1. Purpose

University of Alaska Anchorage (UAA) personnel, student workers, faculty, staff, and outside contractors who work in laboratories handling biohazardous agents face exposure to biological hazards and infections. The hazards associated with biohazardous agents can be substantially reduced with the use of proper knowledge, techniques and equipment for handling these materials. This program for biological safety is intended to ensure personnel are knowledgeable in the hazards when working with biological agents and the steps to be taken to protect themselves and others.

2. Objective

UAA, in its continuing effort to provide personnel with safe, healthful working conditions, and to comply with the Occupational Safety and Health Act is implementing the following program for biological safety to protect personnel working at the University, by helping personnel, student workers, faculty, staff, and outside contractors better understand biological safety.

3. Scope

This program applies to UAA personnel, student employees, faculty, staff, and outside contractors working on UAA equipment who work with or are around biological agents.

4. Definitions

Antimicrobial – an agent that kills microorganisms or suppresses their growth.

Autoclave – a pressure chamber that works with a combination of elevated temperature steam, pressure and time in order to kill microorganisms and spores, used to decontaminate biological waste and sterilize media, and other equipment

Antiseptic – a substance that inhibits the growth and development of microorganisms without necessarily killing them. Antiseptics are usually applied on body surfaces.

Biocide – a general term for any agent that kills unicellular and multicellular organisms.

Biological Agent - include bacteria, viruses, fungi (including yeasts and molds) and internal human parasites (endoparasites). The majority of these agents are harmless however some may have potential to cause ill health

Biological Materials – natural biocompatible materials that comprise a whole or a part of a living structure.

Biological Safety Cabinet (BSC) – an enclosed, ventilated laboratory workspace for safely working with materials contaminated with (or potentially contaminated with) pathogens designated with a biosafety level.

Biohazardous Materials – infectious or etiologic (disease causing) agents of humans, animals and plants, toxins of biological origin, human-derived materials, recombinant DNA and any materials potentially containing infectious agents or biohazards that have the capacity to cause harm or damage to humans or animals

Decontamination – any process for removing and/or killing microorganisms. The same term is also used for removing or neutralizing hazardous chemicals and radioactive materials.

Disinfectant – a chemical or mixture of chemicals used to kill microorganisms, but not necessarily their spores. Disinfectants are usually applied on inanimate surfaces or objects.

Disinfection – a physical or chemical means of killing microorganisms, but not necessarily their spores.

Germicide – substance or other agent that destroys harmful microorganisms; an antiseptic.

Glove Box - enclosed work areas designed to protect the worker, the environment, and the sample from contamination. Personnel can manipulate materials inside the biological safety cabinet by using rubber gloves that are attached and sealed to the cabinet. Outside air is filtered through a HEPA filter prior to entry, and air leaving the class III biological safety cabinet is filtered through two HEPA filters before being vented outside

High Efficiency Particulate Air (HEPA) Filter – type of filter able to trap 99.97% of particles that are 0.3 microns or larger.

Laminar Flow Hood - a carefully enclosed bench designed to prevent contamination of semiconductor wafers, biological samples, or any particle sensitive materials. Air is drawn through a HEPA filter and blown in a very smooth, laminar flow towards the user. A laminar flow hood is designed to protect the media in the hood from contamination from the hood but does not protect the user from contamination from the media in the hood.

Microbicide – a chemical or mixture of chemicals that kills microorganisms. The term is often used in place of "biocide", "germicide" or "antimicrobial".

Other Potentially Infectious Materials (OPIM) - body fluids such as semen, vaginal secretions, cerebrospinal, synovial, pleural, pericardial, peritoneal, amniotic, and any bodily fluid that is potentially contaminated with blood, or all bodily fluids in situations where it is difficult or impossible to differentiate between the fluids. Saliva is considered potentially infectious in dental procedures.

Personal Protective Equipment (PPE) - equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal protective equipment may include items such as gloves, safety glasses and shoes, earplugs or

muffs, hard hats, respirators, or coveralls, vests and full body suits

Prion – an infectious agent responsible for several neurodegenerative diseases found in mammals, including Creutzfeldt-Jakob disease (CJD) in humans.

Recombinant DNA (rDNA) – DNA molecules formed by laboratory methods of genetic recombination to bring together genetic material from multiple sources, creating sequences that would not otherwise be found in the genome.

Sharps - any object that can penetrate the skin including, but not limited to, needles, razor blades, scalpels, and broken capillary tubes.

Sterilization – A process that destroys and/or removes all classes of microorganisms and their spores.

Virus – an infective agent that typically consists of a nucleic acid molecule in a protein coat, is too small to be seen by light microscopy, and is able to multiply only within the living cells of a host.

5. Authority and Responsibilities

In addition to the roles and responsibilities outlined in the UAA Training Program, the following apply to the Biological Safety Program.

EHS/RM

- Works with departments to determine proper classification and safeguards are in place to work with biological agents
- Create, track, and/or conduct inspections on laboratories working with biological agents as needed

Supervisor/ Principle Investigator (PI)

- Ensure experiment reviews occur to establish biological agent classifications and safeguards for handling prior to ordering any biological agent
- Ensure all personnel working with biological agents are properly trained
- Perform audits of biological agent use as necessary
- Ensure all facilities are maintained and have proper signage

Department Safety Coordinator

- Assist in experiment reviews as requested
- Conduct periodic inspections of laboratories to ensure compliance with this program
- Assist in the determination of safe methods for working biological agents

Personnel/Student Workers

- Participate in experimental reviews when appropriate
- Work in compliance with this program and experimental protocol at all times
- Notify Supervisor or PI anytime conditions change, or additional hazards are identified
- Identify and communicate safer and more efficient procedures with Supervisor or PI

Outside Contractors

- Perform all work in compliance with their company's biological safety program~~ as approved by the EHS/RM department~~, which will be reviewed and approved by the EHS/RM department.
- If the company does not have a program, they must comply with this program

6. Hazards Associated with Biological Agent Handling

Sources of biological hazards may include bacteria, viruses, insects, plants, birds, animals, and humans. These sources can cause a variety of health effects including the following:

- Skin irritation
- Allergies
- Infections
- Disease
- Cancer
- Death

7. Engineering Controls

Engineering controls are design plans or changes to the working environment to prevent or reduce personnel exposure to potential biological hazards. The following example of engineering controls should be considered in area design to reduce the risk of biological material exposure.

- Facility Design
- Biological safety cabinets
- Laminar flow hoods
- Laboratory vacuum lines
- Glove boxes

- Containment
- Any laboratory equipment that reduces the amount of manual handling of biological agents

8. Administrative Controls

Administrative controls are safe work practices and procedures designed to reduce the risks associated with working with biological materials. Examples of administrative controls include the following:

- Train personnel who work with biological materials on the hazards of the agents they are working with and the procedures to handle, dispose, and respond to a spill or emergency
- Conduct medical surveillance of personnel who work with biohazardous materials
- Post proper signage and labeling
- Conduct regular inspections of laboratories where biohazardous materials are being used

9. Background Information

Biohazardous Materials

Biohazardous materials are defined as infectious or etiologic (disease causing) agents of humans, animals and plants, toxins of biological origin, human-derived materials, recombinant DNA and any materials potentially containing infectious agents or biohazards that have the capacity to cause harm or damage to humans or animals. They include:

- Certain bacteria
- Fungi
- Viruses
- Rickettsiae
- Chlamydiae
- Parasites
- Recombinant and synthetic nucleic acid molecules
- Allergens
- Cultured human or animal cells and the potentially infectious agents ~~these cells~~they may contain
- Human clinical specimens (e.g. tissues, fluids)

- Tissues from experimental animals (including animal dander)
- Viroids
- Prions
- Other infectious agents as outlined in laws, regulations, or guidelines

Risk Assessments

One of the most important aspects of biosafety is assessing the risk associated with the laboratory manipulations of the agent or organism under investigation. Risk assessments should be performed by individuals most familiar with the specific characteristics of the agent/organism being considered for use, the equipment and procedures to be employed, animal models that may be used and the containment equipment and facilities available. The Supervisor, or PI is responsible for ensuring that adequate risk assessments are performed, and that appropriate equipment and facilities are available to support the work being proposed.

