

GENERAL EXPOSURE CONTROL METHODS

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BIOSAFETY LEVEL 2

General

1. The combination of BUA Sections I, II, and III consolidate the Biosafety Level 2 precautions in CDC/NIH's Biosafety in Microbiological and Biomedical Laboratories (<http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4toc.htm>), Cal/OSHA standards involving biohazards, the NIH Guidelines, and the California Medical Waste Management Act.
2. The combination of Sections I, II, and III of the BUA meets the requirements of CDC/NIH's laboratory-specific biosafety manual, Cal/OSHA's written Bloodborne Pathogen Exposure Control Plan, and the California Department of Health Services' medical waste management plan for your laboratory.
3. Biosafety Level 2 practices, equipment, and facility design apply to clinical, diagnostic, teaching, and other laboratories in which work is done with indigenous, moderate-risk agents associated with human disease of varying severity.
 - a. Primary hazards to personnel working with these agents relate to accidental percutaneous or mucous membrane exposures, or ingestion of infectious materials.
 - b. Even though organisms routinely manipulated at Biosafety Level 2 are not known to be transmissible by the aerosol route, procedures with aerosol or high splash potential that may increase the risk of personnel exposure is conducted in containment equipment whenever possible. Other primary barriers are used as appropriate, such as splash shields, face protection, gowns, and gloves. A combination of both engineering and work practice controls are used to eliminate or minimize employee exposure.
4. According to Cal/OSHA, the hierarchy of controls is:
 - a. Engineering controls (i.e. containment equipment, primary containment or barriers, secondary containment or barriers)
 - b. Administrative controls (i.e. work practice controls)
 - c. Personal protective equipment (PPE)
5. Personnel need to notify the PI if the BUA, which includes Sections I, II and III, contains inaccurate information or needs to be updated.

Training

1. General
 - a. The person conducting training is knowledgeable in the subject matter as it relates to the workplace involved.
 - b. Training records are maintained for 3 years from the date on which training occurred. Training records include the following information:
 - 1) The dates of the training sessions,
 - 2) The contents or a summary of the training sessions,
 - 3) The names and qualifications of personnel conducting the training, and
 - 4) The names and job titles of all personnel in attendance.
2. The PI ensures that personnel with reasonably anticipated occupational exposure are trained on the potential hazards associated with the work involved, the necessary precautions to prevent exposures, and the exposure evaluation procedures.
 - a. Personnel attend the EH&S course "Biosafety for Human, Animal, and Plant Pathogens" at the time of initial assignment to tasks where occupational exposure may take place.
 - b. Personnel read the applicable BUA.
 - c. Personnel read materials provided by CLEB with agent-specific biosafety information. CLEB has selected materials to provide information on the biology of the organisms used in the experiments so that personnel can understand and appreciate the potential biohazards.

- d. The PI ensures personnel receive hands-on training for safe work practices in the laboratory, aseptic technique, and accident response.
3. The PI ensures personnel receive annual updates (or additional training as necessary) for procedural or policy changes such as introduction of new engineering or work practice controls, modification of tasks or procedures, and institution of new tasks or procedures if they affect occupational exposure.
 - a. This requirement can be accomplished in laboratory meetings as long as training records are kept.
 - b. The additional training may be limited to addressing the new exposures.
4. The PI ensures that personnel who must enter the room for program or service purposes when work is in progress are advised of the potential hazard.
5. For animal facilities, personnel are required to attend additional training required by their Animal Use Protocol.

UC Berkeley specifics

1. As noted above, the combination of BUA Sections I, II, and III consolidate the Biosafety Level 2 precautions in CDC/NIH's Biosafety in Microbiological and Biomedical Laboratories, Cal/OSHA standards involving biohazards, the NIH Guidelines, and the California Medical Waste Management Act.
2. UC Berkeley-specific procedures are highlighted below:
 - a. The first page of Section I is posted on the entrance to each room listed in the BUA. Most biological safety cabinets in use at UC Berkeley are Class IIA2 biological safety cabinets.
 - b. For animal rooms, doors to animal rooms open inward unless UC Berkeley's Fire Marshall determines differently.
 - c. UC Berkeley has a policy "Access to Laboratories Containing Hazards" (<http://campuspol.chance.berkeley.edu/policies/labaccess.pdf>). Note: This policy prohibits non-research animals and children under the age of 18 from entering Biosafety Level 2 laboratories.
 - d. If there are designated food areas inside the laboratory, personnel do not perform open bench top work with Biosafety Level 2 agents. Open bench top work includes streaking plates, pipetting, and other activities that may generate aerosols outside of containment.
 - e. Biological waste
 - 1) UC Berkeley classifies Biosafety Level 1 materials that resemble medical waste as 'biotechnology waste.' Examples are Petri dishes, tissue culture flasks, and plastic pipets.
 - 2) UC Berkeley disposes of animal carcasses, tissues, and organs as pathology waste.
 - 3) UC Berkeley laboratories commonly dispose of chemotherapy and pharmaceutical waste as "unwanted hazardous chemicals."
 - f. UC Berkeley has specific emergency procedures that are listed in the Emergency Procedures subsection.

Entry requirements

1. The PI limits access to the laboratory when work with infectious agents and organisms containing recombinant DNA molecules is in progress.
2. The PI establishes policies and procedures whereby only personnel who have been advised of the potential hazards and meet specific entry requirements (e.g., vaccines offered) may enter the laboratory.
3. For animal facilities, only those persons required for program or support purposes are authorized to enter the facility. EH&S provides safety training prior entry.
4. CLEB determines the appropriate vaccines or medical surveillance for the agents handled or potentially present in the laboratory. The PI offers those services to personnel and pays for them. Personnel may refuse these services, but may need to consult with a physician or sign a declination form before starting work.

Signs and labels

1. The first page of Section I is posted on the entrance to each room listed in the BUA.

2. A label with the word “biohazard” and the biohazard symbol is affixed to equipment and containers with agents or materials. The labels are fluorescent orange or orange-red with lettering and symbols in a contrasting color.

Engineering controls/ Containment equipment/ Primary barriers

1. The Biosafety Officer continually identifies currently available engineering controls by attending biosafety conferences, participating on an international biosafety list serve, and routine communication with other University of California biosafety officers. During BUA review, and in conjunction with the PI, the Biosafety Officer and CLEB select controls for the procedures performed.
2. Personnel examine engineering controls every time they are used and report to the PI when engineering controls are ineffective. The PI maintains or replaces engineering controls when needed or per manufacturer’s recommendations.
3. Biological safety cabinets or other appropriate combinations of personal protection or primary containment devices are used for all activities that pose a threat of exposure to droplets, splashes, spills, or aerosols.
4. Biological safety cabinets
 - a. Properly maintained biological safety cabinets, preferably Class II, or other appropriate personal protective equipment or physical containment devices are used whenever:
 - 1) Procedures with a potential for creating infectious aerosols or splashes are conducted. These may include centrifuging, grinding, blending, vigorous shaking or mixing, sonic disruption, opening containers of infectious materials whose internal pressures may be different from ambient pressures, inoculating animals intranasally, and harvesting infected tissues from animals or embryonate eggs.
 - 2) High concentrations or large volumes of infectious agents or organisms containing recombinant DNA molecules are used.
 - b. Biological safety cabinets are certified by Technical Safety Services when installed, whenever they are moved, and at least annually. PIs coordinate this service by contacting Technical Safety Services at (510) 845-5591. EH&S currently pays for the annual certification.
 - c. Biological safety cabinets are used in accordance with Cal/OSHA’s standard “Ventilation Requirements for Biological Safety Cabinets” Title 8, section 5154.2 of the California Code of Regulations (<http://www.dir.ca.gov/title8/5154%5F2.html>).
 - 3) A warning placard is placed on the front of the biological safety cabinet requiring decontamination prior to opening any service panel or other interior access.
 - 4) For Class IIB and Class III biological safety cabinets, an audible and visual alarm system alerts personnel when exhaust flow is insufficient.
 - 5) Biological safety cabinets with canopies or thimbles have a ribbon streamer or like device attached to the edge of the canopy or thimble to indicate the direction of flow. Flow alarms are not required.
 - d. New biological safety cabinets are installed so that fluctuations of the room supply and exhaust air do not cause the biological safety cabinets to operate outside their parameters for containment. Biological safety cabinets should be located away from doors, from windows that can be opened, from heavily traveled laboratory areas, and from other potentially disruptive equipment so as to maintain the biological safety cabinet’s air flow parameters for containment.

- e. The following procedures are excerpted from CDC's Primary Containment for Biohazards: Selection, Care and Use of Biological Safety Cabinets (<http://www.cdc.gov/od/ohs/biosfty/bsc/bsc.htm>).
- 1) General
 - a) The rapid movement of a worker's arms in a sweeping motion into and out of the cabinet will disrupt the air curtain and may compromise the partial barrier containment provided by the biological safety cabinet. Moving arms in and out slowly, perpendicular to the face opening of the cabinet, will reduce this risk.
 - b) Other personnel activities in the room (e.g., rapid movement, open/closing room doors, etc.) may also disrupt the cabinet air barrier.
 - c) Materials or equipment placed inside the cabinet may cause disruption to the airflow, resulting in turbulence, possible cross-contamination, and/or breach of containment. Extra supplies (e.g., additional gloves, culture plates or flasks, culture media) should be stored outside the cabinet. Only the materials and equipment required for the immediate work should be placed in the biological safety cabinet.
 - d) Certain common practices interfere with the operation of the biological safety cabinet. The autoclavable biohazard collection bag should not be taped to the outside of the cabinet. Upright pipet collection containers should not be used in biological safety cabinets nor placed on the floor outside the cabinet. The frequent inward/outward movement needed to place objects in these containers is disruptive to the integrity of the cabinet air barrier and can compromise both personnel and product protection. Only horizontal pipet discard trays containing an appropriate chemical disinfectant should be used within the cabinet.
 - e) Biological safety cabinets are designed to be operated 24 hours per day, and some investigators find that continuous operation helps to control the laboratory's level of dust and other airborne particulates. Although energy conservation may suggest biological safety cabinet operation only when needed, especially if the cabinet is not used routinely, room air balance is an overriding consideration. In some instances, room exhaust is balanced to include air discharged through ducted biological safety cabinets.
 - f) Open flames are not required in the near microbe-free environment of a biological safety cabinet. On an open bench, flaming the neck of a culture vessel will create an upward air current, which prevents microorganisms from falling into the tube or flask. An open flame in a biological safety cabinet, however, creates turbulence, which disrupts the pattern of HEPA-filtered air supplied to the work surface. When deemed absolutely necessary, touch-plate microburners equipped with a pilot light to provide a flame on demand may be used. Internal cabinet air disturbance and heat buildup will be minimized. The burner must be turned off when work is completed. Small electric "furnaces" are available for decontaminating bacteriological loops and needles and are preferable to an open flame inside the biological safety cabinet. Disposable sterile loops can also be used.
 - 2) Before starting work
 - a) Prepare a written checklist of materials necessary for a particular activity and place necessary materials in the biological safety cabinet before beginning work (this serves to minimize the number of arm-movement disruptions across the fragile air barrier of the cabinet.)
 - b) Close the drain valve under the work surface so that all contaminated materials are contained within the cabinet should a large spill occur.
 - c) Wear laboratory coats buttoned over street clothing; latex gloves are worn to provide hand protection. A solid front, back-closing lab gown provides better protection of personal clothing than a traditional lab coat. Gloves should be pulled over the knitted wrists of the gown, rather than worn inside. Elasticized sleeves can also be worn to protect the wrists.
 - d) Connect aspirator bottles or suction flasks to an overflow collection flask containing appropriate disinfectant, and to an in-line HEPA or equivalent filter. This combination will provide protection to the central building vacuum system or vacuum pump, as well as to the personnel who service this equipment. Inactivation of aspirated materials can be accomplished by placing sufficient chemical

decontamination solution into the flask to kill the microorganisms as they are collected. Once inactivation occurs, liquid materials can be disposed of as noninfectious waste.

