

University of Colorado Denver

**Bloodborne Pathogen/
Other Potentially Infectious Material
Exposure Control Program
(ECP)**



Biosafety Office
Department of Environmental Health & Safety
Revised September, 2010

University of Colorado Denver
**Bloodborne Pathogen/
Other Potentially Infectious Material**
Exposure Control Program (ECP)

POINT OF CONTACT: **BIOSAFETY OFFICE**
303-724-0235

Biosafety.Program@ucdenver.edu

TABLE OF CONTENTS

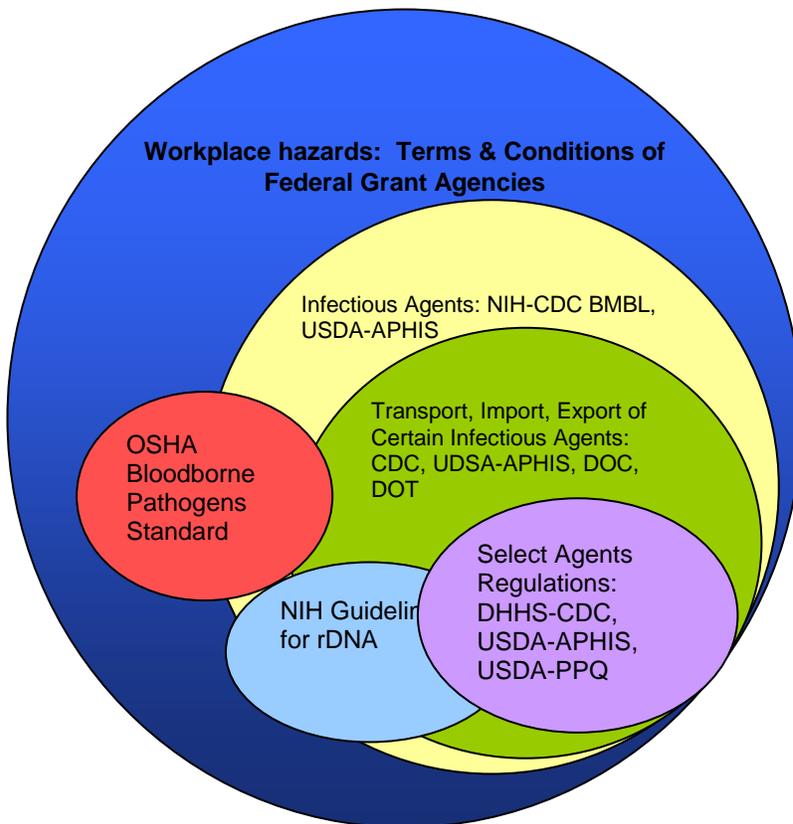
- I.** Introduction
 - II.** References
 - III.** Policy
 - IV.** Program Administration
 - V.** Exposure Determination Process
 - VI.** Exposure Control Methods
 - VII.** Additional Requirements For HIV, HBV and HCV Research Laboratories and
Production Facilities Propagating or Concentrating HIV, HBV and HCV
 - VIII.** General Disinfection and Decontamination
 - IX.** Infectious Waste Disposal
 - X.** Exposure Incidents
 - XI.** Spill Management
- Appendices

I. Introduction

- A. Grantee institutions are responsible for meeting Federal, State, and local health and safety standards and for establishing and implementing necessary measures to minimize employees' risk of injury or illness in activities related to NIH and other federal grants. Federal regulations and guidelines, at multiple levels (Figure 1) must be implemented by the University. (Figure 2).
- B. Pertinent Federal regulations are found in the [NIH Grants Policy Statement](#) and include the Occupational Safety and Health Administration (OSHA) regulations (*General Duty Clause*, *Personal Protective Equipment Standards*, and *Bloodborne Pathogens Standard*); [Select Agent Regulations](#); USDA-APHIS permitting regulations for animal and agricultural pathogens; and DHHS-CDC permitting regulations for infectious agents known or suspected to cause disease in humans.