Biological Risk Groups

As part of the risk assessment, the biological agents should be classified into the appropriate risk group defined by the National Institute of Health (NIH) based on the relative hazard of the biological material. Descriptions of the 4 risk groups are found in Table 1. Risk groups are designated from 1 (the lowest risk) to 4 (the highest risk). The risk group will be used as one of the factors when making a determination for the appropriate biosafety level in which personnel can handle the biological material or toxin. Other information to consider will include:

- Pathogenicity of the agent and infectious dose
- Routes of infection (parenteral, airborne, ingestion)
- Stability of the agent in the environment
- Presence of a suitable host (human or animal)
- Laboratory activity planned (e.g. concentration, sonication, aerosolization, centrifugation, large volumes)
- Any genetic manipulation of the organism that may extend the host range of the agent or alter the agent's sensitivity to known, effective treatment regimens
- Local availability of effective prophylaxis or therapeutic interventions

Table 1 NIH Classification of Infectious Microorganisms by Risk Group

Risk Group	Disease Association	Individual/Community Risk
Risk Group 1	Biological materials not associated with disease in healthy adult humans or animals.	No or low individual and community risk.
Risk Group 2	Agents that are associated with human disease which is rarely serious and for which preventive or therapeutic interventions are often available.	Moderate individual risk; low community risk.
Risk Group 3	Agents that are associated with serious or lethal human disease for which preventive or therapeutic interventions may be available.	High individual risk; low community risk.
Risk Group 4	Agents that are likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not usually available.	High individual risk; high community risk.

Specimens for Which There is Limited Information

When the available information is insufficient to perform an appropriate risk assessment, e.g., with clinical specimens or epidemiological samples collected in the field, it is prudent to take a conservative approach to specimen manipulation, including:

- Universal precautions
- Personal protective equipment
- Basic laboratory containment

Biohazardous / Infectious Waste

In Alaska, disposal of waste is regulated by the Department of Environmental Conservation (DEC). The DEC defines infectious waste as waste that includes the categories listed below. Infectious means containing pathogens with sufficient virulence and quantity so that exposure to an infectious agent by a susceptible host could result in an infectious disease when the infectious agent is improperly treated, stored, transported or disposed. At UAA, infectious waste and biohazardous waste are synonymous since a precise definition of infectious waste, based on the quantity and type of etiologic agents present is virtually impossible. The most practical approach to infectious waste management is to identify those categories of waste that have the greatest potential for transmitting disease. The following categories of waste are designated as infectious; note, the following lists are not exhaustive.

Cultures and Stocks

- Specimens from medical, pathology and research laboratories
- Disposable culture/Petri dishes and devices used to transfer, inoculate, and mix cultures
- Waste from the production of biological agents
- Discarded live and attenuated vaccines

Pathological Wastes and Human Body Fluids

- Tissues, organs, body parts and body fluids that are removed during surgery, autopsy, or other medical procedures
- Specimens of body fluids and their containers
- Cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, and amniotic fluid from humans

Human Blood and Blood Products

- Waste human blood
- Products of human blood
- Items saturated and/or dripping with human blood
- Items that were saturated with human blood that are now caked with dried human blood
- Serum, plasma, and other blood components, and their container(s), which were used in either patient care, testing and laboratory analysis or the development of pharmaceuticals

Sharps, Needles and Hypodermics

- Sharps that have been used in animal or human patient care or treatment or in medical, research or industrial laboratories, including hypodermic needles, syringes, Pasteur pipettes, scalpel blades, razor blades and needles with attached tubing
- Broken or unbroken glassware that was in contact with infectious agents
- Used slides and cover slips
- Shards of contaminated broken glass

Animal Carcasses and Bedding

- Animal carcasses, body parts and bedding of animals that were known to have been exposed to infectious agents during research, production of biological material or testing

of pharmaceuticals are infectious waste.

Isolation Wastes

- These include all wastes that are biological or discarded materials contaminated with blood, excretion, exudates or secretions from humans who are isolated to protect others from highly communicable diseases.

Other Laboratory Wastes

- Specimen containers
- Disposable gloves, lab coats, masks, booties and aprons
- Disposable pipettes
- All cell culture materials
- All microorganisms constructed using recombinant techniques
- Pipette tips
- Solidified blood and body fluids

Containment

The term containment is used to describe methods, practices, procedures, facilities, and equipment used to safely manage biohazardous materials in the laboratory. The purpose of containment is to reduce or eliminate exposure to people or the environment to potentially hazardous agents.

Laboratory Practices and Procedures

The most important element of containment is strict adherence to standard microbiological practices and techniques. Personnel working with biohazardous agents or materials must be aware of the potential hazards in addition to being trained and proficient in the techniques required for safe handling of the material. When standard laboratory practices are not sufficient to control the hazards associated with a particular agent, additional measures may be needed. Safe practices and techniques must be supplemented by appropriate facility design, engineering features, safety equipment and management practices.

Each laboratory should develop or adopt a biological safety plan that identifies the hazards that may be encountered and specifies practices and procedures designed to minimize or eliminate risk. Personnel should be advised of special hazards and should be required to follow the specified practices.

Safety Equipment

Safety equipment includes fume hoods, animal microisolator caging, biological safety cabinets

(BSC), and a variety of other equipment such as enclosed containers (e.g., the safety centrifuge cup, which is designed to prevent aerosol release during centrifugation). The BSC is the principal device used to provide containment of aerosols generated by many microbiological procedures. The three types of BSCs (Class I, II, III) used in microbiological laboratories are described later in this program. Open fronted Class I and Class II BSCs are partial containment cabinets that offer significant levels of protection to laboratory personnel and to the environment when used with good microbiological techniques. The gas-tight Class III BSC provides the highest attainable level of protection from an equipment standpoint.

Safety equipment also includes PPE such as gloves, coats, gowns, shoe covers, boots, respirators, face shields and safety glasses. These personal protective devices are often used in combination with biological safety cabinets and other devices that contain the agents, animals or materials being studied. In some situations, where it is impractical to work in a BSC, PPE may form the primary barrier between personnel and biohazardous materials. Examples of such activities include certain animal studies, large animal necropsy, production activities and activities relating to maintenance, service or support of the laboratory facility.

Facility Design

Facility design is important for providing a barrier to protect persons working outside the laboratory from biohazardous agents that may be accidentally released inside the laboratory. Laboratory management is responsible for providing facilities commensurate with the laboratory's function. Laboratories must meet the guidelines for the Biological Safety Level designation described later in this program.