- e) Personnel verify inward airflow of the biological safety cabinet before initiating work. Compare the magnehelic gauge reading with the “ ΔP ” reading on the certification sticker. Notify the Lab Contact if the difference is $\pm 10\%$. Personnel may also tape a piece of tissue to the bottom of the sash to monitor inward airflow.
 - f) Cabinet blowers should be operated at least three to five minutes before beginning work to allow the cabinet to "purge". This purge will remove any particulates in the cabinet.
 - g) The work surface, the interior walls (not including the supply filter diffuser), and the interior surface of the window should be wiped with 70% ethanol (EtOH), a 1:100 dilution of household bleach (i.e., 0.05% sodium hypochlorite), or other appropriate disinfectant. When bleach is used, a second wiping with sterile water is needed to remove the residual chlorine, which may eventually corrode stainless steel surfaces. Wiping with non-sterile water may recontaminate cabinet surfaces, a critical issue when sterility is essential (e.g., maintenance of cell cultures).
 - h) Similarly, the surfaces of all materials and containers placed into the cabinet should be wiped with 70% EtOH to reduce the introduction of contaminants to the cabinet environment. This simple step will reduce introduction of mold spores and thereby minimize contamination of cultures. Further reduction of microbial load on materials to be placed or used in biological safety cabinets may be achieved by periodic decontamination of incubators and refrigerators.
- 3) Performing work
- a) Personnel should adjust the stool height so that their face is above the front opening. Manipulation of materials should be delayed for approximately one minute after placing the hands/arms inside the cabinet. This allows the cabinet to stabilize and to "air sweep" the hands and arms to remove surface microbial contaminants.
 - b) When the user's arms rest flatly across the front grille, room air may flow directly into the work area, rather than being drawn through the front grille. Raising the arms slightly will alleviate this problem.
 - c) Do not block the front grille with research notes, discarded plastic wrappers, pipetting devices, etc.
 - d) All operations should be performed on the work surface at least four (4) inches from the inside edge of the front grille.
 - e) Plastic-backed absorbent toweling can be placed on the work surface (but not on the front or rear grille openings). This toweling facilitates routine cleanup and reduces splatter and aerosol formation during an overt spill. It can be folded and placed in an autoclavable biohazard bag when work is completed.
 - f) Contaminated items should be placed into a biohazard bag or discard tray inside the biological safety cabinet. When chemical means are appropriate, suitable liquid disinfectant should be placed into the discard pan before work begins.
 - g) All materials should be placed as far back in the cabinet as practical, toward the rear edge of the work surface and away from the front grille of the cabinet. Similarly, aerosol-generating equipment (e.g., vortex mixers, tabletop centrifuges) should be placed toward the rear of the cabinet to take advantage of the air split. Bulky items such as biohazard bags, discard pipet trays and suction collection flasks should be placed to one side of the interior of the cabinet.
 - h) Several measures can be taken to reduce the chance for cross-contamination when working in a biological safety cabinet. Active work should flow from the clean to contaminated area across the work surface. Materials and supplies should be placed in such a way as to limit the movement of "dirty" items over "clean" ones. Opened tubes or bottles should not be held in a vertical position. Investigators working with Petri dishes and tissue culture plates should hold the lid above the open sterile surface to minimize direct impaction of downward air. Bottle or tube caps should not be placed on the toweling. Items should be recapped or covered as soon as possible.
 - i) Many procedures conducted in biological safety cabinets may create splatter or aerosols. Good microbiological techniques should always be used when working in a biological safety cabinet. For example, techniques to reduce splatter and aerosol generation will minimize the potential for personnel

exposure to infectious materials manipulated within the cabinet. Class II cabinets are designed so that horizontally nebulized spores introduced into the cabinet will be captured by the downward flowing cabinet air within fourteen inches of travel. Therefore, as a general rule of thumb, keeping clean materials at least one foot away from aerosol-generating activities will minimize the potential for cross-contamination.

- j) Potentially contaminated materials should not be brought out of the cabinet until they have been surface decontaminated. Contaminated items should be placed into a biohazard bag or discard tray inside the biological safety cabinet. When chemical means are appropriate, suitable liquid disinfectant should be placed into the discard pan before work begins. Items should be introduced into the pan with minimum splatter.
- 4) After work is completed
- a) All containers and equipment are surface decontaminated and removed from the cabinet when work is completed.
 - b) At the end of the workday, the final surface decontamination of the cabinet should include a wipe-down of the work surface, the cabinet's sides and back, and the interior of the glass.
 - c) Personnel should remove their gloves and gowns in a manner to prevent contamination of unprotected skin and aerosol generation and wash their hands as the final step in safe microbiological practices.
- f. Note: Most biological safety cabinets in use at UC Berkeley are Class IIA2 cabinets.
5. Primary containment devices for aerosol-generating equipment
- a. General
 - 1) Equipment that does not disrupt the airflow in a biological safety cabinet can be used in a biological safety cabinet.
 - 2) If equipment cannot be safely used in a biological safety cabinet, primary containment devices are often available to prevent the release of aerosols when using the equipment. The Biosafety Officer can help with the selection of these devices.
 - b. Centrifuges
 - 1) Small centrifuges that do not disrupt the airflow in a biological safety cabinet can be used in a biological safety cabinet. Generally, fan-cooled centrifuges and equipment large enough to cover any of the grills of the biological safety cabinet disrupt the airflow of the biological safety cabinet.
 - 2) For centrifuges that cannot be used in a biological safety cabinet, centrifuge safety cups, sealed centrifuge rotors, or centrifuge tubes with screw tops and o-rings may be used. CLEB may require the use of these devices for some agents, or when high concentrations or large volumes of infectious agents or organisms containing recombinant DNA molecules are used. When possible, allow 20 minutes after the centrifuge run to allow aerosols to settle. Then, these devices are opened only in a biological safety cabinet.
 - c. Cell sorters and flow cytometers – Many manufacturers are building aerosol control devices into newer models. Contact the manufacturer and the Biosafety Officer to evaluate the aerosol control before sorting viable materials.
 - d. Vortexers – Vortexers can be used in a biological safety cabinet or containers with screw tops and o-rings may be used.
 - e. Homogenizers and sonicators
 - 1) Most hand-held homogenizers and sonicators can be used in a biological safety cabinet.
 - 2) If a homogenizer or sonicator cannot be used in a biological safety cabinet, containers that prevent aerosol escape are available.
 - f. Blenders – Blenders flasks with secure closures and o-rings are available.
 - g. Flask filters – Filters for shaker flasks and tissue culture flasks are available.

6. Transport containers
 - a. Containers for storage, transport, or shipping are leak-proof and labeled with the biohazard symbol.
 - b. If the specimen could puncture the primary container, the primary container is placed within a secondary container that is puncture-resistant in addition to the above.
 - c. If outside contamination of the primary container occurs, the primary container is placed within a second container that is leak-proof and labeled with the biohazard symbol.
7. When required by CLEB, animals are housed in primary biosafety containment equipment appropriate for the animal species. Personnel handle filter top cages in properly designed and operating animal biocontainment cabinets recommended for rodents or biological safety cabinets.

Facilities/ Secondary barriers

1. The laboratory can be easily cleaned.
 - a. Carpets and rugs should not be used.
 - b. Chairs and other furniture used in laboratory work should be covered with a non-fabric material that can be easily decontaminated.
 - c. Spaces between benches, cabinets, and equipment are accessible for cleaning.
2. Bench tops are impervious to water and are resistant to moderate heat and the organic solvents, acids, alkalis, and chemicals used to decontaminate the work surfaces and equipment.
3. Laboratory furniture is capable of supporting anticipated loading and uses.
4. Each laboratory contains a sink for hand washing.
5. An eyewash station is readily available. Eyewashes meet the provisions of Section 5162 “Emergency Eyewash and Shower Equipment” of Title 8 California Code of Regulations (<http://www.dir.ca.gov/title8/5162.html>).
 - a. Plumbed or self-contained eyewash or eye/face wash equipment meets the requirements of sections 5, 7, or 9 of American National Standards Institute (ANSI) Z358.1-1981, Emergency Eyewash and Shower Equipment.
 - 1) Both eyes are washed simultaneously.
 - 2) Eyewash units are no greater than 100 feet from the hazard.
 - 3) Each eyewash location is identified with a highly visible sign. The area around or behind the eyewash is painted a bright color and is well lighted.
 - b. Emergency eyewashes are in accessible locations that require no more than 10 seconds for the injured person to reach.
 - c. The area of the eyewash is free of items that obstruct its use.
 - d. Plumbed and self-contained eyewashes supply potable water at the flow rates and time durations specified in ANSI Z358.1-1981.
 - 1) For eyewashes, the flow rate is greater than 0.4 gallons per minute for 15 minutes.
 - 2) For eye/face wash equipment, the flow rate is greater than 3 gallons per minute for 15 minutes.
 - e. The control valve has been designed so that the water flow remains on without requiring the use of the operator's hands, and so that the valve remains activated until intentionally shut off.
 - f. Water hoses, sink faucets, or showers are not used as eyewashes. Personal eyewash units or drench hoses which meet the requirements of section 6 or 8 or ANSI Z358.1-1981 may support plumbed or self-contained units but are not used in lieu of them.
 - 1) Personal eyewash units deliver immediate flushing to the eyes for less than 15 minutes without being injurious to the user. The main purpose of these units is to supply immediate flushing after which the injured individual can proceed to a permanent eyewash and flush the eyes for a total of 15 minutes. Instructions and expiration date, if applicable, are permanently affixed to the unit.
 - 2) Personal eyewash units deliver potable water or other eye-flushing solution approved by the Occupational Health Physician.

- 3) Drench hoses can be used for this purpose only if they are approved by EH&S beforehand.
- g. Plumbed eyewash and shower equipment is activated at least monthly to flush the line and to verify proper operation. Other units are maintained in accordance with the manufacturer's instructions.
6. Illumination is adequate for all activities. Reflections and glare that could impede vision should not be present.
7. New facilities should have an inward flow of air without recirculation to spaces outside of the laboratory.
8. If the laboratory has windows that open to the exterior, they should be fitted with fly screens.
9. Animal rooms
 - a. The animal facility is separated from areas that are open to unrestricted personnel traffic within the building.
 - b. Secure, locked doors limit access to the facility. External doors are self-closing and self-locking. Doors to animal rooms open inward (unless UC Berkeley's Fire Marshall determines differently), are self-closing, and are kept closed when experimental animals are present. Cubicle room inner doors may open outward or be horizontal or vertical sliding.
 - c. The animal facility is designed, constructed, and maintained to facilitate cleaning and housekeeping. The interior surfaces (walls, floors, and ceilings) are water resistant.
 - d. Internal facility apparatus, such as light fixtures, air ducts, and utility pipes, are arranged to minimize horizontal surface areas.
 - e. If floor drains are present in animal rooms, personnel keep the traps filled with an appropriate disinfectant.
 - f. Windows, if present, are resistant to breakage. Where possible, windows should be sealed.

