommendations specific for clinical laboratories may be obtained from the Clinical Laboratory Standards Institute (formerly known as the National Committee for Clinical Laboratory Standards).

BSL-2 recommendations and OSHA requirements focus on the prevention of percutaneous and mucous membrane exposures to clinical material. Primary barriers such as BSCs (Class I or II) should be used when performing procedures that might cause splashing, spraying, or splattering of droplets. Biological safety cabinets also should be used for the initial processing of clinical specimens when the nature of the test requested or other information suggests the likely presence of an agent readily transmissible by infectious aerosols (e.g., *M. tuberculosis*), or when the use of a BSC (Class II) is indicated to protect the integrity of the specimen.

The segregation of clinical laboratory functions and limited or restricted access to such areas is the responsibility of the laboratory director. It is also the director's responsibility to establish standard, written procedures that address the potential hazards and the required precautions to be implemented.

Importation and Interstate Shipment of Certain Biomedical Materials

The importation of etiologic agents and vectors of human diseases is subject to the requirements of the Public Health Service Foreign Quarantine regulations. Companion regulations of the Public Health Service and the Department of Transportation specify packaging, labeling, and shipping requirements for etiologic agents and diagnostic specimens shipped in interstate commerce.

The USDA regulates the importation and interstate shipment of animal pathogens and prohibits the importation, possession, or use of certain exotic animal disease agents which pose a serious disease threat to domestic livestock and poultry.

Appendix D: Laboratory Biosafety Level Criteria

*The material in this section is taken directly from the 5th edition of the CDC/NIH's [Biosafety in Microbiological and Biomedical Laboratories](#) (BMBL 5th ed.). The 5th edition of this manual was released by the Dept. of Health and Human Services in 2009 and remains the standard in the application of good biosafety practices. **At all times shall researchers adhere to the following criteria in their designated spaces and conform their practices to this standard. It is highly recommended that researchers download this freely available publication and keep it as a reference in their laboratory spaces.***

Biosafety Level 1 is suitable for work involving well-characterized agents not known to consistently cause disease in immunocompetent adult humans, and present minimal potential hazard to laboratory personnel and the environment. BSL-1 laboratories are not necessarily separated from the general traffic patterns in the building. Work is typically conducted on open bench tops using standard microbiological practices. Special containment equipment or facility design is not required, but may be used as determined by appropriate risk assessment. Laboratory personnel must have specific training in the procedures conducted in the laboratory and must be supervised by a scientist with training in microbiology or a related science.

The following standard practices, safety equipment, and facility requirements apply to BSL-1:

Standard Microbiological Practices

- The laboratory supervisor must enforce the institutional policies that control access to the laboratory.
- Persons must wash their hands after working with potentially hazardous materials and before leaving the laboratory.
- Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human consumption must not be permitted in laboratory areas. Food must be stored outside the laboratory area in cabinets or refrigerators designated and used for this purpose.
- Mouth pipetting is prohibited; mechanical pipetting devices must be used.
- Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware must be developed and implemented. Whenever practical, laboratory supervisors should adopt improved engineering and work practice controls that reduce risk of sharps injuries. Precautions, including those listed below, must always be taken with sharp items. These include:
 - Careful management of needles and other sharps are of primary importance. Needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal.
 - Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.
 - Non disposable sharps must be placed in a hard walled container for transport to a processing area for decontamination, preferably by autoclaving.

- Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plasticware should be substituted for glassware whenever possible. Perform all procedures to minimize the creation of splashes and/or aerosols.
- Decontaminate work surfaces after completion of work and after any spill or splash of potentially infectious material with appropriate disinfectant.
- Decontaminate all cultures, stocks, and other potentially infectious materials before disposal using an effective method. Depending on where the decontamination will be performed, the following methods should be used prior to transport:
 - Materials to be decontaminated outside of the immediate laboratory must be placed in a durable, leak proof container and secured for transport.
 - Materials to be removed from the facility for decontamination must be packed in accordance with applicable local, state, and federal regulations.
- A sign incorporating the universal biohazard symbol must be posted at the entrance to the laboratory when infectious agents are present. The sign may include the name of the agent(s) in use, and the name and phone number of the laboratory supervisor or other responsible personnel. Agent information should be posted in accordance with the institutional policy.
- An effective integrated pest management program is required.
- The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, and exposure evaluation procedures. Personnel must receive annual updates or additional training when procedural or policy changes occur. Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. Therefore, all laboratory personnel and particularly women of child-bearing age should be provided with information regarding immune competence and conditions that may predispose them to infection. Individuals having these conditions should be encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

Special Practices

None required.