Figure 1

Biosafety/Containment Regulations, Standards and Guidelines¹



¹ Report of the Trans-Federal Task Force on Optimizing Biosafety and Biocontainment Oversight, released July 2009, p. 41. <http://www.hhs.gov/aspr/omsph/biosafetytaskforce/biosafetycontainmentrpt092009.pdf>

Figure 2²

Biosafety and Biocontainment Oversight



C. The University of Colorado Denver (UCDenver) is committed to providing a safe and healthful work environment for faculty, staff and students and compliance with applicable federal, state and local regulations and applicable University policies. UCDenver ensures compliance with the [NIH Grants Policy Statement](#) with respect to [Health and Safety Regulations and Guidelines](#) (Appendix A) as terms and conditions of the University acceptance of federal funds.

II. References

- [NIH Grants Policy Statement, Health and Safety Regulations and Guidelines](#)
- [OSHA Bloodborne Pathogens Standard, 29CFR 1910.1030.](#)
- [UCD BBP and Hepatitis B Vaccination Policy](#)

² Ibid, p. 43. <http://www.hhs.gov/aspr/omsph/biosafetytaskforce/biosafetycontainmentrpt092009.pdf>

III. Policy

- A. The University of Colorado Denver (UCDenver) is committed to providing a safe and healthful work environment for our faculty, staff and students. UCDenver is committed to compliance with all applicable Federal, State and local regulations as well as University policy, in its mission of academic, clinical/patient care and research.
- B. The purpose of the University Exposure Control Program (ECP) is to establish minimum guidelines and procedures, at UCDenver, for the appropriate training, methods and procedures to eliminate or minimize occupational exposures to bloodborne pathogens (BBP) and other potentially infectious materials (OPIM), in accordance with the OSHA Bloodborne Pathogens Standard, 29 CFR 1930.1030.
- C. The University will develop and maintain the written documents (the Exposure Control Program and all associated documents) to explain how we implement these standards, provide training to employees, and protect the health and safety of our faculty and staff.
- D. The written documents will be developed and maintained by the Department of Environmental Health and Safety and shall be made accessible to all employees.

NOTE: All full, part-time, temporary, contract and per diem employees of the University of Colorado Denver are covered by the University policy and this Exposure Control Program.

IV. Program Administration

- A. Scope
 - 1. The UCD Exposure Control Program (ECP):
 - a. Establishes the process for identifying individual employees at risk of occupational exposure to human blood, bodily fluids and other potentially infectious materials as identified in the OSHA Bloodborne Pathogens Standard.
 - b. Additionally, other infectious agents, both human and animal pathogens, have been identified by the NIH and CDC and are classified into Risk Groups 1 through 4.(Appendix C.) Exposure Control practices will be implemented for these occupational exposures as well.
 - c. Provides communication with and training to employees regarding hazards of occupational exposure to human blood, bodily fluids and other potentially infectious materials with related initial, annual refresher and On-the-Job training (OJT) as provided by face-to-face instructor –led or online training modules.
 - d. Communication of hazards to employees and suggest Standard Operating Procedures and implementation of various methods of exposure control, for departments, divisions and individuals to follow to reduce the risk of transmission of diseases associated with clinical, research and educational activities at UCD, including:
 - i. Standard Precautions
 - ii. Administrative Controls
 - iii. Engineering and Work Practice Controls
 - iv. Personal Protective Equipment
 - v. Housekeeping Practices

- e. Provides education about and access to a Medical Surveillance (Occupational Health Program), to include Hepatitis B vaccinations or other appropriate vaccinations or immunizations for those individuals at risk of occupational exposure to infectious agents in their work.
- f. Provides communication regarding the appropriate steps for reporting occupational exposures, and information on post-exposure evaluation and follow-up.
- g. Provides guidance on procedures for evaluating and mitigating circumstances contributing to occupational exposures.
- h. Post-exposure evaluation and follow-up, through the [University Risk Management Workers Compensation Program](#) and Designated Medical Providers.
- i. Procedures for evaluating circumstances surrounding exposure incidents; and Recordkeeping.