Administrative controls/ Work practices

1. Personnel evaluate work practice controls every time they are performed and report to the PI when work practice controls are ineffective. The PI corrects work errors and conditions that may result in the release of infectious or recombinant DNA materials. The PI updates this BUA annually to document effective work practices.
2. If standard operating procedures are written for laboratory tasks, biosafety procedures are incorporated.
3. The PI supervises the safety performance of personnel to ensure that personnel use the safety practices and techniques in the BUA.
4. Laboratory doors are closed when work involving infectious agents is in progress.
5. Animals not involved in the work being performed are not permitted in the laboratory. This is in accordance with UC Berkeley's policy "Access to Laboratories Containing Hazards" (<http://campuspol.chance.berkeley.edu/policies/labaccess.pdf>).
6. Personnel wash their hands after they handle biohazardous or recombinant materials, after removing gloves, and before leaving the laboratory.
7. Personnel perform all procedures carefully to minimize splashing, spraying, spattering, and generation of droplets or aerosols.
8. For transport of biohazardous materials between building floors, personnel use the elevator dedicated for the transport of hazardous materials. If the building does not have an elevator dedicated for the transport of hazardous materials, then personnel should wait to take the elevator until they are alone. See "Transport containers" in the "Engineering controls" section for container requirements.
9. Personnel use the following procedures to avoid ingesting infectious agents.
 - a. Personnel use mechanical pipetters and do not mouth pipet/suction.
 - b. Personnel do not eat, drink, smoke, apply cosmetics or lip balm, or handle contact lenses in work areas where there is a reasonable likelihood of occupational exposure.
 - c. If there are designated food areas inside the laboratory, personnel do not perform open bench top work with Biosafety Level 2 agents. Open bench top work includes streaking plates, pipetting, and other activities that may generate aerosols outside of containment.

- d. Personnel do not keep food and drink in refrigerators, freezers, shelves, cabinets or on countertops or bench tops where laboratory materials are present. Food is stored outside the work area in cabinets or refrigerators designated for this purpose only.
 - e. Laboratory microwaves, refrigerators, and 0°C freezers are labeled with a no food or drink logo.
10. Personnel use the following procedures to avoid percutaneous exposures.
- a. Personnel use a high degree of precaution with any contaminated sharp items, including needles and syringes, slides, pipets, capillary tubes, and scalpels.
 - b. When possible, personnel substitute plastic ware for glassware.
 - c. The PI restricts the use of needles and syringes or other sharp instruments with infectious or recombinant materials for when there is no alternative, such as parenteral injection, phlebotomy, or aspiration of fluids from laboratory animals and diaphragm bottles.
 - d. If applicable, personnel perform all procedures involving the use of sharps in connection with patient care, such as withdrawing body fluids, accessing a vein or artery, or administering vaccines, medications or fluids, using effective patient-handling techniques and other methods designed to minimize the risk of a sharps injury.
 - e. For the injection or aspiration of infectious materials, personnel use needle-locking syringes or disposable syringe-needle units (i.e., needle is integral to the syringe).
 - f. When possible, personnel use syringes that re-sheath the needle, needleless systems, and other safety devices.
 - g. Personnel do not use their hands to pick up broken glassware that may be contaminated. Instead, they use mechanical means, such as a brush and dustpan, tongs, or forceps.
 - h. Personnel do not shear or break contaminated needles and other contaminated sharps.
 - i. Personnel do not bend, recap or remove contaminated sharps from devices unless:
 - 1) The PI can demonstrate that no alternative is feasible or that such action is required by a specific procedure, and
 - 2) Personnel can perform the procedure using a mechanical device or a one-handed technique.
 - j. Immediately or as soon as possible after use, personnel place contaminated sharps into sharps containers.
 - 1) Disposable sharps are not reused.
 - 2) Non-disposable sharps are placed in a hard-walled container for transport to a processing area for decontamination, preferably by autoclaving.
11. Personnel use the following procedures for the safe use of sharps containers.
- a. Personnel do not open, empty, put their hand(s) into, or access sharps containers in any other manner that would expose personnel to the risk of sharps injury. The contents of sharps containers are not accessed unless properly reprocessed or decontaminated.
 - b. At all times during the use of sharps, containers for contaminated sharps are:
 - 1) Easily accessible to personnel and located as close as is feasible to the immediate area where sharps are used or can be reasonably anticipated to be found,
 - 2) Maintained upright throughout use, where feasible, and
 - 3) Replaced as necessary to avoid overfilling.
 - c. Containers of contaminated needles, sharp equipment, and broken glass are decontaminated before disposal, according to California's Medical Waste Management Act.
12. The PI ensures that contaminated equipment is decontaminated before it is repaired or maintained.
- a. Biological safety cabinets are decontaminated by Technical Safety Services with gaseous formaldehyde before they are repaired or moved. PIs coordinate this service by contacting Technical Safety Services at (510) 845-5591.
 - b. For all other equipment, laboratory personnel remove all laboratory materials, disinfect the surfaces with an appropriate disinfectant, remove the biohazard label, and affix a sign to the equipment stating their name, the disinfectant used, and the date.

13. Contaminated lab coats are laundered by a vendor and transported in bags labeled with the biohazard symbol.
14. Personnel keep the worksite clean and sanitary.
 - a. Where infectious materials are used outside of containment equipment, personnel cover equipment and environmental surfaces with protective coverings such as imperviously-backed absorbent paper. Personnel remove and replace these coverings as soon as feasible when they become contaminated.
 - b. Personnel decontaminate work surfaces on completion of work or at the end of the day, and after any spill or splash of infectious material.
 - c. Personnel use a method of cleaning or decontamination effective for the agent of concern and that is appropriate for both the type of surface or equipment to be treated and the type of soil or contamination present.
 - d. Personnel inspect the following every time they are used: all bins, pails, cans, and similar receptacles intended for re-use that have a reasonable likelihood for becoming contaminated. Personnel decontaminate these containers when visibly contaminated.

Personal protective equipment/ Primary barriers

1. General

- a. The PI provides, repairs and replaces personal protective equipment at no cost to personnel. The PI ensures that appropriate personal protective equipment in the appropriate sizes is readily accessible.
- b. Personal protective equipment does not permit infectious materials to pass through to or reach personnel's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time that the protective equipment is used.
- c. Personnel remove all personal protective equipment prior to leaving the work area and place it in an appropriately designated area or container for storage, washing, decontamination or disposal.
- d. Personal protective equipment can be worn outside of the laboratory room when transporting materials between laboratory rooms on the same floor as long as the personal protective equipment is not contaminated.
 - 1) Materials are in primary containment devices and labeled appropriately (see "Transport containers" in the "Engineering controls" section.)
 - 2) Personnel keep one hand un-gloved to open doors.

2. Gloves

- a. Personnel wear gloves when they anticipate that hand contact with infectious materials, contaminated surfaces or equipment may occur.
- b. For organisms containing recombinant DNA molecules, personnel take special care to avoid skin contamination. Personnel wear gloves when handling experimental animals and when skin contact with the agent would be unavoidable.
- c. Personnel replace disposable (single use) gloves as soon as practical when contaminated or as soon as feasible if they are torn, punctured, or when their ability to function as a barrier is compromised.
- d. Personnel do not wash or decontaminate disposable (single use) gloves for re-use.
- e. Personnel may decide to wear two pairs of gloves with some materials, during long procedures, spill clean up, and when the skin on the hands is broken (open wound, dermatitis, etc.) Personnel may additionally apply a band-aid over any open wound and underneath the first glove layer.
- f. Personnel remove disposable gloves before touching "clean" surfaces (keyboards, telephones, etc.) and before leaving the laboratory.
- g. The PI makes alternatives to powdered latex gloves available. The PI also makes available hypoallergenic gloves, glove liners, powderless gloves, or other similar alternatives to personnel who are allergic to the gloves normally provided.

3. Eye and face protection
 - a. Masks, in combination with eye protection devices such as goggles or glasses with solid side shields, or chin-length face shields, are worn whenever splashes, spray, spatter, or droplets of infectious materials may be generated and eye, nose, or mouth contamination can be reasonably anticipated.
 - b. The following requirements of Section 3382 “Eye and Face Protection” of Title 8 California Code of Regulations (<http://www.dir.ca.gov/title8/3382.html>) are also in effect.
 - 1) Personnel wear face or eye protection when working in locations where there is a risk of receiving eye injuries such as punctures, abrasions, contusions, or burns as a result of contact with flying particles, hazardous substances, projections or injurious light rays that are inherent in the work or environment.
 - 2) Design, construction, testing and use of devices for eye and face protection purchased after January 12, 1995 are in accordance with ANSI Z87.1-1989, Practice for Occupational and Educational Eye and Face Protection. Eye protection in compliance is labeled “Z87.1”.
4. Respirators
 - a. CLEB determines if respirators are required.
 - b. Where respiratory protection is used, the provisions of Section 5144 “Respiratory Protective Equipment” Title 8 California Code of Regulations (<http://www.dir.ca.gov/title8/5144.html>) are required.
5. Lab coats, gowns, aprons, and other protective body clothing
 - a. Personnel wear appropriate protective clothing such as, but not limited to, gowns, aprons, lab coats, clinic jackets, or similar outer garments in occupational exposure situations. The type and characteristics depend upon the task and degree of exposure anticipated.
 - b. Personnel wear surgical caps or hoods and/or shoe covers or boots in instances when gross contamination of the head or feet can reasonably be anticipated.
 - c. Personnel remove protective clothing before leaving the laboratory and entering non-laboratory areas (e.g., cafeteria, library, administrative offices).
 - d. The following requirements of Section 3383 “Body Protection” of Title 8 California Code of Regulations (<http://www.dir.ca.gov/title8/3383.html>) are also in effect.
 - 1) If moving machinery is present, personnel do not wear loose sleeves, tails, ties, lapels, cuffs, or other loose clothing that can be entangled in moving machinery.
 - 2) If infectious materials penetrate garments, personnel remove them immediately or as soon as feasible.