Safety Equipment (Primary Barriers and Personal Protective Equipment)

- Special containment devices or equipment, such as BSCs, not generally required.
- Protective laboratory coats, gowns, or uniforms are recommended to prevent contamination of personal clothing.
- Wear protective eyewear when conducting procedures that have the potential to create splashes of microorganisms or other hazardous materials. Persons who wear contact lenses in laboratories should also wear eye protection.
- Gloves must be worn to protect hands from exposure to hazardous materials.

- Glove selection should be based on an appropriate risk assessment. Alternatives to latex gloves should be available. Wash hands prior to leaving the laboratory. In addition, BSL-1 workers should:
 - Change gloves when contaminated, integrity has been compromised, or when otherwise necessary.
 - Remove gloves and wash hands when work with hazardous materials has been completed and before leaving the laboratory.
 - Do not wash or reuse disposable gloves. Dispose of used gloves with other contaminated laboratory waste. Hand washing protocols must be rigorously followed.

Laboratory Facilities (Secondary Barriers)

- Laboratories should have doors for access control.
- Laboratories must have a sink for hand washing.
- The laboratory should be designed so that it can be easily cleaned. Carpets and rugs in laboratories are not appropriate.
- Laboratory furniture must be capable of supporting anticipated loads and uses.
- Spaces between benches, cabinets, and equipment should be accessible for cleaning.
- Bench tops must be impervious to water and resistant to heat, organic solvents, acids, alkalis, and other chemicals.
- Chairs used in laboratory work must be covered with a non-porous material that can be easily cleaned and decontaminated with appropriate disinfectant.
- Laboratories windows that open to the exterior should be fitted with screens.

Biosafety Level 2 builds upon BSL-1. BSL-2 is suitable for work involving agents that pose moderate hazards to personnel and the environment. It differs from BSL-1 in that 1) laboratory personnel have specific training in handling pathogenic agents and are supervised by scientists competent in handling infectious agents and associated procedures; 2) access to the laboratory is restricted when work is being conducted; and 3) all procedures in which infectious aerosols or splashes may be created are conducted in BSCs or other physical containment equipment.

The following standard and special practices, safety equipment, and facility requirements apply to BSL-2:

Standard Microbiological Practices

- The laboratory supervisor must enforce the institutional policies that control access to the laboratory.
- Persons must wash their hands after working with potentially hazardous materials and before leaving the laboratory.

- Eating, drinking, smoking, handling contact lenses, applying cosmetics, and storing food for human consumption must not be permitted in laboratory areas. Food must be stored outside the laboratory area in cabinets or refrigerators designated and used for this purpose.
- Mouth pipetting is prohibited; mechanical pipetting devices must be used.
- Policies for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware must be developed and implemented. Whenever practical, laboratory supervisors should adopt improved engineering and work practice controls that reduce risk of sharps injuries. Precautions, including those listed below, must always be taken with sharp items. These include:
 - Careful management of needles and other sharps are of primary importance. Needles must not be bent, sheared, broken, recapped, removed from disposable syringes, or otherwise manipulated by hand before disposal.
 - Used disposable needles and syringes must be carefully placed in conveniently located puncture-resistant containers used for sharps disposal.
 - Non-disposable sharps must be placed in a hard walled container for transport to a processing area for decontamination, preferably by autoclaving.
 - Broken glassware must not be handled directly. Instead, it must be removed using a brush and dustpan, tongs, or forceps. Plasticware should be substituted for glassware whenever possible.
 - Perform all procedures to minimize the creation of splashes and/or aerosols.
 - Decontaminate work surfaces after completion of work and after any spill or splash of potentially infectious material with appropriate disinfectant.
 - Decontaminate all cultures, stocks, and other potentially infectious materials before disposal using an effective method. Depending on where the decontamination will be performed, the following methods should be used prior to transport:
 - Materials to be decontaminated outside of the immediate laboratory must be placed in a durable, leak proof container and secured for transport.
 - Materials to be removed from the facility for decontamination must be packed in accordance with applicable local, state, and federal regulations.
 - A sign incorporating the universal biohazard symbol must be posted at the entrance to the laboratory when infectious agents are present. Posted information must include:
 - The laboratory's biosafety level, the supervisor's name (or other responsible personnel), telephone number, and required procedures for entering and exiting the laboratory. Agent information should be posted in accordance with the institutional policy.
- An effective integrated pest management program is required.
- The laboratory supervisor must ensure that laboratory personnel receive appropriate training regarding their duties, the necessary precautions to prevent exposures, and exposure evaluation procedures. Personnel must receive annual updates or additional training when procedural or policy changes occur. Personal health status may impact an individual's susceptibility to infection, ability to receive immunizations or prophylactic interventions. Therefore, all laboratory personnel and particularly women of child-bearing