10. General Biosafety Practices and Procedures

General Laboratory Safety Procedures

A few general laboratory practices can significantly decrease the likelihood of accidents occurring in the laboratory. Procedures to follow when working in any laboratory include:

- Be familiar with the materials and the potential hazards of the materials you are working with (e.g., chemical, biological, radioactive)
  - Refer to written laboratory protocols and review all chemical SDS (Safety Data Sheets)
  - Consider the toxicity of the materials and the health and safety hazards of each procedure (e.g., generation of aerosols)
  - Take advantage of the knowledge and experience of laboratory personnel and the safety equipment that is available
- Know the location of safety equipment and emergency procedures in your area

- Always wear appropriate clothing (e.g., pants, shirts, shoes) in the laboratory. Open sandals are prohibited; shorts and skirts are not recommended
- Never work alone in the laboratory. Arrangements should be made to have another person present in the lab, including nights and weekends
- Always maintain good housekeeping
- Work with all hazardous chemicals inside a fume hood
- Never eat, smoke, drink, chew gum, prepare food or apply cosmetics in the laboratory
- Do not leave reactions unattended
- Prohibit unauthorized individuals from entering the laboratory

Signage/Labeling

All areas and laboratories that contain biohazardous agents must be posted with a sign containing the universal biohazard symbol (Figure 1). Laboratory supervisors and PIs must ensure that labels on incoming containers of biohazardous agents are not removed or defaced. Laboratory containers, including bottles, flasks, sample vials, and other containers used to hold biological agents, must be marked, labeled or coded in all cases. The label should be dated and should identify the owner of the agent.

Figure 1: Biohazard Symbol

Good Microbiological Techniques

Personnel working in laboratories must be aware of the characteristics and hazards of the microorganisms in the laboratory. Good Microbiological Techniques (GMT) can describe a range of techniques and procedures that when applied in a laboratory setting will mitigate contamination of the laboratory personnel and the environment. The following GMTs should be applied anytime personnel are working with any microorganism, regardless of the agent's risk group:

- Follow proper aseptic techniques.
- Wear appropriate PPE.
- Minimize the production of aerosols
- Ensure aerosol producing activities are performed in a biological safety cabinet
- Adhere to universal precautions with bloodborne pathogens
- Disinfection of work surfaces and equipment.
- Immediate clean-up of spills.
- Restrict work with infectious material to designated areas
- Proper waste disposal
- Hand washing
- Incident reporting and investigation

Biological Safety Cabinets

BSCs are among the most effective and commonly used primary containment devices in laboratories working with biohazardous agents. There are three classes of BSCs, each having different performance characteristics.

Class I BSCs are designed to provide personnel and environmental protection only.

- A Class I cabinet does not protect the product from contamination because dirty room air constantly enters the cabinet front to flow across the work surface
- As a partial containment unit, the Class I cabinet is suitable for work involving low to moderate risk agents (Biosafety levels 1,2 and 3) where there is a need for containment, but not for product protection
- Unlike conventional fume hoods, the HEPA filter in the Class I cabinet protects the environment by filtering air before it is exhausted
- Personnel protection is made possible by constant movement of air into the cabinet and away from the user

Class II BSCs provide protection for the user, environment and sample, and are divided into four types: A1, A2, B1 and B2. The main differences between these types is their minimum inflow velocities and exhaust systems. All Class II BSC share these common characteristics:

- Front access opening with carefully maintained inward airflow
- HEPA-filtered, vertical, unidirectional airflow within the work area

- HEPA-filtered exhaust air to the room or exhaust to a facility exhaust system

Class III BSCs, commonly referred to as glove boxes, provide the highest level of personnel, product and environmental protection. These cabinets are specifically designed for work with BSL-4 pathogenic agents, providing maximum protection. The enclosure is gas-tight, and all materials enter and leave through a dunk tank or double-door autoclave. Gloves attached to the front prevent direct contact with hazardous materials.

All personnel must be trained in the proper use of BSCs prior to performing any work in them. Those who work in and around BSCs must be trained in their proper use, including activities that may disrupt inward directional airflow through the work opening and allow the escape of aerosolized particles from within the cabinet.

BSC cabinets must be tested and certified at the time of installation, any time they are moved, following internal repair, and at least annually thereafter. Cabinets must be decontaminated prior to moving and certain repairs/maintenance. Departments with BSCs are responsible for ensuring all maintenance is performed per manufacturers recommendations and schedules. This includes all filter changes.

Laminar Flow Hoods (a.k.a. “clean benches”)

Laminar flow hoods utilize HEPA-filtered supply air to provide product protection. It is important that users are aware of the differences between clean benches and BSCs. Clean benches do not provide personnel or environmental protection and therefore must never be used with hazardous agents.

Personal Protective Equipment

Personnel working in biological laboratories must wear the prescribed PPE as determined by laboratory PPE assessment or as designated in the experimental design. PPE should be used as an additional barrier to minimize the risk of exposure to aerosols, splashes and accidental inoculation. PPE should be used as the last line of defense from chemical exposure, while BSCs and other prescribed safety equipment should be used as the primary method to protect personnel. PPE should be worn only while working in the laboratory; all PPE must be removed, and hands must be washed each time before exiting the laboratory. Common PPE used for biological laboratory hazards are listed in Table 2.

Table 2 Common Biological Laboratory PPE

Hazard	Recommended PPE	Summary
Chemical or Biological Exposure	Proper Clothing	Appropriate clothing provides basic protection against skin exposure. Footwear that completely covers the feet (no open toed shoes or sandals), full length pants, and a shirt with sleeves are required in laboratories at all times.
Chemical or Biological Exposure of Clothing or Body	Lab Coats	Provide additional protection and keep hazardous materials off the clothes so it does not get transferred into areas outside the laboratory. They should be removed quickly if a splash occurs. Lab coats require a special laundry service and should not be taken home for washing. Check with your department about laundry services. Disposable lab coats can provide an alternative if the coat material is suitable for the hazards involve.
Exposure to Hazardous Chemicals or biological Materials	Chemical Resistant Aprons or Smocks	Chemically resistant aprons and smocks provide better protection against chemical splashes than lab coats. They should be worn for chemicals with a high dermal toxicity (e.g., hydrofluoric acid), when handling large amounts of corrosive chemicals, or when splashes are likely to occur.
Incidental Chemical Splash to the eyes	Safety Glasses	ANSI Z87.1 safety glasses provide minimal protection to the eyes from incidental splashing. Safety glasses are required at all times while in UAA laboratories.
Hazardous or Biological Chemical Exposure to the eyes	Chemical Goggles	Provide a higher level of protection than safety glasses. They should be used when handling highly corrosive chemicals that can permanently damage the eye. Three different types of goggles are available: • Unvented goggles protect from irritating and corrosive vapors and splashes • Goggles with indirect vents protect against splashes but not against vapor • Vented goggles provide impact resistance only and should not be used when handling chemicals
Splashes or Impact to the face or eyes	Face Shield	Protects the face against splashes and impacts. It should be worn in conjunction with splash goggles when handling chemicals that are highly corrosive and/or toxic when in contact with skin, in particular when large volumes of liquid are used that make splashes likely. It should also be used when performing potentially explosive experiments.

Hazard	Recommended PPE	Summary
Inhalation of Dangerous Airborne Contaminants	Respirator	Used to protect personnel from harmful airborne contaminants via filtration of the air prior to breathing. The use of any respirator falls under the UAA Reparatory Protection Program and usually requires medical evaluation and training prior to use. Contact EHS/RM for assistance.
Chemical Exposure to Hands	Gloves	Hands are most likely to come into contact with chemicals and biological materials. Gloves come in a wide variety of materials and sizes for protection against different chemicals, cuts, hot surfaces, and many others. It is important to evaluate hand hazards for the lab or task and ensure the proper glove use is prescribed.

General PPE Selection

PPE should be selected based on the physical and chemical hazards anticipated while in the laboratory or while performing a specific task. Chemical resistance and breakthrough time of different materials must be considered when selecting PPE. The proper PPE must be available in the proper size for personnel in order for them to perform the work.