Waste disposal

1. General
 - a. All medical waste generators dispose of medical waste in accordance with the Medical Waste Management Act, California Health and Safety Code, sections 117600 – 118360 (http://www.dhs.ca.gov/ps/ddwem/environmental/Med_Waste/LawRegs/default.htm).
 - b. In general, personnel are not required to autoclave medical waste prior to transport to a satellite accumulation area. CLEB may require autoclaving waste prior to disposal as medical waste if the agent in use is not indigenous to the United States, is from a Biosafety Level 3 laboratory, or is very stable in the environment.
 - c. An off-site vendor treats all medical waste for final disposal. The medical waste vendor is not permitted to treat hazardous chemicals except for specific chemicals in small quantities. Therefore, before disposing of mixed biohazardous/chemical waste, personnel contact EH&S for the correct disposal procedure.
 - d. If outside contamination of a container of medical waste occurs, personnel place it in a second container. The second container has the same construction characteristics as the primary container.
 - e. Per the medical waste vendor, containers in satellite accumulation areas do not exceed 40 pounds.
 - f. For assistance, personnel can use EH&S FactSheet No. 1 “Managing and Disposing of Medical Waste.” The FactSheet contains additional information for disposing of medical waste that may contain hazardous chemicals or radioactive materials.

2. Cannot be disposed of as medical waste
 - a. Containers in satellite accumulation areas that exceed 40 pounds
 - b. Radioactive material
 - c. Any item listed as being hazardous in federal, state, or local regulations, for example:
 - 1) Ethidium bromide (refer to EH&S FactSheet No. 47 “Ethidium Bromide: Hazards and Precautions”)
 - 2) Organs or tissues that contain greater than 2% v/v formaldehyde/formalin, ova-parasite fixative, or other chemical preservatives
 - 3) Items preserved in thimerosal in concentrations exceeding 0.002%
 - 4) Acids
 - 5) Alcohol
 - 6) Solvents, acetone
 - 7) Mercury or mercury-containing reagents
 - 8) Compressed gas cylinders, canisters, inhalers, and aerosol cans
 - 9) Drums or other containers with hazard warning signs
 - 10) Batteries
 - 11) Paints
 - d. Recognizable human anatomical parts or fetuses
3. Sharps
 - a. A sharp is any object capable of cutting or piercing skin. At UC Berkeley, both biohazardous and uncontaminated sharps are disposed of as medical waste. This includes, but is not limited to, hypodermic needles, scalpels, razor blades, and biohazardous syringes and glass.
 - 1) Plastic pipets and tips can be disposed of as sharps or, if in appropriate 4mil thickness bags, as solid medical waste.
 - 2) Uncontaminated glass, syringes, and plastic pipets can also be disposed of in a cardboard box, lined with a plastic bag, and labeled “Uncontaminated”.
 - 3) For assistance, personnel can use EH&S FactSheet No. 12 “Handling and Disposing of Sharps.”
 - b. A sharps container is defined to be a rigid puncture-resistant container that, when sealed, is leak resistant and cannot be reopened without great difficulty.
 - c. Red sharps containers are preferred for medical waste.
 - d. All sharps containers are rigid, puncture-resistant, leak-proof on the sides and bottom, portable (if portability is necessary to ensure easy access), and labeled as “Sharps Waste” with the biohazard symbol.
 - e. When sealed for disposal (taped or tightly-lidded), the sharps container is leak-resistant and cannot be reopened without great difficulty. If leakage is possible, personnel place the sharps container in a leak-proof secondary container labeled with the biohazard symbol.
 - f. If cultures and stocks are discarded in sharps container, the container must be placed in a securely-tied red biohazard bag prior to disposal as solid medical waste.
4. Solid medical waste, non-sharp
 - a. Solid medical waste is waste contaminated with infectious agents known to cause human illness or any materials that require Biosafety Level 2.
 - b. Personnel dispose of non-liquid, non-sharp medical waste in red bags labeled with the biohazard symbol. For plastic pipets and tips disposed of as solid, non-sharp medical waste, ‘double-thick’ puncture-resistant 4 mil bags are used.
 - c. Red, biohazard waste bags are placed in containers that are:
 - 1) Closable, have tight-fitting covers, and are constructed to contain all contents and prevent leakage during handling, storage, transport, or shipping,
 - 2) Preferably red in color, and

- 3) Labeled as “Biohazardous Waste”, or with the international biohazard symbol and the word “Biohazard”, on the lid and on the sides so as to be visible from any lateral direction.
 - d. Personnel close containers when not in active use.
 - e. Prior to transport to the satellite accumulation area, personnel tie the bag closed and, whenever possible, label the bag with the building and room number of the generating laboratory.
 - f. Once the bag is closed, personnel transport the waste to the satellite accumulation area for the building by the end of the day in a leak- and puncture-resistant container that prevents spillage or protrusion of contents.
 - g. Personnel keep waste containers clean and in good repair.
5. Pathology waste
 - a. Pathology waste includes human surgery specimens or tissues, including those that have been fixed (fixative to be decanted off prior to disposal.)
 - b. The medical waste vendor does not accept recognizable human anatomical parts or fetuses.
 - c. UC Berkeley disposes of animal carcasses, tissues, and organs as pathology waste.
 - d. Containers of pathology waste are labeled with the words “Pathology Waste” on the lid and on all sides.
 - e. The off-site medical waste vendor incinerates pathology waste.
 - f. CDC recommends autoclaving all wastes from the animal room (including animal tissues, carcasses, contaminated bedding, unused feed, sharps, and other refuse) prior to off-site incineration.
 6. Solid ‘biotechnology waste’, non-sharp
 - a. UC Berkeley classifies Biosafety Level 1 materials that resemble medical waste as ‘biotechnology waste.’ Examples are Petri dishes, tissue culture flasks, and plastic pipets.
 - b. Personnel place contaminated materials in white or clear bags labeled “non-medical waste” and dispose of the bags as regular trash. For plastic pipets and tips disposed of as solid, non-sharp biotechnology waste, ‘double-thick’ puncture-resistant 4 mil bags are used.
 - c. If the materials also contain recombinant organisms, personnel dispose of these materials in clear autoclave bags labeled “non-medical waste” and autoclave the bags prior to disposal as regular trash.
 7. Liquid medical waste
 - a. Liquid medical waste can generally be drain disposed if they are effectively decontaminated first.
 - b. Section II of the BUA lists how liquid medical waste is treated before disposal.
 - c. Personnel refer to the “Guidelines for Drain Disposal of Chemicals at University of California, Berkeley” in the EH&S website (<http://ehs.berkeley.edu>.) For example, phenols cannot be drain disposed.
 8. Chemotherapy and pharmaceutical waste
 - a. UC Berkeley laboratories commonly dispose of chemotherapy and pharmaceutical waste as “unwanted hazardous chemicals.” For assistance, personnel can use the EH&S FactSheet No. 52 “Unwanted Hazardous Chemicals.”
 - b. Trace amounts can be disposed of in the medical waste stream, but special containers are required. Laboratory personnel coordinate this type of disposal with EH&S.
 9. Animal cages – In accordance with CDC guidelines, cages are washed manually or in an appropriate cage washer. The mechanical cage washer has a final rinse temperature of at least 180°F.

Emergency procedures

1. Exposures
 - a. Personnel immediately report all injuries and accidental autoinoculation, ingestion or inhalation of infectious agents to the PI. For exposures involving human source materials, in most cases the material can be tested for hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) if it is saved.
 - b. Personnel can dial 911 immediately for any medical emergency.

- c. During office hours (8am - 5pm), personnel report to the Occupational Health Physician located in Clinic 4 of UC Berkeley's Tang Center, 2222 Bancroft Avenue (510-642-6891) for evaluation and possible treatment.
- d. After office hours, personnel should report to Alta Bates Hospital located at 2450 Ashby Avenue (510-204-4444).
- e. Both the Tang Center and Alta Bates can provide medical evaluation, surveillance, and appropriate treatment. Both also maintain written records.
- f. The PI notifies EH&S at (510) 642-3073.
- g. The PI completes an accident investigation and submits a copy to the Biosafety Officer at the Office of Environment, Health and Safety, 317 University Hall #1150. For assistance, the PI can use the EH&S FactSheet No. 41 "Accident Investigation."
- h. For accidents involving recombinant materials, the PI investigates and reports any significant problems pertaining to the operation and implementation of containment practices and procedures in writing to the Biosafety Officer, CLEB, NIH/Office of Biotechnology Activities (OBA), and other appropriate authorities (if applicable). Reports to NIH/OBA are sent to the Office of Biotechnology Activities, National Institutes of Health, 6705 Rockledge Drive, Suite 750, MSC 7985, Bethesda, MD 20892-7985 (20817 for non-USPS mail), 301-496-9838, 301-496-9839 (fax).

2. Spills

- a. Personnel immediately contain and clean all spills. Only laboratory personnel or others properly trained and equipped to work with potentially concentrated infectious materials perform the clean up.
- b. For spills personnel can clean safely
 - 1) Wear personal protective equipment such as goggles, or safety glasses and a face shield, a long-sleeved lab coat, and two layers of gloves. If latex gloves are used, change your outer gloves every 5 minutes.
 - 2) Remove any sharps or broken glass with tongs or forceps and place into a red sharps container.
 - 3) Place an absorbent pad or towel over the spill sufficient to completely absorb the liquid.
 - 4) Minimizing aerosols, apply a freshly made 10% solution of household bleach over the spill and let sit for a minimum of 10 minutes, and preferably 30 minutes.
 - 5) Start wiping up the spill with a dry absorbent pad or towel from the periphery of the spill towards the center. Dispose of the contaminated materials into a red biohazard bag.
 - 6) Spray the wiped surface with the freshly made 10% solution of household bleach and wipe with a dry absorbent pad or towel. Dispose of the pad into a red biohazard bag.
 - 7) If the spill is in a biological safety cabinet and liquids have flowed into the front or rear grilles:
 - a) Disinfect the surfaces of all items within the biological safety cabinet and remove them,
 - b) Ensure the drain valve is closed,
 - c) Pour disinfectant onto the work surface and through the grille(s) into the drain pan,
 - d) Empty the drain pan into a collection vessel with disinfectant, minimizing aerosols. To do so, attach a flexible tube to the drain valve and submerge the open end in the disinfectant.
 - e) Open the drain pan and allow the decontaminated liquid to drain into the collection vessel,
 - f) Flush the drain pan with water and collect the liquid in the collection vessel, and
 - g) Wipe the work surface, the interior walls (do not wipe the supply filter diffuser), and the interior surface of the window with disinfectant.
 - 8) Place your personal protective equipment into the biohazard bag. Don a new pair of gloves and close the biohazard bag.
 - 9) Dispose of the sharps container and biohazard bag as medical waste.
- c. For spills personnel may not be able to clean safely
 - 1) Stop breathing.
 - 2) Evacuate the room.
 - 3) Post a sign and close off the room so that people do not re-enter the area.

- 4) Call the PI and call EH&S at (510) 642-3073.
3. Power failures
 - a. Personnel immediately discontinue all work.
 - b. If a biological safety cabinet is being used, personnel close all open containers, turn the gas off, and close the biological safety cabinet sash.
4. Fires and natural disasters
 - a. Personnel immediately follow emergency procedures as outlined in the Building Emergency Plan.
 - b. Personnel call 911 or EH&S at (510) 642-3073 as appropriate.
 - c. Emergency personnel should enter the laboratory with personal protective equipment and follow disinfecting procedures described above until EH&S has evaluated the integrity of infectious material containers.

Insect and rodent control

An insect and rodent control program is in effect through UC Berkeley's Pest Management program.