age should be provided with information regarding immune competence and conditions that may predispose them to infection. Individuals having these conditions should be encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

Special Practices

- All persons entering the laboratory must be advised of the potential hazards and meet specific entry/exit requirements.
- Laboratory personnel must be provided medical surveillance and offered appropriate immunizations for agents handled or potentially present in the laboratory.
- Each institution should consider the need for collection and storage of serum samples from at-risk personnel.
- A laboratory-specific biosafety manual must be prepared and adopted as policy. The biosafety manual must be available and accessible.
- The laboratory supervisor must ensure that laboratory personnel demonstrate proficiency in standard and special microbiological practices before working with BSL-2 agents.
- Potentially infectious materials must be placed in a durable, leak proof container during collection, handling, processing, storage, or transport within a facility.
- Laboratory equipment should be routinely decontaminated, as well as, after spills, splashes, or other potential contamination.
- Spills involving infectious materials must be contained, decontaminated, and cleaned up by staff properly trained and equipped to work with infectious material.
- Equipment must be decontaminated before repair, maintenance, or removal from the laboratory.
- Incidents that may result in exposure to infectious materials must be immediately evaluated and treated according to procedures described in the laboratory biosafety safety manual. All such incidents must be reported to the laboratory supervisor. Medical evaluation, surveillance, and treatment should be provided and appropriate records maintained.
- Animals and plants not associated with the work being performed must not be permitted in the laboratory.
- All procedures involving the manipulation of infectious materials that may generate an aerosol should be conducted within a BSC or other physical containment devices.

Safety Equipment (Primary Barriers and Personal Protective Equipment)

- Properly maintained BSCs (preferably Class II), other appropriate personal protective equipment, or other physical containment devices must be used whenever:
- Procedures with a potential for creating infectious aerosols or splashes are conducted. These may include pipetting, centrifuging, grinding, blending, shaking, mixing, sonicating, opening containers of infectious materials, inoculating animals intranasally, and harvesting infected tissues from animals or eggs.
- High concentrations or large volumes of infectious agents are used.

- Such materials may be centrifuged in the open laboratory using sealed rotor heads or centrifuge safety cups.
- Protective laboratory coats, gowns, smocks, or uniforms designated for laboratory use must be worn while working with hazardous materials. Remove protective clothing before leaving for non-laboratory areas (e.g. cafeteria, library, administrative offices). Dispose of protective clothing appropriately, or deposit it for laundering by the institution. It is recommended that laboratory clothing not be taken home.
- Eye and face protection (goggles, mask, face shield or other splatter guard) is used for anticipated splashes or sprays of infectious or other hazardous materials when the microorganisms must be handled outside the BSC or containment device. Eye and face protection must be disposed of with other contaminated laboratory waste or decontaminated before reuse. Persons who wear contact lenses in laboratories should also wear eye protection.
- Gloves must be worn to protect hands from exposure to hazardous materials.
- Glove selection should be based on an appropriate risk assessment. Alternatives to latex gloves should be available. Gloves must not be worn outside the laboratory. In addition, BSL-2 laboratory workers should:
 - Change gloves when contaminated, integrity has been compromised, or when otherwise necessary. Wear two pairs of gloves when appropriate.
 - Remove gloves and wash hands when work with hazardous materials has been completed and before leaving the laboratory.
 - Do not wash or reuse disposable gloves. Dispose of used gloves with other contaminated laboratory waste. Hand washing protocols must be rigorously followed.
- Eye, face and respiratory protection should be used in rooms containing infected animals as determined by the risk assessment.