NOTE: The ECP cannot cover all potential circumstances of occupational exposure. It is a tool for education and training. Individual departments may need to develop more complete site-specific plans and Standard Operating Procedures.

B. Applicability of the BBP Standard to Cell Cultures

1. It is widely recognized among biosafety professionals that many human subcultures of primary cells are potentially endogenously infected in the donor with silent HTLV viruses, papilloma, JC, BK, CJ, herpes, hepatitis and other viruses, as well as possible intracellular bacterial pathogens, and as such may represent a real and present source for human infection.
2. Human cell lines from the American Type Culture Collection [ATCC] and other sources are labeled to indicate that they may contain BBP. ATCC recommends that these cells must be handled at BSL-2 and in compliance with the BBP Standard.
3. Applicability of 1910.1030 to established human cell lines, has been incorporated by OSHA. The OSHA Standards Interpretation and Compliance Letter dated 6/21/1994, reads as follows:

“Established human cell lines* (see definitions below) which are characterized** (see below) to be free of contamination from human hepatitis viruses, human immunodeficiency viruses, and other recognized bloodborne pathogens, are not considered to be OPIM and are not covered by Bloodborne Pathogen Standard (BPS). Established human or other animal cell lines, which are known to be or likely infected/contaminated with human microbes or agents classed as bloodborne pathogens, especially hepatitis viruses and human immunodeficiency viruses are covered by the BPS.

The final judgment for making the determination that human, or other animal cell lines, in culture, are free of bloodborne pathogens must be made by a biosafety professional or other qualified scientist with the background and experience to review such potential contamination and risk, in accordance with the requirements of the BPS. Documentation that such cell lines are not OPIM should be a matter of written record and on file with the employer for OSHA review.

All primary human cell explants from tissues and subsequent in vitro passages of human tissue explant cultures (human cell "strains" ***, see below) must be regarded as containing potential bloodborne pathogens and should be handled in accordance with the BPS.

Non-transformed, human cell "strains", characterized by documented, reasonable laboratory testing as described in the attachment, to be free of human immunodeficiency virus, hepatitis viruses, or other bloodborne pathogens may be exempted from the standard's requirements.

However, if such tissue explants or subsequent cultures are derived from human subjects known to carry bloodborne pathogens, such as hepatitis viruses or human immunodeficiency viruses or are deliberately infected with bloodborne pathogens, they must be handled in accordance with the precautions noted in the BPS.

Likewise, animal tissues, explants or cell cultures known to be contaminated by deliberate infection with human immunodeficiency virus or Hepatitis B virus are also subject to the BPS.

All laboratory work with primary human tissues or body fluids is covered by the BPS.

Definitions

A Human Cell LINE is defined as in vitro or animal passaged (e.g., nude mouse) cultures or human cells that fulfill traditional requirements of a cell line designation. That is, the cells are immortalized cells, transformed by spontaneous mutation or natural or laboratory infection with an immortalizing agent such as Epstein-Barr virus (EBV). EBV is a bloodborne pathogen. It should be noted that human cervical carcinoma cells or other transformed human cell lines like Helga cells are sometimes adulterated with laboratory pathogens accidentally introduced by cultivation with other cell cultures, or physically contaminated by other cell cultures handled in the same lab. In order to handle human HeLa cells, without having to comply with the requirements of the bloodborne pathogens standard (BPS), human HeLa cells should be documented to be pure HeLa cells and shown to be free of bloodborne pathogens by testing.

Characterization of human cells, for inclusion or exclusion from compliance with the BPS, would include screening of the cells lines or "strains" for viruses characterized as bloodborne pathogens by the Standard, including human immunodeficiency viruses, hepatitis viruses or EBV, if the cells are capable of propagating such viruses. Most cell lines are screened for human mycoplasmas and are free of bacterial and mycotic contaminants. Testing may include antigenic screening for viral or agent markers, co-cultivation with various indicator cells that allow contaminants to grow, or using molecular technology (polymerase chain reaction or nucleic acid hybridization) to identify latent viruses capable of infecting humans such as Herpes viruses(e.g., EBV), or papilloma members of the Papovavirus group, etc. Cell lines that are procured from commercial vendors or other sources with documented testing to be free of human bloodborne pathogens and which have been protected by the employer from environmental contamination may be excluded from the BBP Standard.