HUMAN SOURCE MATERIALS – ADDITIONAL PRECAUTIONS

Special precautions

1. Personnel observe universal precautions, as defined by CDC, to prevent contact with human blood or other potentially infectious materials. Under universal precautions, blood and certain body fluids from all people are considered potentially infectious for bloodborne pathogens.
 - a. In the laboratory, Biosafety Level 2 precautions for all human blood or other potentially infectious materials is equivalent to universal precautions. For work with people, the 1987 publication describing universal precautions for patient care is at <http://www.cdc.gov/ncidod/hip/BLOOD/UNIVERSA.HTM>.
 - b. Other potentially infectious materials, as defined by Cal/OSHA, are
 - 1) The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any other body fluid that is visibly contaminated with blood such as saliva or vomitus, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids such as emergency response;
 - 2) Any unfixed tissue or organ (other than intact skin) from a human (living or dead); and
 - 3) Any of the following, if known or reasonably likely to contain or be infected with HIV, HBV, or HCV:
 - a) Cell, tissue, or organ cultures from humans or experimental animals;
 - b) Blood, organs, or other tissues from experimental animals; or
 - c) Culture medium or other solutions.
 - 4) Federal OSHA considers cell lines to be included (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=21519), and Cal/OSHA concurs.
 - c. Under circumstances in which differentiation between body fluid types is difficult or impossible, personnel consider all body fluids to be potentially infectious materials.
2. Personnel use needleless systems, needle devices and non-needle sharps according to section (d)(3)(A) of Cal/OSHA's Bloodborne Pathogen Standard (<http://www.dir.ca.gov/title8/5193.html>).
 - a. Personnel use engineered sharps injury protection devices for any procedure involving the potential for an exposure incident for which a needle device with engineered sharps injury protection is available.
 - b. Personnel are not required to use these engineered sharps injury devices if patient safety or personnel safety would be compromised, but this assessment is in writing.
3. If contaminated equipment cannot be decontaminated prior to maintenance or service, personnel affix a label on the equipment. The label states which portions of the equipment remain contaminated. The label also has the word "biohazard" and the biohazard symbol, is fluorescent orange or orange-red, and has lettering and symbols in a contrasting color. For these cases, personnel will contact the Biosafety Officer prior to following this procedure.

Hepatitis B Vaccine

1. The PI makes the hepatitis B vaccination available to personnel
 - a. After Bloodborne Pathogen training, and
 - b. Within 10 working days of initial assignment to activities with occupational exposure.
2. This requirement does not apply to personnel who have previously received the complete hepatitis B vaccination series, antibody testing has revealed that personnel are immune, or the vaccine is contraindicated for medical reasons. In these cases, personnel should have this information transferred to their medical record at the Tang Center. If the information cannot be transferred, personnel sign a declination statement (see below.)
3. The PI pays for the hepatitis B vaccination for personnel with occupational exposure. The Tang Center needs an Interdepartmental Order and/or Charge (IOC), which personnel bring to their first appointment.
4. The vaccination process occurs in accordance with Cal/OSHA's Bloodborne Pathogen Standard.

5. The PI assures that personnel who decline to accept hepatitis B vaccination sign a declination statement. Declination statements are available from the Occupational Health Clinic at the Tang Center and should be kept in the medical record.
6. If the U.S. Public Health Service recommends a routine booster dose(s) of hepatitis B vaccine at a future date, the PI will make available the booster dose(s).

Post-exposure evaluation and follow-up

1. An exposure, as defined by Cal/OSHA (see “Special precautions” subsection above), is a specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with human blood or other potentially infectious materials that results from the performance of one’s duties. Note: Contact with intact skin is not an exposure.
2. Post-exposure evaluation and follow-up occurs in accordance with section (f)(3) of Cal/OSHA’s Bloodborne Pathogen Standard. Once personnel report an exposure incident to the Occupational Health Clinic at the Tang Center, the Clinic provides a confidential medical evaluation and follow-up, including at least the following elements:
 - a. Document the route(s) of exposure, and the circumstances under which the exposure incident occurred,
 - b. Identify and document the source individual, unless identification is infeasible or prohibited by state or local law,
 - 1) UC Berkeley will coordinate testing of the source individual's blood as soon as feasible, and after consent is obtained, in order to determine HIV, HBV, and HCV infectivity. If consent is not obtained, UC Berkeley will establish that legally required consent cannot be obtained. If the source individual's consent is not required by law, UC Berkeley will coordinate the testing of the source individual's blood and document the results.
 - 2) When the source individual is already known to be infected with HIV, HBV, or HCV, testing for the source individual's known HIV, HBV, or HCV status need not be repeated.
 - 3) UC Berkeley will provide the results of the source individual's testing to exposed personnel. UC Berkeley will also inform exposed personnel of applicable laws and regulations concerning disclosure of the identity and infectious status of the source individual.
 - c. Provide for collection and testing of the employee's blood for HIV, HBV, and HCV serological status,
 - 1) The exposed employee's blood will be collected as soon as feasible and tested after consent is obtained.
 - 2) If the employee consents to baseline blood collection, but does not give consent at that time for HIV serologic testing, the sample will be preserved for at least 90 days. If, within 90 days of the exposure incident, the employee elects to have the baseline sample tested, such testing will be done as soon as feasible.
 - 3) UC Berkeley will provide additional collection and testing as recommended by the U.S. Public Health Service.
 - d. Provide for post-exposure prophylaxis, when medically indicated, as recommended by the U.S. Public Health Service,
 - e. Provide for counseling and evaluation of reported illnesses, and
 - f. Obtain and provide personnel with a copy of the evaluating healthcare professional's written opinion within 15 days of the completion of the evaluation.
3. All exposure incidents involving a sharp are recorded on UC Berkeley’s Sharps Injury Log, which is maintained at the Occupational Health Clinic at the Tang Center.
 - a. On an annual basis, CLEB will review the Sharps Injury Log and determine the frequency of use of the types and brands of sharps involved in the exposure incidents.
 - b. The Sharps Injury Log is maintained 5 years from the date the exposure incident occurred.

Training

1. Training is provided at no cost to personnel and during working hours.
2. At a minimum, training contains the elements listed in section (g)(2) of Cal/OSHA's Bloodborne Pathogen Standard.
 - a. The EH&S course "Biosafety for Human, Animal, and Plant Pathogens" meets these requirements.
 - b. The PI, or another person knowledgeable in the subject matter covered as it relates to the laboratory, can conduct the annual refresher training.
3. The elements listed in section (g)(2) of Cal/OSHA's Bloodborne Pathogen Standard are as follows:
 - a. Copy and Explanation of Standard - an accessible copy of the regulatory text of this standard and an explanation of its contents. A copy of the standard is available online at <http://www.dir.ca.gov/title8/5193.html>,
 - b. Epidemiology and Symptoms - a general explanation of the epidemiology and symptoms of bloodborne diseases,
 - c. Modes of Transmission - an explanation of the modes of transmission of bloodborne pathogens,
 - d. The Exposure Control Plan - an explanation of this exposure control plan and the means by which personnel can obtain a copy of the written plan. The combination of BUA Sections I, II, and III meet this requirement.
 - e. Risk Identification - an explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to human blood and other potentially infectious material (identified in the Section II of the BUA),
 - f. Methods of Compliance - an explanation of the use and limitations of methods that prevent or reduce exposure including appropriate engineering controls, administrative or work practice controls and personal protective equipment,
 - g. Decontamination and Disposal - information on the types, proper use, location, removal, handling, decontamination and disposal of personal protective equipment (identified in Section II of the BUA),
 - h. Personal Protective Equipment - an explanation of the basis for selection of personal protective equipment,
 - i. Hepatitis B Vaccination - information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration, the benefits of being vaccinated, and that the vaccine and vaccination is offered free of charge (the Tang Center has an information sheet for the Hepatitis B vaccination given at UC Berkeley),
 - j. Emergency - information on the appropriate actions to take and personnel to contact in an emergency involving human blood or other potentially infectious material,
 - k. Exposure Incident - an explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident, the medical follow-up that will be made available and the procedure for recording the incident on the Sharps Injury Log,
 - l. Post-Exposure Evaluation and Follow-Up - information on the post-exposure evaluation and follow-up that the PI is required to provide for personnel following an exposure incident,
 - m. Signs and Labels - an explanation of the biohazard signs and labels required, and
 - n. Interactive Questions and Answers - an opportunity for interactive questions and answers with the person conducting the training session.

HIV, HBV and HCV RESEARCH LABORATORIES -- ADDITIONAL PRECAUTIONS

General

1. Cal/OSHA's Bloodborne Pathogen Standard (<http://www.dir.ca.gov/title8/5193.html>) has additional requirements for HIV, HBV, and HCV research laboratories and production facilities. These requirements include the requirements listed in the previous section for human source materials.
2. Research laboratories are those engaged in the culture, production, concentration, experimentation, and manipulation of HIV, HBV and HCV.
3. This section does not apply to clinical or diagnostic laboratories engaged solely in the analysis of blood, tissues, or organs.
4. HIV, HBV and HCV production facilities do not exist at UC Berkeley. The Bloodborne Pathogen Standard lists specific design criteria for these facilities comparable to Biosafety Level 3.

Special precautions

1. The PI establishes entry and exit procedures and requires personnel to follow those procedures.
2. Entrance signs are fluorescent orange-red or predominantly so, with lettering and symbols in a contrasting color, and meet the requirements of Section 3340 "Accident Prevent Signs" Title 8 California Code of Regulations (<http://www.dir.ca.gov/title8/3340.html>).
3. Personnel conduct all activities involving HIV, HBV, or HCV cultures in a biological safety cabinet or other containment device within the containment laboratory. Personnel do not conduct work with HIV, HBV, or HCV cultures on the open bench.
4. If protective clothing will be laundered, personnel decontaminate the protective clothing beforehand.
5. The PI incorporates written biosafety procedures into laboratory procedures. The PI requires personnel to read instructions on practices and procedures and follow them.
6. Personnel restrict the use of hypodermic needles and syringes to parenteral injection and aspiration of fluids from laboratory animals and diaphragm bottles.
7. Personnel place contaminated materials that are to be decontaminated at a site away from the work area in a durable, leak-proof, biohazard-labeled container that is closed before being removed from the work area.

Training

1. The PI provides a training program to personnel who have no prior experience in handling human pathogens. Initial work activities do not include the handling of infectious agents. The PI assigns a progression of work activities as personnel learn techniques and develop proficiency. The PI assures that personnel participate in work activities involving infectious agents only after proficiency has been demonstrated.
2. The PI assures that personnel have prior experience in the handling of human pathogens or tissue cultures before working with HIV, HBV or HCV.
3. The PI assures that personnel demonstrate proficiency in standard microbiological practices and techniques and in the practices and operations specific to the facility before being allowed to work with HIV, HBV or HCV.