PPE Use Guidelines

The following must always be considered when selecting the appropriate PPE:

- All laboratories will have the minimum PPE required to enter clearly posted at the entrance to that area
- If the PPE selected is to be laundered, the department must make arrangements for the laundering
- No PPE should ever be laundered at home
- PPE should be removed prior to exiting the lab to avoid contamination of common areas
- Proper disposal containers, or storage must be accessible to accommodate the removal of PPE prior to leaving the lab
- Personnel must always wash hands with soap and water after removing gloves and prior to exiting the lab

Work Practice Controls

Work practice controls are meant to reduce the likelihood of exposure by altering the manner in which a task is performed. In other words, these controls are dependent upon personnel behavior. It is necessary to employ good work practices in tandem with effective engineering controls and

personal protective equipment in order to achieve the goals of this program.

Standard Operating Procedure (SOP)

The Biological Safety Program provides guidance on what should be included in laboratory standard operating procedures relevant to safety and health concerns with work involving biohazardous agents. Lab-specific operations should be included by the department, PI or supervisor. The SOP is intended to provide personnel with the necessary guidelines for conducting work in a safe and consistent manner.

The types and quantity (as in large scale quantities) of organisms and the operations performed all define at which biosafety level the lab must function. Each level has certain recommended criteria in the areas of standard microbiological practices, special practices, safety equipment and laboratory facilities. See Section 11 for biosafety level criteria and Section 12 for the vertebrate animal biosafety level criteria.

Laboratory SOPs should include the following provisions:

- Biological materials and chemical to be used
- Hazard information on biological materials and chemicals to be used
- Safe operation procedures for equipment to be used
- Use of containment devices such as BSCs
- PPE requirements
- Procedures for proper disposal of contaminated waste
- Decontamination procedures
- Spill procedures

Bloodborne Pathogens (BBP)

All occupational exposure to blood or other potentially infectious materials (OPIM) is regulated under the Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens Standard, Title 29 of the Code of Federal Regulations (29 CFR 1910.1030). UAA requires that all personnel follow the UAA Bloodborne Pathogen Safety Program found in the programs section of the UAA EHS/RM website.

Laboratory SOPs must take into account the possible exposure of personnel to BBP and ensure precautions including engineering and administrative controls as well as PPE are put in place to protect personnel who are working in the lab.

Bloodborne pathogens are present in human blood and therefore it is necessary to protect workers from the following:

- Human blood
- Blood components
- Blood products
- Semen
- Vaginal secretions
- Cerebrospinal fluid
- Synovial fluid
- Pleural fluid
- Pericardial fluid
- Peritoneal fluid
- Amniotic fluid
- Saliva in dental procedures
- Any body fluid that is visibly contaminated with blood
- All body fluids where it is difficult or impossible to differentiate between body fluids
- Any unfixed tissues or organs (other than intact skin) from a human (living or dead)
- HIV- or HBV-containing cell, organ, tissue cultures, culture mediums or other solutions
- Blood, organs or other tissue from animals infected with HIV or HBV

It is important to remember personnel working with Other potentially infectious material (OPIM) must receive bloodborne pathogen training and be offered a Hepatitis C vaccination per the UAA BBP Program.

11. Biosafety Level Criteria

A biosafety level is a set of biocontainment precautions required to isolate dangerous biological agents in an enclosed laboratory facility. The levels of containment range from the lowest biosafety level 1 (BSL-1) to the highest at level 4 (BSL-4). In the United States, the Centers for Disease Control and Prevention (CDC) have specified requirements for these levels. Table 3 presents a summary of the different biosafety level requirements. A more detailed description can be found in the current edition of the CDC Biosafety in Microbiological and Biomedical Laboratories (BMBL). BSL-3 requirements are included for reference only. BSL-4 requirements are not included because UAA does not have the facilities in place to work with them.

Table 3 CDC Summary of Recommended Biosafety Levels for Infectious Agents

BSL Level	Agents	Practices	Primary Barriers and Safety Equipment	Facilities (Secondary Barriers)
BSL-1	Not known to consistently cause diseases in healthy adults	Standard microbiological practices	No primary barriers required • PPE: laboratory coats and gloves; eye, face protection, as needed	Open bench top sink required
BSL-2	Agents associated with human disease Routes of transmission include percutaneous injury, ingestion, mucous membrane exposure	BSL-1 practice plus: • Limited access • Biohazard warning signs • "Sharps" precautions • Biosafety manual defining any needed waste decontamination or medical surveillance policies	Primary barriers: • BSCs or other physical containment devices used for all open manipulations of agents • PPE: Protective laboratory clothing, gloves, face, eye and respiratory protection, as needed	BSL-1 plus: • Autoclave available
BSL-3	Indigenous or exotic agents that may cause serious or potentially lethal disease through the inhalation route of exposure	BSL-2 practice plus: • Controlled access • Decontamination of all waste • Decontamination of laboratory clothing before laundering	Primary barriers: • BSCs or other physical containment devices used for all open manipulations of agents • PPE: Protective laboratory clothing, gloves, face, eye and respiratory protection, as needed	BSL-2 plus: • Physical separation from access corridors • Self-closing, double door access • Exhausted air not recirculated • Negative airflow into laboratory • Entry through airlock or anteroom • Handwashing sink near laboratory exit

12. Animal Biosafety Criteria

The handling and storage of animals can present unique problems. In the animal room and during handling, the activities of the animals themselves can present unique hazards not found in standard microbiological laboratories. Animals may generate aerosols, they may bite and scratch, and they may be infected with a zoonotic agent. The co-application of Biosafety Levels and the Animal Biosafety Levels are determined by a protocol-driven risk assessment.

These guidelines describe three combinations of practices, safety equipment and facilities for experiments on animals infected with agents that produce or may produce human infection. They provide increasing levels of protection to personnel and the environment and are recommended as minimal standards for activities involving infected laboratory mammals. These three combinations are designated in each of the Animal Biosafety Levels (ABSL) 1 through 3 and describe animal facilities and practices applicable to work on animals infected with agents assigned to corresponding BSL-1 through BSL-3. A more detailed description can be found in the current edition of the CDC Biosafety in Microbiological and Biomedical Laboratories (BMBL).

13. Disinfection and Sterilization

Routine housekeeping in the laboratory including disinfection and sterilization is required. Laboratory personnel may use several different methods to decontaminate the lab, dependent on the type of experimental work and the nature of the infectious agents present. Prions are highly resistant to inactivation by most physical and chemical agents; decontamination of prions will be addressed separately in this program. Standard procedures should be established for each laboratory, designed to meet the needs of the various levels of biohazards found in that lab.

Disinfection

Disinfection is needed to eliminate infectious and pathogenic agents in the workspace. Different disinfectants need to be selected depending on the infectious agents known or suspected to be present, because different chemicals have different selective germicidal activity. Liquid disinfectants are available under a wide variety of trade names. Some disinfectants have undesirable characteristics such as corrosivity or flammability. When selecting a disinfectant, personnel should consider laboratory conditions, equipment and what viable agents are being disinfected. The most practical use of liquid disinfectants is for surface decontamination. At sufficient concentrations they can be used as decontaminants for liquid wastes prior to disposal in the sanitary sewer. The following disinfectants are widely used to disinfect pathogenic agents; however, they are often sold under different names.

Alcohol

Alcohols (ethyl and isopropyl) are a good general disinfectant at concentrations of 70-80 percent

(volume/volume) in water. They are effective against vegetative bacteria, fungi and lipid-containing viruses but not against spores.

The activity against non-lipid viruses varies. The contact time to achieve effective disinfection is at least 10 seconds on skin and at least 3 minutes on environmental surfaces. An advantage of alcohols is that they do not leave any residue on treated items.

Chlorine Compounds

Chlorine is a broad-spectrum germicide and is the recommended general all-purpose laboratory disinfectant. Chlorine is effective against bacteria, mycobacteria, viruses and fungal spores. However, not all bacterial spores are killed by chlorine and the amount of available chlorine must be considered when preparing the disinfectant. A concentration of 5,000 parts per million (ppm) available chlorine is recommended as an all-purpose disinfectant. A higher concentration, near 10,000 ppm available chlorine, is recommended for biohazardous spills, emergency situations involving viruses and in the presence of large amounts of organic matter (protein, including dirt).