Laboratory Facilities

- Laboratory doors should be self-closing and have locks in accordance with the institutional policies.
- Laboratories must have a sink for hand washing. The sink may be manually, hands-free, or automatically operated. It should be located near the exit door.
- The laboratory should be designed so that it can be easily cleaned and decontaminated. Carpets and rugs in laboratories are not permitted.
- Laboratory furniture must be capable of supporting anticipated loads and uses. Spaces between benches, cabinets, and equipment should be accessible for cleaning.
 - Bench tops must be impervious to water and resistant to heat, organic solvents, acids, alkalis, and other chemicals.
 - Chairs used in laboratory work must be covered with a non-porous material that can be easily cleaned and decontaminated with appropriate disinfectant.

- Laboratory windows that open to the exterior are not recommended. However, if a laboratory does have windows that open to the exterior, they must be fitted with screens.
- BSCs must be installed so that fluctuations of the room air supply and exhaust do not interfere with proper operations. BSCs should be located away from doors, windows that can be opened, heavily traveled laboratory areas, and other possible airflow disruptions.
- Vacuum lines should be protected with liquid disinfectant traps.
- An eyewash station must be readily available.
- There are no specific requirements on ventilation systems. However, planning of new facilities should consider mechanical ventilation systems that provide an inward flow of air without recirculation to spaces outside of the laboratory.
- HEPA filtered exhaust air from a Class II BSC can be safely re-circulated back into the laboratory environment if the cabinet is tested and certified at least annually and operated according to the manufacturer's recommendations. BSCs can also be connected to the laboratory exhaust system by either a thimble (canopy) connection or a direct (hard) connection. Provisions to assure proper safety cabinet performance and air system operation must be verified.
- A method for decontaminating all laboratory wastes should be available in the facility (e.g., autoclave, chemical disinfection, incineration, or other validated decontaminated method).

Biosafety Level 3 facility design and practices are covered in UCF's separate BSL-3 manual.

Appendix E: Statement on Biosafety and Biosecurity

The following material is drawn from the 5th edition of the CDC/NIH's [Biosafety in Microbiological and Biomedical Laboratories](#) regarding biosecurity and biosecurity procedures. When drafting SOPs for laboratory spaces and work practices, security concerns should always be taken into consideration. It is the responsibility of researchers to properly address security concerns in their own spaces. The biosecurity section of the BMBL should be referenced when addressing these concerns and remains the standard.

Biosafety and Biosecurity

Biosafety and biosecurity are related, but not identical, concepts. Biosafety programs reduce or eliminate exposure of individuals and the environment to potentially hazardous biological agents. Biosafety is achieved by implementing various degrees of laboratory control and containment, through laboratory design and access restrictions, personnel expertise and training, use of containment equipment, and safe methods of managing infectious materials in a laboratory setting.

The objective of biosecurity is to prevent loss, theft or misuse of microorganisms, biological materials, and research-related information. This is accomplished by limiting access to facilities, research materials and information. While the objectives are different, biosafety and biosecurity measures are usually complementary.

Biosafety and biosecurity programs share common components. Both are based upon risk assessment and management methodology; personnel expertise and responsibility; control and accountability for research materials including microorganisms and culture stocks; access control elements; material transfer documentation; training; emergency planning; and program management.

Biosafety and biosecurity program risk assessments are performed to determine the appropriate levels of controls within each program. Biosafety looks at appropriate laboratory procedures and practices necessary to prevent exposures and occupationally-acquired infections, while biosecurity addresses procedures and practices to ensure that biological materials and relevant sensitive information remain secure.