TOXINS -- ADDITIONAL PRECAUTIONS

General

1. For the purposes of this section, toxins are defined as toxic products resulting from the metabolic activities of a living organism. They are hazardous chemicals produced by microorganisms, plants, and animals.
2. Cal/OSHA's "Occupational Exposure to Hazardous Chemicals in Laboratories" Standard (<http://www.dir.ca.gov/title8/5191.html>) regulates the laboratory use of hazardous chemicals, which includes toxins.
 - a. Toxins are considered "particularly hazardous substances" which have a high degree of acute toxicity, and merit additional employee protection for work, including, where appropriate;
 - 1) Establishment of a designated area;
 - 2) Use of containment devices such as chemical fume hoods or glove boxes;
 - 3) Procedures for safe removal of contaminated waste; and
 - 4) Decontamination procedures.
 - b. Toxins will be included in the laboratory's Chemical Hygiene Plan, Chemical Inventory, and on the Biological Use Authorization. The Biological Use Authorization provides standard information for working with toxins, and can serve as the Laboratory Specific Standard Operating Procedure referred to in the Chemical Hygiene Plan.
 - c. The Laboratory Specific Standard Operating Procedure:
 - 1) Identifies the hazards that will be encountered in normal use of the toxin
 - 2) Identifies the hazards that could be encountered in case of a spill or other accident
 - 3) Specifies the policies and practices to be used to minimize risks
3. The LD₅₀ is the amount of a substance that will kill 50% of the test animals. Many toxins do not have human LD₅₀ data. A human LD₅₀ can be extrapolated from animal toxicity data using safety factors (multiple of 10 for inter-specific variability and multiple of 10 for intra-specific variability, resulting in a multiple of 100.) An LD₅₀ may be even lower depending on the individual.
4. Personnel do not deviate from the containment procedures in the Biological Use Authorization without approval by the Principal Investigator.
5. Any new procedure that increases the risk of exposure requires approval by the Committee for Laboratory & Environmental Biosafety.
6. Personnel working with estimated human LD₅₀ amounts of toxins will work with them during business hours.
7. CDC/NIH's Biosafety in Microbiological and Biomedical Laboratories also includes guidelines for work with toxins of biological origin (<http://www.cdc.gov/od/ohs/biosfty/bmb14/b4ai.htm>).
8. Toxins listed as "Select Agents and Toxins" (check <http://www.cdc.gov/od/sap/docs/salist.pdf>) will not exceed the exemption amounts per Principal Investigator (<http://www.cdc.gov/od/sap/toxinamt.htm>) without CDC or USDA approval.

Signs and labels

1. When toxins are in use, the room is posted to indicate "Toxins in Use – Authorized Personnel Only."
2. Until decontaminated, any chemical fume hood, glove box, or biological safety cabinet used with toxins is posted to indicate the specific toxin(s) in use. In addition, access to the equipment and apparatus is restricted to necessary, authorized personnel.

Engineering controls/ Containment equipment/ Primary barriers

1. Toxins are stored in locked storage rooms, cabinets, freezers, or secured lockboxes when not in use.
2. A chemical fume hood, a glove box, a biological safety cabinet, or equivalent containment system approved by the Office of Environment, Health & Safety is used, unless indicated by the Committee for Laboratory or Environmental Biosafety, for any high-risk procedure, as designated in the section for “Toxins—Characterization and Handling”.
 - a. Performing procedures with amounts that could be lethal for a person
 - b. Purposefully generating aerosols (glovebox or biological safety cabinet)
 - c. Modifying the toxin from its original form
 - d. Using the toxin in conjunction with diffusible chemicals (chemical fume hood or Class IIB2 biological safety cabinet only)
 - e. Using the toxin in conjunction with infectious materials (biological safety cabinet only)
 - f. Working with a dry form, other than reconstituting lyophilized toxin in a sealed vial (glovebox or biological safety cabinet)
3. Depending on the toxin, HEPA and/or charcoal filtration of the exhaust air may also be required.
4. Chemical fume hood, a glove box, or a biological safety cabinet procedures:
 - a. Personnel verify inward airflow of the chemical fume hood or biological safety cabinet before initiating work.
 - 1) For biological safety cabinets, compare the magnehelic gauge reading with the “ΔP” reading on the certification sticker. Notify the Lab Contact if the difference is +/- 10%.
 - 2) For chemical fume hoods with a ventilation flow monitor, verify the reading is at least 100 fpm (feet per minute.)
 - 3) Personnel may also tape a piece of tissue to the bottom of the sash to monitor inward airflow.
 - b. All work should be done within the operationally effective zone of the chemical fume hood or biological safety cabinet.
 - 1) For biological safety cabinets, all operations should be performed on the work surface at least four (4) inches from the inside edge of the front grille.
 - 2) For chemical fume hoods, all operations should be performed at least six (6) inches from the front edge.
 - c. Toxin containers are kept in racks to avoid spills.
 - d. Spill trays lined with plastic-backed absorbent are used to contain accidental spills.
 - e. The interior of the chemical fume hood, glove box, or biological safety cabinet should be decontaminated periodically, for example, at the end of a series of related experiments.
 - f. Before containers are removed from the chemical fume hood, biological safety cabinet, or glove box, the exterior of the closed primary container is decontaminated and placed in a clean secondary container.
5. Toxins are transported only in leak/spill-proof secondary containers.
6. When water aspirators are used, sink drains are protected to prevent the entry of toxins.

Administrative controls/ Work practices

1. An inventory control system should be in place. The inventory may include (specifics taken from 42 Code of Federal Regulations Parts 72 and 73, “Possession, Use, and Transfer of Select Agents and Toxins” at http://www.cdc.gov/od/sap/final_rule.htm):
 - a. The toxin’s name and characteristics,
 - b. The quantity acquired from another individual or entity (e.g. containers, vials, tubes, etc.), date of acquisition, and the source,
 - c. The initial and current quantity amount (e.g. milligrams, milliliters, grams, etc.),
 - d. The toxin used and purpose of use, quantity, date(s) of the use and by whom,

- e. Where stored (e.g. building, room, and freezer),
 - f. When moved from storage, when returned to storage, by whom, and including quantity amount.
2. All high-risk operations, as designated in the section for “Toxins—Characterization and Handling”, are conducted with two knowledgeable individuals present. Each person is familiar with the applicable procedures, maintains visual contact with the other, and is ready to assist in the event of an accident.

Personal protective equipment/ Primary barriers

1. When using an open-fronted chemical fume hood or biological safety cabinet, personnel wear protective clothing, including gloves and a disposable long-sleeved body covering (gown, laboratory coat, smock, coverall, or similar garment) so that hands and arms are completely covered.
2. Personnel wear eye protection if an open-fronted containment system is used.
3. When handling dry forms of toxins that are electrostatic, personnel:
 - a. Do not wear gloves (such as latex) that help to generate static electricity
 - b. Use a glove bag within a chemical fume hood or biological safety cabinet, a glove box, or a class III biological safety cabinet.
4. When handling toxins that are percutaneous hazards (irritants, necrotic to tissue, or extremely toxic from dermal exposure), personnel wear gloves that are known to be impervious to the toxin.

Waste disposal

1. Personnel dispose of all toxin wastes (including disposable personal protective equipment) as “unwanted hazardous chemicals” according to EH&S FactSheet No. 52.
2. Materials contaminated with infectious agents and toxins are managed as medical waste.

BIOSAFETY LEVEL 1

General

1. The combination of BUA Sections I, II, and III consolidate the Biosafety Level 1 precautions in CDC/NIH's Biosafety in Microbiological and Biomedical Laboratories (<http://www.cdc.gov/od/ohs/biosfty/bmb14/bmb14toc.htm>), Cal/OSHA standards involving biohazards, the NIH Guidelines, and the California Medical Waste Management Act.
2. Biosafety Level 1 is suitable for work involving well-characterized agents not known to consistently cause disease in healthy adult humans, and of minimal potential hazard to laboratory personnel and the environment.
3. According to Cal/OSHA, the hierarchy of controls is:
 - a. Engineering controls (i.e. containment equipment, primary containment or barriers, secondary containment or barriers)
 - b. Administrative controls (i.e. work practices)
 - c. Personal protective equipment (PPE)
4. Personnel need to notify the PI if the BUA (including the exposure control plan) contains inaccurate information or needs to be updated with respect to the procedures performed.

Training

1. The PI ensures that personnel with reasonably anticipated occupational exposure are trained on the potential hazards associated with the work involved, the necessary precautions to prevent exposures, and the exposure evaluation procedures.
 - a. Personnel attend the EH&S course “Biosafety for Human, Animal, and Plant Pathogens” at the time of initial assignment to tasks where occupational exposure may take place.
 - b. Personnel read the applicable BUA.
 - c. Personnel read materials provided by CLEB with agent-specific biosafety information. CLEB has selected materials to provide information on the biology of the organisms used in the experiments so that personnel can understand and appreciate the potential biohazards.
2. The PI ensures personnel receive hands-on training for safe work practices in the laboratory, aseptic technique, and accident response. The PI ensures that personnel who must enter the room for program or service purposes when work is in progress are advised of the potential hazard.
3. For animal facilities, personnel are required to attend additional training required by their Animal Use Protocol.
4. For greenhouses, prior to entering the greenhouse, personnel are required to read and follow instructions on Biosafety Level 1-Plant greenhouse practices and procedures.

UC Berkeley specifics

1. As noted above, the combination of BUA Sections I, II, and III consolidate the Biosafety Level 1 precautions in CDC/NIH's Biosafety in Microbiological and Biomedical Laboratories, Cal/OSHA standards involving biohazards, the NIH Guidelines, and the California Medical Waste Management Act.
2. UC Berkeley-specific procedures are highlighted below
 - a. The first page of Section I is posted on the entrance to each room listed in the BUA.
 - b. For animal rooms, doors to animal rooms open inward unless UC Berkeley's Fire Marshall determines differently.
 - c. UC Berkeley has a policy “Access to Laboratories Containing Hazards” (<http://campuspol.chance.berkeley.edu/policies/labaccess.pdf>). Note: This policy prohibits non-research animals and children under the age of 18 from entering laboratories with hazardous materials.

- d. Biological waste
 - 1) UC Berkeley classifies Biosafety Level 1 materials that resemble medical waste as ‘biotechnology waste.’ Examples are Petri dishes, tissue culture flasks, and plastic pipets.
 - 2) UC Berkeley disposes of animal carcasses, tissues, and organs as pathology waste.
 - 3) UC Berkeley laboratories commonly dispose of chemotherapy and pharmaceutical waste as “unwanted hazardous chemicals.”
- e. UC Berkeley has specific emergency procedures that are listed in the Emergency Procedures subsection.

Entry requirements

- 1. The PI limits or restricts access to the laboratory when experiments or work with cultures and specimens is in progress.
- 2. For animal facilities, only those persons required for program or support purposes are authorized to enter the facility. EH&S provides safety training prior entry.
- 3. CLEB determines the appropriate vaccines or medical surveillance for the agents handled or potentially present in the laboratory. The PI offers those services to personnel and pays for them. Personnel may refuse these services, but may need to consult with a physician or sign a declination form before starting work.

Signs and labels

- 1. The first page of Section I is posted on the entrance to each room listed in the BUA.
- 2. A label with the word “biohazard” and the biohazard symbol may be affixed to equipment and containers with agents or materials. The labels are fluorescent orange or orange-red with lettering and symbols in a contrasting color.