Sodium hypochlorite (NaOCl), as an aqueous solution, is sold as bleach. Household commercial bleach contains 5.25 percent available chlorine; solutions of 10 percent or 20 percent will yield concentrations of 5,000 ppm and 10,000 ppm available chlorine, respectively. The activity of chlorine, especially as bleach, is reduced in the presence of protein. Solutions receiving material containing high levels of organic matter several times a day should be replaced daily, while less frequently used solutions can last for one week. Furthermore, low levels of chlorine gas are naturally released from stored solutions of chlorine and reduce the germicidal activity.

Note: Chlorine gas is highly toxic and therefore bleach should not be mixed with acids which would cause the release of chlorine gas. Additionally, chlorine is highly alkaline and is corrosive to metal. By-products of chlorine can be harmful to humans and the environment, therefore chlorine containing compounds should not be used indiscriminately.

Chloramines release chlorine at slower rates than hypochlorites and therefore higher concentrations are required to achieve equivalent activity to those of hypochlorites. However, chloramine solutions are virtually odor-free and are not inactivated by organic matter to the same extent as hypochlorites. Concentrations of 20,000ppm available chlorine are recommended for both “clean” and “dirty” situations.

Formaldehyde

Formaldehyde (HCHO) is effective against vegetative bacteria, spores and viruses. Formaldehyde is available in two forms: as a solid polymer, paraformaldehyde, or as a solution of the gas dissolved in water, formalin. Concentrations of 5-8 percent formalin in water are an effective liquid disinfectant. Formaldehyde - Alcohol solutions of 8 percent formaldehyde in 70 percent alcohol are considered very good for disinfection purposes because of the effectiveness against vegetative bacteria, spores and viruses.

Note: Formaldehyde is carcinogenic, and its fumes irritate the eyes and mucous membranes. All storage and use of formaldehyde must be done in a fume hood or well-ventilated area.

Glutaraldehyde

Glutaraldehyde (OHC(CH2)3CHO) is also effective against vegetative bacteria, spores and viruses. It is non-corrosive and faster acting than formaldehyde; however, it takes several hours to kill the bacterial spores. Glutaraldehyde is often purchased as a 2 percent solution and requires "activation" (made alkaline) before use by adding a bicarbonate compound supplied with the product. A solution of glutaraldehyde which has become turbid should not be used.

Note: Glutaraldehyde is toxic, and its fumes irritate the eyes and mucous membranes. All use must be done in a fume hood or well-ventilated area. Additionally, it is not recommended as a spray or solution to decontaminate environmental surfaces.

Hydrogen Peroxide and Peracids

Hydrogen peroxide (H2O2) and peracids are strong oxidants and are active against vegetative bacteria, spores and viruses. They are safer than chlorine to both humans and the environment. Hydrogen peroxide is available as a 3 percent ready-to-use solution or as a 30 percent aqueous solution that should be diluted 5-10 times with sterilized water before use; however, 3-6 percent solutions are slow acting and limited as germicides. Hydrogen peroxide can be used on work surfaces of laboratory benches and biosafety cabinets; stronger solutions can be used to disinfect heat-sensitive medical/dental devices.

Note: Hydrogen peroxide and peracids are corrosive to metals, including aluminum, copper, brass and zinc, and can decolorize fabrics, hair, skin and mucous membranes. Items treated with them must be thoroughly rinsed before contact with eyes and mucous membranes.

Iodine and Iodophors

Iodine and iodophors are effective against lipid-containing viruses, bacteria and fungi but exhibit variable activity against mycobacteria, non-enveloped viruses and bacterial spores. Iodine can stain fabrics and environmental surfaces, is neutralized by organic matter and is generally

unsuitable for use as a disinfectant. However, iodophors and tinctures of iodine are good antiseptics. Several advantages of iodophors include:

- A wide spectrum of anti-microbial and antiviral activity
- A built-in indicator (if the solution is brown or yellow, it is still active)
- Use as a preoperative skin antiseptic and surgical scrub

Note: Iodine can be toxic, and antiseptics based on iodine are generally unsuitable for use on medical/dental devices. Iodine should not be used on aluminum or copper.

Mercurials

Mercurials are toxic and therefore are not recommended for use.

Phenolic Compounds

Phenolic compounds are active against vegetative bacteria (including mycobacteria), fungi and lipid-containing viruses. They are not active against bacterial spores and show variable use against non-lipid viruses. Phenolic compounds are commonly used as antiseptics (e.g., triclosan and chloroxylenol); however, in laboratory-based studies, bacteria made resistant to low concentrations of triclosan also show resistance to certain types of antibiotics.

Note: Phenolic compounds are not recommended for use on food contact surfaces and around areas with young children. They can be absorbed by rubber and penetrate the skin. Often, they have an unpleasant odor (e.g., Amphyl, Vesphene II).

Quaternary Ammonium Compounds

Quaternary ammonium compounds are active against vegetative bacteria and non-lipid containing viruses but not against bacterial spores at the usual concentrations (1:750). These compounds are often used as mixtures and in combination with other germicides. However, the activity of quaternary ammonium compounds may be neutralized by organic matter, water hardness and anionic detergents (soap).

Note: Potentially harmful bacteria can grow in quaternary ammonium compound solutions. Also, these compounds may accumulate in the environment as a result of low biodegradability.

General Procedures

Decontamination is required in order to protect personnel and the environment from exposure to biological agents and to prevent contamination of experimental materials. Below are several general guidelines that should be followed in the research laboratory.

- Infectious materials and contaminated equipment originating from the lab must be sterilized before being washed and stored or discarded. Autoclaving is the preferred method. Each individual working with infectious material is responsible for its sterilization
- Biohazardous materials should not be placed in autoclaves overnight in anticipation of autoclaving the next day. To minimize hazard to emergency responders, all biohazardous materials should be placed in an appropriately marked refrigerator or incubator, sterilized or otherwise confined at the close of each work day
- Special precautions should be taken to prevent accidental removal of material from an autoclave before it has been sterilized or the simultaneous opening of both doors on a double-ended autoclave
- Dry hypochlorites or any other strong oxidizing material must not be autoclaved with organic materials such as paper, cloth, or oil. Oxidizer + organic material + heat = explosion potential
- Laboratory rooms containing biohazardous materials should designate, where appropriate, separate areas or containers labeled:
  - BIOHAZARDOUS--TO BE AUTOCLAVED
  - NON-INFECTIOUS--TO BE CLEANED
- All floors, laboratory benches and other surfaces in buildings where biohazardous materials are handled should be disinfected as often as deemed necessary by the supervisor
- After completion of operations involving plating, pipetting, centrifuging and similar procedures with biohazardous materials, the surroundings should be disinfected
- Floor drains should be flooded with water at least once each week or filled with mineral oil in order to fill traps and prevent backflow of sewer gases
- Floors should be wet mopped with a disinfectant added to the mop water. Vacuum cleaners equipped with HEPA filtration may also be used
- Stock solutions of suitable disinfectants should be maintained in each laboratory for disinfection purposes

Local Environmental Decontamination

Surfaces can be decontaminated using a solution of bleach; a solution containing 5,000 ppm available chlorine may be suitable for general environmental sanitation, but stronger solutions (10,000 ppm) are recommended when dealing with high-risk situations. For environmental decontamination, formulated solutions containing 3% ~~percent~~ hydrogen peroxide make suitable substitutes for bleach solutions.