Human cell STRAINS are defined as cells propagated in vitro from primary explants of human tissue or body fluids which have finite lifetime (non-transformed) in tissue culture for 20-70 passages. Human cell "strains" must be handled as potential biohazards unless characterized by testing to be free of bloodborne pathogens (e.g., WI-38 cells are often so documented)."

C. Roles & Responsibilities

1. The Office of the Chancellor has primary responsibility for regulatory compliance and policies for the UCD campuses. The day-to-day oversight for regulatory compliance has been delegated to the Assistant Vice Chancellor for Regulatory Compliance.
2. The Department of Environmental Health and Safety (EHS), manages those programs for public health and safety and environmental compliance matters, and in this case, specifically for compliance with the Bloodborne Pathogens Standard and the Exposure Control Program.
3. The Biosafety Office, Department of Environmental Health and Safety (EHS) is responsible for authoring and the implementation of the Exposure Control Program (ECP) and all related documents and making all documents available to employees.
 - a. The ECP will be available on-line at the website: www.ucdenver.edu/ehs
 - b. Conduct an annual review and make revisions as necessary to the ECP.
 - c. The Biosafety Office will maintain, review, and update the [University Bloodborne Pathogens/Exposure Control and Hepatitis B Vaccination Policy](#) at least annually, and whenever necessary to include new or modified procedures or regulatory standards.
 - d. The Biosafety Office in collaboration with other University resources will be responsible for the delivery of appropriate training and documentation of that training for all employees, faculty and staff covered under the Exposure Control Program.
 - e. Assist UCD work units in developing exposure control policies specific for the work area to comply with the ECP.
 - f. Assist Principal Investigators or supervisors in the evaluation of employee exposure potential and in assigning an exposure category for each employee.
 - g. Employees covered by the Bloodborne Pathogens/Exposure Control Policy will receive an explanation of this ECP during their initial training and it shall be reviewed in annual refresher training.
 - h. All employees can review this plan at any time during their work shifts by contacting the Biosafety Office.
 - i. Contact Information for the Biosafety Office is:
 - j. Phone: 303-724-0345
 - k. Email: biosafety.program@ucdenver.edu
4. Principal Investigator/Supervisor Responsibilities³
 - a. It is the responsibility of the Principal Investigator, Laboratory Director or Supervisor to make the appropriate risk assessment for the workplace and employees and to maintain a list of all job classifications within the work unit detailing those job descriptions for which:
 - i. all employees have occupational exposure and
 - ii. some employees have occupational exposure and
 - iii. a list of tasks and procedures, or groups of closely related tasks and procedures, in which occupational exposure may occur for these individuals.

³ The UCD School of Dental Medicine has prepared its own Exposure Control Manual, with appropriate infection control procedures and protocols for faculty and students. For additional information or copies of this document, please contact the Office of the Associate Dean of Clinical Affairs, School of Dental Medicine.

- b. All job descriptions (PDQs, etc) will annotate potential occupational exposure to infectious materials, as appropriate. That information should be recorded in the PeopleSoft HRMS system.
- c. It remains the responsibility of the Principal Investigator, Laboratory Director or Supervisor to offer Hepatitis B vaccination to occupationally exposed employees, per University policy, at no cost to the individual employee.
- d. It remains the responsibility of the Principal Investigator, Laboratory Director or Supervisor to maintain a copy of the ECP where all employees can access it.
- e. Principal Investigators, Laboratory Director or Supervisors shall monitor and ensure compliance with the ECP. Specifically, they must ensure that:
 - i. They document individual employee training on potential occupational exposures and exposure controls specific to the work unit, when new or modified tasks are introduced, new work procedures are introduced and for new employees as they are hired and as regulatory standards and UCD policies are changed. This On-the-Job training (OJT) should be documented and evidence of training should be maintained with employee work records.
 - ii. Provide and maintain all necessary personal protective equipment (PPE), engineering controls (e.g., sharps containers), and other supplies as required by the standard.
 - iii. Personnel have access to appropriate and necessary personal protective equipment.
 - iv. Have been assigned a determination of their potential occupational exposure to blood or other potentially infectious materials.
 - v. Have received the necessary vaccinations prior to beginning work with blood or OPIM. Vaccinations can be coordinated through the Occupational Health Office, EHS.