Facilities/ Secondary barriers

- 1. The laboratory can be easily cleaned.
 - a. Carpets and rugs should not be used.
 - b. Chairs and other furniture used in laboratory work should be covered with a non-fabric material that can be easily decontaminated.
 - c. Spaces between benches, cabinets, and equipment are accessible for cleaning.
- 2. Bench tops are impervious to water and are resistant to moderate heat and the organic solvents, acids, alkalis, and chemicals used to decontaminate the work surfaces and equipment.
- 3. Laboratory furniture is capable of supporting anticipated loading and uses.
- 4. Each laboratory contains a sink for hand washing.
- 5. Illumination is adequate for all activities. Reflections and glare that could impede vision should not be present.
- 6. New facilities should have an inward flow of air without recirculation to spaces outside of the laboratory.
- 7. If the laboratory has windows that open to the exterior, they should be fitted with fly screens.
- 8. Animal rooms
 - a. The animal facility is separated from areas that are open to unrestricted personnel traffic within the building.
 - b. External doors are self-closing and self-locking. Doors to animal rooms open inward (unless UC Berkeley’s Fire Marshall determines differently), are self-closing, and are kept closed when experimental animals are present. Cubicle room inner doors may open outward or be horizontal or vertical sliding.
 - c. The animal facility is designed, constructed, and maintained to facilitate cleaning and housekeeping. The interior surfaces (walls, floors, and ceilings) are water resistant.
 - d. Internal facility apparatus, such as light fixtures, air ducts, and utility pipes, are arranged to minimize horizontal surface areas.

- e. If floor drains are present in animal rooms, personnel keep the traps filled with an appropriate disinfectant.
- f. Windows, if present, are resistant to breakage. Where possible, windows should be sealed.

Administrative controls/ Work practices

1. Personnel evaluate work practice controls every time they are performed and report to the PI when work practice controls are ineffective. The PI corrects work errors and conditions that may result in the release of infectious or recombinant DNA materials. The PI updates this BUA annually to document effective work practices.
2. If standard operating procedures are written for laboratory tasks, biosafety procedures are incorporated.
3. The PI supervises the safety performance of personnel to ensure that personnel use the safety practices and techniques in the BUA.
4. Laboratory doors are closed when work involving infectious agents is in progress.
5. Animals not involved in the work being performed are not permitted in the laboratory. This is in accordance with UC Berkeley's policy "Access to Laboratories Containing Hazards" (<http://campuspol.chance.berkeley.edu/policies/labaccess.pdf>).
6. Personnel wash their hands after they handle biohazardous or recombinant materials, after removing gloves, and before leaving the laboratory.
7. Personnel perform all procedures carefully to minimize splashing, spraying, spattering, and generation of droplets or aerosols.
8. Personnel use the following procedures to avoid ingesting infectious agents.
 - a. Personnel use mechanical pipetters and do not mouth pipet/suction.
 - b. Personnel do not eat, drink, smoke, apply cosmetics or lip balm, or handle contact lenses in work areas where there is a reasonable likelihood of occupational exposure.
 - c. Personnel do not keep food and drink in refrigerators, freezers, shelves, cabinets or on countertops or bench tops where laboratory materials are present. Food is stored outside the work area in cabinets or refrigerators designated for this purpose only.
 - d. Laboratory microwaves, refrigerators, and 0°C freezers are labeled with a no food or drink logo.
9. Personnel use the following procedures to avoid percutaneous exposures.
 - a. When possible, personnel substitute plastic ware for glassware.
 - b. Personnel do not use their hands to pick up broken glassware that may be contaminated. Instead, they use mechanical means, such as a brush and dustpan, tongs, or forceps.
 - c. Personnel should not shear or break needles and other sharps.
 - d. Personnel should not bend, recap or remove contaminated sharps from devices unless a mechanical device or a one-handed technique is used.
 - e. Immediately or as soon as possible after use, personnel place contaminated sharps into sharps containers.
 - 1) Disposable sharps are not reused.
 - 2) Non-disposable sharps are placed in a hard-walled container for transport to a processing area for decontamination, preferably by autoclaving.
10. Personnel use the following procedures for the safe use of sharps containers.
 - a. Containers of contaminated needles, sharp equipment, and broken glass are decontaminated before disposal, according to California's Medical Waste Management Act.
 - b. Personnel do not open, empty, put their hand(s) into, or access sharps containers in any other manner that would expose personnel to the risk of sharps injury. The contents of sharps containers are not accessed unless properly reprocessed or decontaminated.
 - c. At all times during the use of sharps, containers for contaminated sharps are:

- 1) Easily accessible to personnel and located as close as is feasible to the immediate area where sharps are used or can be reasonably anticipated to be found,
 - 2) Maintained upright throughout use, where feasible, and
 - 3) Replaced as necessary to avoid overfilling.
11. The PI ensures that contaminated equipment is decontaminated before it is repaired or maintained.
- a. Technical Safety Services decontaminates biological safety cabinets with gaseous formaldehyde before biological safety cabinets are repaired or moved. PIs coordinate this service by contacting Technical Safety Services at (510) 845-5591.
 - b. For all other equipment, laboratory personnel remove all laboratory materials, disinfect the surfaces with an appropriate disinfectant, and affix a sign to the equipment stating their name, the disinfectant used, and the date.
12. Personnel keep the worksite clean and sanitary.
- a. Personnel decontaminate work surfaces on completion of work or at the end of the day, and after any spill or splash of viable or recombinant material.
 - b. Personnel use a method of cleaning or decontamination effective for the agent of concern and that is appropriate for both the type of surface or equipment to be treated and the type of soil or contamination present.
 - c. Personnel inspect the following every time they are used: all bins, pails, cans, and similar receptacles intended for re-use that have a reasonable likelihood for becoming contaminated. Personnel decontaminate these containers when visibly contaminated.

Personal protective equipment

1. General

- a. The PI provides, repairs and replaces personal protective equipment at no cost to personnel. The PI ensures that appropriate personal protective equipment in the appropriate sizes is readily accessible.
- b. Personnel remove all personal protective equipment prior to leaving the work area and place it in an appropriately designated area or container for storage, washing, decontamination or disposal.
- c. Personal protective equipment can be worn outside of the laboratory room when transporting materials between laboratory rooms on the same floor as long as the personal protective equipment is not contaminated.
 - 1) Materials are in leak-resistant devices and are labeled with the contents.
 - 2) Personnel keep one hand un-gloved to open doors.

2. Gloves

- a. Personnel wear gloves when the skin on the hands is broken or if a rash is present.
- b. For organisms containing recombinant DNA molecules, personnel take special care to avoid skin contamination. Personnel wear gloves when handling experimental animals and when skin contact with the agent would be unavoidable.
- c. The PI makes alternatives to powdered latex gloves available. The PI also makes available hypoallergenic gloves, glove liners, powderless gloves, or other similar alternatives to personnel who are allergic to the gloves normally provided.

3. Eye Protection

- a. Personnel wear protective eyewear when conducting procedures in which splashes of microorganisms or other hazardous materials is anticipated.
- b. The following requirements of Section 3382 “Eye and Face Protection” of Title 8 California Code of Regulations (<http://www.dir.ca.gov/title8/3382.html>) are also in effect.
 - 1) Personnel wear face or eye protection when working in locations where there is a risk of receiving eye injuries such as punctures, abrasions, contusions, or burns as a result of contact with flying particles, hazardous substances, projections or injurious light rays that are inherent in the work or environment.

- 2) Design, construction, testing and use of devices for eye and face protection purchased after January 12, 1995 are in accordance with ANSI Z87.1-1989, Practice for Occupational and Educational Eye and Face Protection. Eye protection in compliance is labeled “Z87.1”.
4. Lab coats, gowns, aprons, and other protective body clothing
 - a. Personnel should wear laboratory coats, gowns, or uniforms to prevent contamination or soiling of street clothes.
 - b. Personnel remove protective clothing before leaving the laboratory and entering non-laboratory areas (e.g., cafeteria, library, administrative offices).
 - c. The following requirements of Section 3383 “Body Protection” of Title 8 California Code of Regulations (<http://www.dir.ca.gov/title8/3383.html>) are also in effect.
 - 1) If moving machinery is present, personnel do not wear loose sleeves, tails, ties, lapels, cuffs, or other loose clothing that can be entangled in moving machinery.
 - 2) If infectious materials penetrate garments, personnel remove the garment(s) immediately or as soon as feasible.

Waste disposal

1. General

- a. With Biosafety Level 1 materials, only sharps waste, pathology waste, chemotherapy waste and pharmaceutical waste are considered medical waste.
- b. All medical waste generators dispose of medical waste in accordance with the Medical Waste Management Act, California Health and Safety Code, sections 117600 – 118360 (http://www.dhs.ca.gov/ps/ddwem/environmental/Med_Waste/LawRegs/default.htm).
- c. An off-site vendor treats all medical waste for final disposal. The medical waste vendor is not permitted to treat hazardous chemicals except for specific chemicals in small quantities. Therefore, before disposing of mixed biohazardous/chemical waste, personnel contact EH&S for the correct disposal procedure.
- d. Per the medical waste vendor, containers in satellite accumulation areas do not exceed 40 pounds.
- c. For assistance, personnel can use EH&S FactSheet No. 1 “Managing and Disposing of Medical Waste.” The FactSheet contains additional information for disposing of medical waste that may contain hazardous chemicals or radioactive materials.

2. Cannot be disposed of as medical waste

- a. Containers in satellite accumulation areas that exceed 40 pounds
- b. Radioactive material
- c. Any item listed as being hazardous in federal, state, or local regulations, for example:
 - 1) Ethidium bromide (refer to EH&S FactSheet No. 47 “Ethidium Bromide: Hazards and Precautions”)
 - 2) Organs or tissues that contain greater than 2% v/v formaldehyde/formalin, ova-parasite fixative, or other chemical preservatives
 - 3) Items preserved in thimerosal in concentrations exceeding 0.002%
 - 4) Acids
 - 5) Alcohol
 - 6) Solvents, acetone
 - 7) Mercury or mercury-containing reagents
 - 8) Compressed gas cylinders, canisters, inhalers, and aerosol cans
 - 9) Drums or other containers with hazard warning signs
 - 10) Batteries
 - 11) Paints
- e. Recognizable human anatomical parts or fetuses