Fumigation of spaces with a vaporous solution of hydrogen peroxide is an effective decontamination method and is replacing formaldehyde gas decontaminations. Relatively low concentrations of hydrogen peroxide (1 milligram/liter) can be effective area fumigants. As with any disinfectant, the efficacy of hydrogen peroxide will vary depending on the contaminating organism, the presence of organic and/or inorganic material and on the type of surface being decontaminated. One advantage over paraformaldehyde is that the residual vapor of hydrogen peroxide decomposes into water and oxygen. Contact EHS/RM if you have any questions or concerns.

Decontamination of BSCs

Class II BSCs can be decontaminated with vaporized hydrogen peroxide. This procedure shall only be done by qualified technicians due to the potential for exposure to biohazardous agents and the chemicals used. Cabinets must be decontaminated before they are moved, before any repairs are done that require access to the plenum and before the filters are changed. Contact the biosafety specialist or EHS/RM when a BSC decontamination is required or for any questions regarding decontamination of BSCs.

Hand Washing

Appropriate gloves should always be worn when handling biohazardous materials, however, gloves do not eliminate the need for regular and proper hand washing. Hands must be washed with soap and running water after handling biohazardous materials and animals, before leaving the laboratory and before eating. In most situations, thorough washing of hands with ordinary soap and water is enough to decontaminate them, but the use of germicidal soaps is recommended in high-risk situations. Alcohol-based hand-rubs should be used to decontaminate lightly soiled hands when proper hand washing is not available or used as an additional precaution.

Heat Disinfection and Sterilization

Heat is the most common physical agent used for the decontamination of pathogens. “Dry” heat, which is totally non-corrosive, is used to process many items of laboratory ware which can withstand temperatures of 160°C or higher for 2-4 hours. Burning or incineration (see below) is also a form of dry heat. “Moist” heat is most effective when used in the form of autoclaving. Boiling does not necessarily kill all microorganisms and/or pathogens, but it may be used as the minimum processing for disinfection where other methods (chemical disinfection or decontamination, autoclaving) are not applicable or available.

Sterilized items must be handled and stored such that they remain uncontaminated until used.

The necessary treatment to achieve sterility will vary in relation to the volume of material treated, its contamination level, moisture content and other factors. The material presented below is to be used as general criteria for biohazardous/infectious agents coming from BSL-2 laboratories.

Autoclaving

Autoclaving is the most effective and reliable means of sterilizing laboratory materials. Autoclaving sterilizes material using saturated steam under pressure. Standard autoclave cycles for commonly used material are shown below.

- Laundry: 121°C for 30 minutes with 15 minutes prevacuum of 27 inches of mercury (in. Hg)
- Glassware and trash: 121°C for 1 hour with 15 minutes prevacuum of 27 in. Hg
- Liquids: 121°C for 1 hour for each gallon

General Autoclaving Guidelines

- Every autoclave and sterilizer should be inspected and serviced on a regular basis. This will help ensure the equipment is functioning properly
- Each unit should have a standard operating procedure written in sufficient detail to ensure that operators will use the equipment properly
- Units should be tested regularly with a commercial preparation of Bacillus stearothermophilus (a biological indicator)
- Tape indicators (autoclave tape) with heat sensitive, chemical indicators should be used in every autoclave load. Please note: the indicators only verify that the autoclave has reached normal operating temperatures; they have no time factor. Therefore, tape indicators cannot be used to prove organisms are actually killed during an autoclave run
- Keep detailed records on biological tests, recording thermometers, and service work performed on the unit
- Do not autoclave flammable liquids, toxic chemicals, carcinogens, cytotoxic drugs, or radioactive materials. The careless autoclaving of hazardous materials may generate toxic vapors or explosive environments
- Do not autoclave items containing more than trace amounts of solvents and other volatile chemicals or corrosives (e.g., phenol, trichloroacetic acid, ether, chloroform, hypochlorite)
- Do not autoclave bulk liquids without following the manufacturer's written instructions. See the following section on autoclave containers for more information
- Neutralize waste containing bleach with equal amounts of 1 percent sodium thiosulfate in water prior to autoclaving
- High density wastes or materials that insulate the agents from heat and steam penetration are not suitable for steam sterilization. Items that are covered with dirt or film require

additional retention times. The importance of properly cleaning items to be sterilized cannot be over emphasized

- Place all autoclaved infectious waste into red bags for disposal

Autoclave Bags / Container Guidelines

- The proper packaging and containment of infectious materials are crucial to achieve effective sterilization. The most frequent reason for sterilization failure is the lack of contact between the steam and microorganisms
- To facilitate steam penetration, bottle caps and stoppers should be loosened after placement into the chamber. If left sealed, they may not be properly sterilized and could burst violently if exposed to extreme heat
- Most bags that are marketed as autoclavable are not suitable if closed because the steam will not penetrate them. Steam resistant bags must be left open or have holes punched into the top to allow the steam to penetrate. Do not transfer open bags to the autoclave
- Never close autoclave bags that have a printed warning stating they are to remain open during sterilization. If air remains trapped in the bag, the material may not be properly sterilized
- Autoclave bags that allow steam penetration tend to melt or crumble during the sterilization process. Autoclavable bags may be placed inside paper bags, or open steam resistant polypropylene bags
- Autoclavable bags can leak so they should be placed into a shallow stainless-steel pan. Plastic pans are less effective because they do not transfer heat as fast or efficiently
- Sterilization of bulk liquids requires special care to prevent the containers from exploding
- Each gallon of infectious liquid must be autoclaved for one hour at 250°F at 15 pounds per square inch. Closures and lids must be loosened prior to sterilizing
- Bulk solutions must be sterilized separately from all other items in a load dedicated to liquids only. Solutions are subjected to a cycle designed specifically for liquids
- Sterilized liquids must be allowed to cool before unloading. Removing hot bottles may cause them to explode

Loading the Autoclave

- Follow the manufacturer's instructions before attempting to load the chamber
- Materials should be loosely packed in the chamber for easy steam penetration and air removal. Add 250ml of water to solid waste in order to create additional steam that drives

residual air from the bag

- Transfer infectious waste to the autoclave in a sealed secondary container. The autoclave bags should be left open during autoclaving to insure steam penetration and sufficient temperatures inside the bag are achieved
- Avoid rough handling of waste containers in order to minimize the formation of infectious aerosols

Unloading the Autoclave

- Follow the manufacturer's instructions before unloading the chamber
- Do not open the autoclave while the chamber is pressurized, released steam can cause severe burns
- Wear heat-resistant gloves, safety glasses/goggles and a laboratory coat when removing items
- Wait until the autoclave has cooled prior to opening the door. Most autoclaves have safety interlocks that prevent the door from opening when the temperature inside is greater than 80°C; however, a puff of steam may be ejected if the autoclave is opened immediately after the cycle
- Avoid standing directly in front of the autoclave door when it is opened after a run
- Handle waste containers containing liquids with care to avoid being burned by hot liquid splashes or spills. Liquids should be allowed to cool for 20 minutes before transport to prevent sudden eruption from the containment vessel

14. Spills

Prior to ordering biological materials it must be determined what equipment and procedures will be required in the event of spills. Each laboratory must have appropriate equipment and materials Each laboratory should have a spill kit which is clearly labeled; it is recommended that a sign be posted indicating where the kit is located (such as with an arrow) if the kit is placed up on a shelf or under a cabinet for example. A basic biological spill kit could include the following:

- Protective clothing, e.g., lab coat, gloves and face protection (i.e. face shield, safety glasses or goggles
- Scoops and/or autoclavable dustpan
- Forceps for picking up broken glass
- absorbent material (i.e. paper towels)
- Concentrated disinfectant (chlorine bleach or other appropriate disinfectant)

- Nonflammable detergent
- Biohazard bag

The potential health risk of the spilled agent must be considered. For example, with *Mycobacterium tuberculosis* the risk of exposure from the spill of a small quantity might be many times that of a much larger spill of *E. coli*. A minimally biohazardous material (BSL1 or RG1 agent) spilled without generating significant aerosols may be cleaned up with a paper towel soaked in an effective decontaminating agent. A spill of a large volume with generation of aerosols will require personnel to wear protective clothing and possibly respiratory protection, depending on the biological agent involved. A third-party spill response crew will likely be utilized in the event of a large or highly hazardous spill.