5. Individual Responsibilities

- a. All individual UCD employees and students who are identified by their Department, Division, Principal Investigator, Supervisor, and/or the UCD Biosafety Office, as being at risk of occupational exposure will participate in the UCD BBP/Exposure Control training and adhere to the requirements as outlined in this Exposure Control Program (ECP).
- b. It is the responsibility of the individual to use the appropriate Standard Precautions and Personal Protective Equipment for the work they perform and to report any occupational exposures or injuries as outlined in the [University Workers' Compensation Program](#) and this ECP.
- c. University work units with equivalent BBP/Exposure Control training may consult with the Biosafety Office for exemption from the University training program when all applicable training, documentation and related requirements can be demonstrated.

6. Employee Training

- a. The Biosafety Office, Dept. of Environmental Health and Safety (EHS) will provide appropriate Bloodborne Pathogen (BBP)/Exposure Control training to all identified employees.
- b. Training will be conducted by an individual who is knowledgeable in the subject matter, at no cost to the employee, during regular working hours, and in a manner accessible to the employee. Training information will be available on the EHS website.
- c. Initial Training

- i. New employees with potential occupational exposures in research, clinical or academic laboratories, must be trained on the UCDenver Bloodborne Pathogens/Exposure Control Program and Standard Precautions.
 - ii. This initial training is achieved by enrolling in [the on-line training sessions](#) available in the training modules in the [myCU](#) portal and completing the training and assessment. Employees will need their University domain login and password to access these features.
 - iii. New employees must complete the training and assessment at the time of their hire and prior to their working with potentially infectious materials. The expectation is that employees will be afforded this training within 10 days of initial assignment and prior to working with potentially infectious materials.
 - iv. This training session will include information on obtaining the Hepatitis B vaccine, and other topics as generally appropriate to a biomedical research institution.
- d. Clinical Staff Training
- i. Employees of UCDenver involved in direct patient care settings (e.g. ARTS clinics of the Department of Psychiatry) must also participate in a training and education program to meet the intent of the OSHA Bloodborne Pathogens Standard.
 - ii. This training/education will be developed and delivered by the Biosafety Office based on the specific needs for those direct patient care settings, by arrangement with the Biosafety Office.
 - iii. This training session will include information on the Hepatitis B vaccine, and other topics as generally appropriate to a direct patient care setting.
- e. Support Staff
- i. Support staff (e.g. Facilities, University Police, housekeeping, etc) at the University also have potential occupational exposures to human blood, bodily fluids and other potentially infectious materials, based on the nature of the research done at our institution and the locations in which they work.
 - ii. The applicable BBP/Exposure Control training/education will be developed and delivered by the Biosafety Office based on the specific needs for those support staff in the research and clinical settings. Training will be by arrangement with the Biosafety Office.
 - iii. This training session will include information on the Hepatitis B vaccine, and other topics as generally appropriate to our University research, clinical and academic setting.
- f. Additional Initial Training for Employees in HIV and Hepatitis Research Laboratories and Production Facilities
- i. The supervisor must assure that employees in these facilities demonstrate proficiency in standard microbiological practices and techniques and in operations and techniques specific for the facility, before being allowed to work with HIV, HBV, HCV stocks or cultures in our research or production laboratories.
 - ii. The supervisor must assure that the employee has sufficient experience in handling human pathogens and cell cultures to be able to work safely with HIV, HBV, HCV stocks or cultures.
 - iii. If an employee is lacking sufficient experience, then the employee(s) must be adequately trained with non-infectious materials to learn correct practices before being allowed to work independently with HIV, HBV, or HCV. The employee

should be able to demonstrate proficiency before participating in work activities involving infectious agents.