3. Sharps
 - a. A sharp is any object capable of cutting or piercing skin. At UC Berkeley, both biohazardous and uncontaminated sharps are disposed of as medical waste. This includes, but is not limited to, hypodermic needles, scalpels, razor blades, and biohazardous syringes and glass.
 - 1) Plastic pipets and tips can be disposed of as sharps or, if in appropriate 4mil thickness bags, as solid medical waste.
 - 2) Uncontaminated glass, syringes, and plastic pipets can also be disposed of in a cardboard box, lined with a plastic bag, and labeled “Uncontaminated”.
 - 3) For assistance, personnel can use EH&S FactSheet No. 12 “Handling and Disposing of Sharps.”
 - b. A sharps container is defined to be a rigid puncture-resistant container that, when sealed, is leak resistant and cannot be reopened without great difficulty.
 - c. Red sharps containers are preferred for medical waste.
 - d. All sharps containers are rigid, puncture-resistant, leak-proof on the sides and bottom, portable (if portability is necessary to ensure easy access), and labeled as “Sharps Waste” with the biohazard symbol.
 - e. When sealed for disposal (taped or tightly-lidded), the sharps container is leak-resistant and cannot be reopened without great difficulty. If leakage is possible, personnel place the sharps container in a leak-proof secondary container labeled with the biohazard symbol.
 - e. If cultures and stocks are discarded in sharps container, the container must be placed in a securely-tied red biohazard bag prior to disposal as solid medical waste.
4. Solid ‘biotechnology waste’, non-sharp
 - a. UC Berkeley classifies Biosafety Level 1 materials that resemble medical waste as ‘biotechnology waste.’ Examples are Petri dishes, tissue culture flasks, and plastic pipets.
 - b. Personnel place contaminated materials in white or clear bags labeled “non-medical waste” and dispose of the bags as regular trash. For plastic pipets and tips disposed of as solid, non-sharp medical waste, ‘double-thick’ puncture-resistant 4 mil bags are used.
 - c. If the materials contain recombinant organisms, personnel dispose of these materials in clear autoclave bags labeled “non-medical waste” and autoclave the bags prior to disposal as regular trash.
5. Liquid waste
 - a. Discarded vaccines are treated as medical waste and can generally be drain disposed if they are decontaminated first with a chemical disinfectant effective for the agent.
 - b. Section II of the BUA lists how liquid waste is treated before disposal.
 - c. Personnel refer to the “Guidelines for Drain Disposal of Chemicals at University of California, Berkeley” in the EH&S website (<http://ehs.berkeley.edu>.) For example, phenols cannot be drain disposed.
6. Pathology waste
 - a. UC Berkeley disposes of animal carcasses, tissues, and organs as pathology waste.
 - b. Containers of pathology waste are labeled with the words “Pathology Waste” on the lid and on all sides.
 - c. CDC recommends incinerating all wastes from the animal room (including animal tissues, carcasses, and contaminated bedding.)
 - d. The off-site medical waste vendor incinerates pathology waste.
7. Chemotherapy and pharmaceutical waste
 - a. UC Berkeley laboratories commonly dispose of chemotherapy and pharmaceutical waste as “unwanted hazardous chemicals.” For assistance, personnel can use the EH&S FactSheet No. 52 “Unwanted Hazardous Chemicals.”
 - b. Trace amounts can be disposed of in the medical waste stream, but special containers are required. Laboratory personnel coordinate this type of disposal with EH&S.

8. Animal cages – In accordance with CDC guidelines, cages are washed manually or in an appropriate cage washer. The mechanical cage washer has a final rinse temperature of at least 180°F.

Emergency procedures

1. Exposures
 - a. Personnel immediately report all injuries and accidental autoinoculation, ingestion or inhalation of infectious agents to the PI.
 - b. Personnel can dial 911 immediately for any medical emergency.
 - c. During office hours (8am - 5pm), personnel report to the Occupational Health Physician located in Clinic 4 of UC Berkeley's Tang Center, 2222 Bancroft Avenue (510-642-6891) for evaluation and possible treatment.
 - d. After office hours, personnel should report to Alta Bates Hospital located at 2450 Ashby Avenue (510-204-4444).
 - e. Both the Tang Center and Alta Bates can provide medical evaluation, surveillance, and appropriate treatment. Both also maintain written records.
 - f. The PI notifies EH&S at (510) 642-3073.
 - g. The PI completes an accident investigation and submits a copy to the Biosafety Officer at the Office of Environment, Health and Safety, 317 University Hall #1150. For assistance, the PI can use the EH&S FactSheet No. 41 "Accident Investigation."
 - h. For accidents involving recombinant materials, the PI investigates and reports any significant problems pertaining to the operation and implementation of containment practices and procedures in writing to the Biosafety Officer, CLEB, NIH/Office of Biotechnology Activities (OBA), and other appropriate authorities (if applicable). Reports to NIH/OBA are sent to the Office of Biotechnology Activities, National Institutes of Health, 6705 Rockledge Drive, Suite 750, MSC 7985, Bethesda, MD 20892-7985 (20817 for non-USPS mail), 301-496-9838, 301-496-9839 (fax).
2. Spills
 - a. Personnel immediately contain and clean all spills. Only laboratory personnel or others properly trained and equipped to work with potentially concentrated infectious materials perform the clean up.
 - b. For spills personnel can clean safely
 - 1) Wear personal protective equipment such as gloves, safety glasses with side shields and a long-sleeved lab coat.
 - 2) Remove any sharps or broken glass with tongs or forceps and place into a red sharps container.
 - 3) Place an absorbent pad or towel over the spill sufficient to completely absorb the liquid.
 - 4) Wipe the spill with a dry absorbent pad or towel from the periphery of the spill towards the center. Dispose of the contaminated materials as 'biotechnology waste.'
 - 5) Spray the wiped surface with a disinfectant effective for the viable or recombinant material and wipe with a dry absorbent pad or towel. Dispose of the pad as 'biotechnology waste.'
3. Power failures, natural disasters and fires
 - a. Personnel immediately follow emergency procedures as outlined in the Building Emergency Plan.
 - b. Personnel call 911 or EH&S at (510) 642-3073 as appropriate.

Insect and rodent control

An insect and rodent control program is in effect through UC Berkeley's Pest Management program.

PLANT EXPERIMENTS -- ADDITIONAL PRECAUTIONS

General

1. The "greenhouse facility" includes the actual greenhouse rooms or compartments for growing plants, including all immediately contiguous hallways and head-house areas, and is considered part of the confinement area.
2. The Biosafety Officer and Greenhouse Manager keeps records of experiments currently in progress.
3. The Greenhouse Manager and researchers control undesired species (e.g., weed, rodent, or arthropod pests and pathogens).
4. Some of the following criteria are from: Traynor PL, Adair D, Irwin R. A Practical Guide to Containment: Greenhouse Research with Transgenic Plants and Microbes. Information Systems for Biotechnology, Virginia Tech, 2001.

Signs and labels

1. Transgenic material is marked to distinguish it from non-transgenic material.
2. Signs may say "Regulated Material Present" or "Genetically Engineered Organisms Present."

Training

1. Prior to entering the greenhouse, personnel are required to read and follow greenhouse practices and procedures.

Facilities/ Secondary barriers

1. The greenhouse floor may be composed of gravel or other porous material. At a minimum, impervious (e.g., concrete) walkways are recommended.
2. Windows and other openings in the walls and roof of the greenhouse facility may be open for ventilation as needed for proper operation and do not require any special barrier to contain or exclude pollen, microorganisms, or small flying animals (e.g., arthropods and birds). However, screens are recommended to exclude pollinating insects and birds. The Committee for Laboratory & Environmental Biosafety may require screens or other containment.
3. The greenhouse perimeter is sealed to prevent rodents and other large pests from entering the greenhouse facility.
4. Arthropods and other motile macroorganisms are housed in appropriate cages. If macroorganisms (e.g., flying arthropods or nematodes) are released within the greenhouse, precautions are taken to minimize escape from the greenhouse facility.
5. Transgenic seed
 - a. Transgenic seed is stored in a locked cabinet, preferably in the greenhouse room so as to minimize handling in unconfined spaces.
 - b. When transgenic seed is stored or handled outside the area of confinement, such as in a cabinet or on a potting bench in a head-house corridor, the seed is in a spill-proof container.
 - c. Transgenic seed is clearly identified and labeled to distinguish it from other stored seeds or materials in the cabinet.
 - d. The Greenhouse Manager and researchers prevent transgenic seed germination in unwanted locations.

Administrative controls/ Work practices

1. Personnel maintain all transgenic plants, plant materials, seeds, associated soil/potting medium, associated containers, and recombinant organisms associated with plants only in designated areas in the greenhouse.
2. Personnel immediately and thoroughly pick up all transgenic plants, plant materials, seeds, associated soil/potting medium, and associated containers that spill outside the designated areas in the greenhouse.

3. Personnel immediately and thoroughly disinfect and clean up spills of recombinant organisms associated with plants.

Biological containment for plants

1. Biological containment practices may be used to meet containment requirements. These practices may only be used if they prevent effective dissemination that could possibly lead to the establishment of the organism or its genetic material in the environment, resulting in deleterious consequences to managed or natural ecosystems.
2. For plants, effective dissemination of plants by pollen or seed can be prevented by one or more of the following procedures:
 - a. Cover the reproductive structures to prevent pollen dissemination at flowering and seed dissemination at maturity;
 - b. Remove reproductive structures by employing male sterile strains, or harvest the plant material prior to the reproductive stage;
 - c. Ensure that experimental plants flower at a time of year when cross-fertile plants are not flowering within the normal pollen dispersal range of the experimental plant; or
 - d. Ensure that cross-fertile plants are not growing within the pollen dispersal range of the experimental plant.
 - e. For small seeds, a sheet of dampened paper may be placed on the work surface to facilitate recovery of easily scattered seeds.
3. For microorganisms associated with plants, effective dissemination of microorganisms beyond the confines of the greenhouse can be prevented by one or more of the following procedures:
 - a. Confine all operations to injections of microorganisms, and confine these injections to internal plant parts or adherent plant surfaces;
 - b. Avoid creating aerosols when inoculating plants with recombinant microorganisms.
 - c. Confine all operations to biological procedures (including genetic manipulation) that limit microorganism replication (or sequences derived from microorganisms);
 - d. Determine the farthest distance that the airborne virus or microorganism may be expected to be effectively disseminated, and ensure that hosts and vectors of the microorganism are not present;
 - e. Provide adequate distance between an infected plant and another susceptible host, especially if the microorganism can be disseminated through air or by leaf contact;
 - f. Conduct experiments at a time of year when plants that can serve as hosts are either not growing or are not susceptible to productive infection;
 - g. Use microorganisms that have an obligate association with the plant; or
 - h. Use microorganisms that are:
 - 1) Genetically disabled to minimize survival outside of the research facility, and
 - 2) Whose natural mode of transmission requires injury of the target organism, or
 - 3) Whose natural mode of transmission assures that inadvertent release is unlikely to initiate productive infection of organisms outside of the facility.
4. For macroorganisms associated with plants, effective dissemination of arthropods and other small animals can be prevented by using one or more of the following procedures:
 - a. Use non-flying, flight-impaired, or sterile arthropods;
 - b. Use non-motile or sterile strains of small animals;
 - c. Conduct experiments at a time of year that precludes the survival of escaping organisms;
 - d. Use animals that have an obligate association with a plant that is not present within the dispersal range of the organism;
 - e. Avoid the use of small-sized insects in greenhouse cages;
 - f. Destroy pollinating insects in greenhouse cages after pollen transfer to eliminate potential for dissemination of transgenic pollen into the environment.

5. Biological indicator plants may be used in the greenhouse room to monitor for evidence of disease transmission from experiments in progress.

Waste disposal

1. Transgenic plants, transgenic plant materials, seeds, recombinant organisms associated with plants, and soil from these plant experiments are autoclaved prior to disposal. Other methods for devitalization require approval from the Committee for Laboratory & Environmental Biosafety.
2. Waste water from plants infected with microorganisms or macroorganisms
 - a. Decontaminate run-off water using a disinfectant effective for the organism or visible eggs and larvae, or
 - b. Evaporate run-off water.