Spills Inside a BSC

Preparation

- Cleanup materials should be kept in, or in the immediate area of the cabinet so they are available when a spill occurs
- Personnel working in the BSC must be trained in the spill response procedures

Cleanup

- Do not remove anything from the cabinet, including your hands, to prevent dispersion outside the cabinet
- Continue to operate the cabinet to clear the air of contaminants
- While wearing gloves, use a clean cloth and appropriate disinfectant solution (most commonly used: freshly-prepared 10% dilution of household bleach) to:
    - Clean up the spill
    - Disinfect interior surfaces of the cabinet, including walls and work surfaces
    - Wipe down any equipment contained within the cabinet
    - In moderate to high-risk spills, flood catch-basins
- Prevent the generation and escape of aerosols and contaminants from the cabinet during decontamination by working cautiously to prevent splashing materials outside the cabinet
- Allow a 20-minute disinfectant contact period
- To prevent corrosion of the cabinet's stainless-steel surfaces, wipe disinfected surfaces with 70% alcohol to remove the bleach
- Put all cleanup materials in a biohazard bag (before removing from the area) and dispose

of as biohazardous waste

- Wash hands and any exposed skin with soap and water
- Allow the cabinet to run for at least 15 minutes following cleanup prior to using again

Spills Outside a Biological Safety Cabinet

Incidental Spill

A spill is considered to be incidental if it is easily contained, has not generated infectious aerosols, and is not considered to be a significant threat to the personnel in other areas of the building.

- Wear disposable gloves and a lab coat.
- Soak paper towels in disinfectant and place over the spill area, allowing sufficient contact time with the disinfectant (20 minutes- most commonly used: freshly-prepared 10% dilution of household bleach).
- Clean spill area with fresh towels soaked in disinfectant.
- Pick up any broken glass with forceps and place in a sharps container.
- Put all materials used in the cleanup into a biohazard bag and dispose of as biohazardous waste.
- Thoroughly wash hands with soap and water.

Large Spill

A spill is considered to be large if it is difficult to contain within the laboratory or the facility, and/or it constitutes a significant health hazard. This type of spill may require special assistance in controlling and clean up.

Preparation:

- Evacuate the area immediately
- If biological safety cabinet or fume hood is in the room, leave it on and immediately exit the room. Close and lock the door
- If safe to do so post a "Biohazard" and "Do Not Enter" sign on the door to keep people out of the area and to prevent the spread of the contaminant
- Notify supervisor and EHS/RM to determine proper spill response actions

Clean-up:

- Thoroughly wash face, hands and any exposed body area. Remove all contaminated clothing, and decontaminate (autoclave, if necessary). If necessary, use an emergency

shower in the immediate area

- Allow at least 30 minutes for droplets to settle and aerosols to be reduced before any responders may reenter
- Responders must don protective equipment (long sleeved lab coat, disposable gloves, safety goggles and face shield and disposable shoe covers, if needed)
- If the spill is large, apply absorbent booms or dike around the spill area to avoid spreading
- Cover spill area with paper towels or absorbent pads soaked in disinfectant
- Decontaminate with an appropriate disinfectant
  - Pour the disinfectant slowly around the spill, not on the spill, to avoid aerosolizing the material
  - Allow a 20-minute disinfectant contact period
  - Clean up the liquid working from the outside of the spill area inward to avoid spreading the spill
- Wipe down all surfaces that may have been splashed
- Using an autoclavable dust pan and squeegee, transfer all contaminated glassware or sharp material into a sharp's bucket
- Re-wipe spill area with disinfectant
- Dispose of all cleanup items in the proper container and dispose of as biohazardous waste
- Wash hands and any exposed skin with soap and water

Spills – Blood

- While wearing appropriate PPE, including lab coat and gloves, use paper towels to absorb the spill
- Cleanup all visible blood with a detergent solution
- Soak clean paper towels with a disinfectant (freshly-prepared 10% dilution of household bleach) and wipe down spill area
- Place all cleanup material in a biohazard bag and dispose of as biohazardous waste
- Wash hands and any exposed skin with soap and water

Spills – BSL-3 / ABSL-3 Agent

If BSL3/ABSL-3 agents are ever used on campus, emergency response procedures must be developed, and third-party spill response company contracted to assist in the event of a spill.

15. Waste Disposal

Biohazardous waste disposal must be handled in accordance with procedures and practices established in the UAA Waste Management Program. This waste must be segregated from general waste at the point of origin. Potentially infectious material or biohazard waste must be discarded directly into red-bag lined Rubbermaid transport containers or a red-bag lined white biohazard box which is clearly identifiable and distinguishable from general waste. Containers must be marked with the universal biohazard symbol (Figure 1). Plastic bags must be distinctly colored red or orange and marked with the universal biohazard symbol.

16. Research Involving Recombinant DNA (rDNA)

rDNA research conducted at UAA must comply with the NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules (NIH Guidelines). The NIH Guidelines defines rDNA as either (1) molecules that are constructed outside living cells by joining natural or synthetic DNA segments to DNA molecules that can replicate in a living cell or (2) molecules that result from the replication of those described in (1) above.

17. Select Agents and Toxins

As required by the Public Health Security and Bioterrorism Act of 2002, the DHHS (Department of Health and Human Services) and USDA (United States Department of Agriculture) have set forth rules regarding the possession, use and transfer of select agents and toxins. The biological agents and toxins subject to these rules have the potential to pose a severe threat to public health and safety, to animal health or to animal products. These rules, defined as the Select Agent Program, are outlined in the CFR (Code of Federal Regulations), Title 42, part 73, Possession, Use and Transfer of Select Agents and Toxins. Prior to ordering any select agent or toxins on the CDC Select Agents and Toxins List consult with the IBC and EHS/RM for review and assistance.

18. Shipping Regulations

IATA (International Air Transport Association) and DOT (Department of Transportation) regulate the shipping of infectious substances and diagnostic specimens. Specific requirements regarding the classification of agents, package preparation, package marking/identification and shipper's declaration have been established. It is the shipper's responsibility to be aware and to adhere to applicable laws, regulations and requirements.

Infectious Substances

Infectious substances are substances known to contain, or can reasonably be expected to contain viable microorganisms, including bacteria, viruses, rickettsia, parasites, or fungi, or other agents such as prions, that can cause disease in humans or animals. Cultures or lab stocks (e.g., tissue

culture systems and agar plates) in which such pathogens are amplified or propagated in high concentrations are also considered an infectious substance.

Infectious substances are further categorized as Category A and Category B infectious substances.

Category A infectious substances are cultures of microorganisms listed in the far right column of Appendix A of this manual "Microorganism Classified as Category A only when Cultured", or materials (such as tissue or blood, in addition to cultures) that contain or can reasonably be expected to contain organisms listed in the center column of Appendix A.

Category B infectious substances are those that do not meet the criteria for inclusion as a Category A substance. Category B substances should be labeled as "Biological substance, Category B."