Both programs assess personnel qualifications. The biosafety program ensures that staff are qualified to perform their jobs safely through training and documentation of technical expertise. Staff must exhibit the appropriate level of professional responsibility for management of research materials by adherence to appropriate materials management procedures. Biosafety practices require laboratory access to be limited when work is in progress. Biosecurity practices ensure that access to the laboratory facility and biological materials are limited and controlled as necessary.

An inventory or material management process for control and tracking of biological stocks or other sensitive materials is also a component of both programs. For biosafety, the shipment of infectious

biological materials must adhere to safe packaging, containment and appropriate transport procedures, while biosecurity ensures that transfers are controlled, tracked and documented commensurate with the potential risks. Both programs must engage laboratory personnel in the development of practices and procedures that fulfill the biosafety and biosecurity program objectives but that do not hinder research or clinical/diagnostic activities. The success of both of these programs hinges on a laboratory culture that understands and accepts the rationale for biosafety and biosecurity programs and the corresponding management oversight.

In some cases, biosecurity practices may conflict with biosafety practices, requiring personnel and management to devise policies that accommodate both sets of objectives. For example, signage may present a conflict between the two programs. Standard biosafety practice requires that signage be posted on laboratory doors to alert people to the hazards that may be present within the laboratory. The biohazard sign normally includes the name of the agent, specific hazards associated with the use or handling of the agent and contact information for the investigator. These practices may conflict with security objectives. Therefore, biosafety and biosecurity considerations must be balanced and proportional to the identified risks when developing institutional policies.

Designing a biosecurity program that does not jeopardize laboratory operations or interfere with the conduct of research requires a familiarity with microbiology and the materials that require protection. Protecting pathogens and other sensitive biological materials while preserving the free exchange of research materials and information may present significant institutional challenges. Therefore, a combination or tiered approach to protecting biological materials, commensurate with the identified risks, often provides the best resolution to conflicts that may arise. However, in the absence of legal requirements for a biosecurity program, the health and safety of laboratory personnel and the surrounding environment should take precedence over biosecurity concerns.

Appendix F: References in This Manual and Additional Resources

Website of UCF Environmental Health and Safety

- [EHS Contacts](#)
- [EHS Policies Page](#)
- [UCF Respiratory Protection Program](#)
- [UCF Controlled Substances Procedures](#)
- [Building Evacuation Policy](#)
- [Departmental Emergency Evacuation Plan](#)
- [Office of Emergency Management](#)
- [UCF Alert System](#)

Forms Available:

- [Biological Agent Registration Application](#)
- [Incident Report Form](#)

UCF Manuals:

- [Laboratory Safety Manual](#)
- [Bloodborne Pathogens Exposure Control Plan](#)

Biosafety in Microbiological and Biomedical Laboratories, 5th edition

- [Principles of Biosafety](#)
- [Laboratory Biosafety Level Criteria](#)
- [Quick Link to Biosafety Cabinet Design](#)
- [BMBL Section on Biosecurity](#)

Other Health Services Resources:

- [UCF Health](#)
- [UCF Student Health Services](#)
- [AmeriSys](#): UCF's current Medical Case Management for Workers' Compensation

Lists of Government Agencies and Influential Bodies:

- [CDC Home Website](#)
- [USDA Home Website](#)
 - [APHIS Home Website](#)
- [Occupational Health and Safety Administration](#)
 - [OSHA 29 CFR 1910.1030 Regulations on Bloodborne Pathogens](#)
- [US Department of Transportation](#)

- [Hazardous Materials Table](#)
- [International Air Transportation Association](#)
- [Federal Select Agent Program](#)
 - [List of Federal Select Agents and Toxins](#)
- [National Institutes of Health](#)
 - [NIH Guidelines on the Use of Recombinant DNA in Research](#)
- [World Health Organization](#)
 - [World Health Organization Biosafety Manual](#)
- [American Biological Safety Association](#)
 - [American Biological Safety Association Risk Group Database](#)
- [Florida Department of Health Website](#)
 - [Administrative Code Chapter 64E-16 Regulations on Biomedical Waste](#)

Helpful Resources for Permitting Information (Consult the EHS)

- [CDC Permitting Information](#)
- [USDA Import/Export Permitting](#)

Cited Legislation

- [Controlled Substances Act](#)