- iv. The responsibility for assuring that employees possess adequate knowledge and skills for such work is the responsibility of the supervisor and the employer.
 - g. Annual Refresher Training
 - i. Annual refresher training on the applicable topics is mandatory, and will be available to all employees.
 - ii. The supervisor will ensure the employee's participation in a training session at least annually and within one year (twelve calendar months) of their previous training.
 - h. Additional Training
 - i. Additional training is required at any time when changes in tasks or procedures occur that may affect employee exposure.
 - ii. The supervisor will ensure the employee's participation in any **on-the-job training** sessions as appropriate.
 - iii. For additional on-the-job training guidance, please see Appendix G.
7. Training Records
- a. EHS will keep the applicable training records and will include the following:
 - i. Names, job titles, and department/division of all persons participating in or attending the training
 - ii. Date training and assessment completed
 - iii. Content or summary of the training session (videos used, etc.)
 - b. The records shall be kept for 3 years from the date the training occurred.
 - c. It is strongly recommended that on-the-job training records be maintained within an employee file at the work unit.

C. Communication of Hazards to Employees

- 1. Warning labels and signs of an appropriate size must be displayed at or on:
 - a. Laboratories at BSL2 containment or higher, for work with potentially infectious materials
 - b. containers of infectious wastes;
 - c. refrigerators and freezers containing blood or other potentially infectious materials;
 - d. containers used to ship, transport or store blood or other potentially infectious materials; and
 - e. equipment contaminated with or likely to become contaminated with infectious materials (e.g. incubators, centrifuges)
- 2. Warning labels must include the universal biohazard symbol and the word "BIOHAZARD". See Appendix F for a sample.
- 3. It is not necessary to label individual containers that are placed for storage within a larger, labeled container used for storage, transport, shipping, or disposal.

V. Exposure Determination Process

A. Exposure Determination

1. Each Principal Investigator, Laboratory Director or Supervisor will make the exposure determination, for each employee and job classification within their work unit.
2. The exposure determination process requires that the supervisor perform an inventory of tasks, job duties and a site assessment. The specific tasks for each employee within each job classification must be evaluated to determine the occupational exposure to the individual employee.
3. The criteria for the determination are listed below. UCD Exposure Determination Forms are provided in Appendix C of this document. A copy of each completed form should be kept with laboratory records.
4. Each job classification will be categorized by the appropriate supervisor as to the risk of occupational exposure to human blood and OPIM.
 - a. Category I—All employees within the job classification are at risk because they execute tasks that involve occupational exposure to blood or OPIM.
Examples: nurses, physicians, dentists, phlebotomists, pathologists, emergency response staff, plumbers, janitors, etc.
 - b. Category II—Some employees within the job classification are at risk because they execute tasks that involve occupational exposure to blood or OPIM
Examples: Professional Research Assistants, technicians, receptionists
 - c. Category III—Employees within the job classification are unlikely to be at risk because they do not execute tasks that involve occupational exposure to blood or OPIM. Examples: secretaries, parking attendants
5. Complete UCD HSD Form 1030-1, for Employee Exposure Categories
 - a. Record the names and job classification information for each employee, and categorize with respect to occupational exposure. Be sure to include student workers and work study employees.
 - b. This exposure determination is to be made without regard to mitigation by the use of personal protective equipment (PPE).
 - c. An example of the completed form would look as follows:

Name	UCD Job Classification Title	Exposure Category	HBV Vaccine Y/N
John Doe	Clinical Lab Tech	I	Y
Mary Smith	Lab Tech	I	Y
James Jones	Professor	II	N
Anne Jones	Secretary	III	N/A

6. Complete UCD HSD Form 1030-2, Employee Exposure Category Assessment.
 - a. List employees identified on Form 1030-1, including student workers and work-study employees. List the tasks and procedures that may result in occupational exposure to human blood and OPIM.
 - b. Fill in the other blanks, as appropriate, with a checkmark to identify the infectious materials, PPE and so on, associated with each task.