A culture plate or slant shipped for diagnosis or clinical purposes is considered a "Biological substance, Category B", unless it is a culture of a highly pathogenic organism or is included in Appendix A (center or far right columns). A patient specimen (e.g. blood, tissue) suspected to contain an organism found in the far-right column of Appendix B, should be shipped as a "Biological substance, Category B." For example, a blood or tissue sample from a patient with rabies or HIV would be shipped as a "Biological substance, Category B" since Appendix B lists each of these viruses as "Classified as Category A only when Cultured" (i.e. far right column).

Patient Specimens

Specimens taken directly from a patient (either human or animal) may be classified as an "Exempt human Specimen" or "Exempt animal specimen", if there is minimal likelihood that the specimen contains a pathogen. The likelihood that the specimen contains a pathogen must be determined by a professional and be based on the patient's medical history, the patient's symptoms, and endemic local conditions.

Dry Ice Shipping

Dry ice is included in the Miscellaneous Hazard Class 9 and as a result, any shipments with dry ice are regulated by DOT/IATA. If the shipment also includes an infectious substance or diagnostic specimen, packing instructions for those agents must be followed and the Infectious Substances/Diagnostic Substances training completed. DOT/IATA Dangerous Goods Regulations require that anyone using dry ice in shipments or anyone signing documentation for a dry ice shipment (e.g., FedEx Air Waybill) must have current shipping training. Contact EHS/RM for assistance prior to shipping biological agents and chemicals.

19. Exposure Evaluation and Follow-Up

Medical Evaluation

Where to seek medical treatment following an exposure

In case of a medical emergency, injured workers should

When a hazardous exposure incident occurs, a medical evaluation and follow-up will be done by an occupational medical provider appointed by EHS/RM.

What to do following an exposure

Cleanse the exposed area thoroughly using mild soap and water. For a mucus membrane exposure, flush the area with copious amounts of water.

Report the incident immediately to your supervisor or PI and report using the on-line incident reporting tool as soon as feasible.

Report to the proper facility for medical evaluation and treatment.

During your medical evaluation you should:

- Inform medical personnel of the agent(s) or material to which you were exposed. If the exposure involved a chemical, provide medical personnel with the chemical's SDS if possible
- Inform medical personnel of the conditions and route under which exposure occurred
- Discuss with medical personnel the signs and symptoms of infection with the agent(s) to which you were exposed. Ensure you are made aware of the signs/symptoms to watch for following your visit and what you should do if those signs/symptoms appear

20. Inspections

To ensure biological materials at UAA are managed in a safe compliant manner the following inspections are required:

Prior to working with biological materials personnel must ensure:

- They understand all procedures and operation of all equipment
- The laboratory and all equipment is in proper working condition
- Required PPE and spill kits are available.

21. Training

Departments must provide personnel with information and training in order to ensure that they are apprised of biohazards in their work area. Training may take the form of individual instruction, group seminars, audiovisual presentations, handout material or any combination of the above. Training should include the specific hazards associated with agents in the work area when generic training is insufficient to address specific hazards. Training should be provided at the time of an employee's initial assignment to a work area where biohazardous agents are present and prior to assignment involving new exposure situations. Personnel should receive periodic refresher information and training. All training must be documented.

Information and training provided by departments should include all of the following:

- The location and availability of the written Biological Safety Manual
- The health hazards, signs and symptoms associated with exposure(s) and infection(s) with the biohazardous agent(s) used in the work area
- The measures personnel can take to protect themselves from these hazards, including specific procedures the University or department has implemented such as appropriate work practices, emergency procedures and personal protective equipment
- The location and availability of reference material on the hazards, safe handling, storage and disposal of biohazardous agents

Although students are not covered under AKOSH (Alaska's Occupational Safety and Health Administration), they should be aware of biohazards in teaching situations and be provided information and equipment to protect themselves from those hazards. Departments should provide student training at the beginning of each course in which biohazardous agents are used, with specific safety instructions provided at the beginning of each class period.

Departments are responsible for ensuring that personnel and students receive the proper training.

Shipping Training

Specific training is required to ship hazardous materials. Current regulations for shipping infectious substances/diagnostic specimens can be found through IATA, DOT, USPS (United States Postal Service) EHS/RM should be contacted for shipping training if required.

22. Program Evaluation

The Biological Safety program shall be evaluated on an annual basis utilizing the protocols set forth by Biological Safety Committee. Biological Safety Committee will define the scope of the evaluation. The final report will be developed by the EHS/RM utilizing the information received

during the evaluation. The deficiencies determined in the report will be documented and corrective action plans will be developed.

23. References

OSHA regulations that apply to Biological Safety include:

- 29 CFR 1910.1030 - Bloodborne Pathogens
- 29 CFR 1910.1200 - Hazard Communication
- 29 CFR 1910.1450 - Occupational Exposure to Hazardous Chemicals in Laboratories (Lab Standard)
- 29 CFR 1910.132 - PPE - General Requirements
- 29 CFR 1910.133 - PPE - Eye and Face Protection
- 29 CFR 1910.338 - PPE - Hand Protection
- 1910.145 - Accident Prevention Signs & Tags
- 1910.1000 - Air contaminants

Other regulations and guidelines that apply to the Biological Safety Program include:

- Federal Select Agent Program jointly comprised of the Centers for Disease Control and Prevention/Division of Select Agents and Toxins and the Animal and Plant Health Inspection Service/Agriculture Select Agent Services
- CDC Biosafety in Microbiological and Biomedical Laboratories (BMBL) 5th Edition
- National Institute of Health Guidelines for research Involving Recombinant or Synthetic Nucleic Acid Molecules (NIH Guidelines)
- *Guide for Care and Use of Laboratory Animals (NIH)*

24. Revision History

Revision Number	Date Revised	Description of Change	Revised By	Approved By
0	05/17/2021	Initial Issue		
1				
2				

Appendix A: Indicative Examples of Category A Infectious Substances*

UN # and Proper Shipping Name	Microorganism Classified as Category A in any Form (Always Classified as Category A)	Microorganism Classified as Category A only when Cultured
UN 2814 Infectious substance, affecting humans	Crimean-Congo hemorrhagic fever virus Ebola virus Flexal virus Guanarito virus Hantaan virus Hantaviruses causing haemorrhagic fever with renal syndrome Hendra virus Junin virus Kyasanur Forest disease virus Lassa virus Machupo virus Marburg virus Monkeypox virus Nipah virus Omsk hemorrhagic fever virus Sabia virus Variola virus	*Bacillus anthracis* *Brucella abortus* *Brucella melitensis* Brucella suis *Burkholderia mallei-Pseudomonas mallei* - Glanders *Burkholderia pseudomallei-Pseudomonas pseudomallei* *Chlamydia psittaci*- avian strains *Clostridium botulinum* *Coccidioides immitis* *Coxiella burnetiid* Dengue virus Eastern equine encephalitis virus *Escherichia coli*, verotoxigenic Far Eastern Tick-borne Encephalitis virus (formally known as Russian spring-summer encephalitis virus) *Francisella tularensis* Hepatitis B virus Herpes B virus Human immunodeficiency virus Highly pathogenic avian influenza virus Japanese encephalitis virus *Mycobacterium tuberculosis* Poliovirus Rabies virus *Rickettsia prowazekii* *Rickettsia rickettsii* Rift Valley fever virus *Shigella dysenteriae* type 1 Tick-borne encephalitis virus Venezuelan equine encephalitis virus West Nile virus Yellow fever virus *Yersinia pestis*
UN 2900 Infectious substance, affecting animals		African swine fever virus Avian paramyxovirus Type 1- Velogenic Newcastle disease virus Classical swine fever virus Foot and mouth disease virus Lumpy skin disease virus *Mycoplasma mycoides* – Contagious bovine pleuropneumonia Peste des petits ruminants virus Rinderpest virus Sheep-pox virus Goatpox virus Swine vesicular disease virus Vesicular stomatitis virus

*** This list is not exhaustive**