VI. Exposure Control Methods

- A. Observation and execution of the control methods outlined in this section are the responsibility of every individual and supervisor who has been determined to be at risk of occupational exposure.
1. Occupational exposure to human blood and OPIM can occur through:
 - a. Direct inoculation through the skin by means of cuts, abrasions, punctures, needlesticks, etc.
 - b. Contact through direct or diffuse deposition on mucous membranes, i.e. mouth, eyes, nose, etc.
 - c. Direct contact with broken skin, e.g. cuts, abrasions and dermatitis
 - d. Ingestion of infectious materials, especially those which are infectious by the oral-fecal route (e.g. Salmonella, Hepatitis A, E. Coli)
 - e. Inhalation of infectious materials, specifically those which are infectious by the respiratory route (e.g. tuberculosis, influenza, adenoviruses)
 2. Hepatitis B Vaccination
 - a. Among the bloodborne pathogens, Hepatitis B is one of a number of infectious diseases affecting the liver. There are approximately 12,000 new cases among health care workers each year in the U.S. Hepatitis B can be prevented by a very effective and safe vaccine. Workers at risk of exposure to Hepatitis B should seriously consider the benefits of receiving the vaccine.
 - b. If you or your employees will be working with human blood, bodily fluids or tissues, or with bloodborne pathogens in culture or animals, request and receive the Hepatitis B vaccine immediately, if you have not previously been vaccinated.
 - c. It is the responsibility of the employer to provide access to the vaccine for occupationally exposed workers. Employee health services are not covered by Workers' Compensation. These services are paid by the UCD department or division in which you work.
 - d. Employees have the right to refuse vaccination, but may request to be vaccinated at a later date. Employees and students who refuse vaccination must sign a declination statement, which should be kept on file in the employing department. A sample declination form is available on the Environmental Health and Safety website.
 - e. Initial vaccinations should begin within 10 working days of initial assignment.
- B. Standard Precautions
1. The prevalence of HIV, HBV, and HCV infections in the general population increases the risk of infections to individuals who have occupational exposure to human blood, bodily fluids and OPIM.
 2. Standard precautions are those practices, which have been developed over several years, for working with all human blood, bodily fluids and OPIM, whether or not there is a documented infectious agent present.
 3. Standard precautions are to be practiced by all UCD employees who handle human blood, bodily fluids or other OPIM.
 4. Standard precautions are intended to prevent parenteral, mucous membrane and non-intact skin exposures of workers to bloodborne pathogens. In addition, immunization

with the HBV vaccine is recommended as an important adjunct to standard precautions for workers who have exposures to these materials.

5. Standard precautions do not specifically apply to feces, nasal secretions, sputum, sweat, tears, urine, and vomitus unless they contain visible blood. The risk of transmission of HIV, HBV and HCV from these fluids and materials is extremely low or nonexistent. However, it is important to remember that these fluids and excretions represent a potential source for nosocomial and community-acquired infections with other pathogens.

C. Fundamentals of Handwashing

1. A sink for hand washing shall be provided readily accessible to the work area. Personnel shall wash hands with soap and water.
2. The physical activity of rubbing hands together under running water is the most effective means of removing infectious agents. The best handwashing relies on the use of friction for a minimum of 15 seconds. Anti-bacterial soaps are not necessary.
3. Hands shall be washed:
 - a. immediately following any contact with blood, body fluids, tissues, or other potentially infectious materials;
 - b. after removing gloves or other protective equipment;
 - c. after handling potentially infectious materials (even when gloves are worn);
 - d. after completion of work;
 - e. before leaving a laboratory;
 - f. before and after eating, drinking, smoking, applying cosmetics, and manipulating contact lenses;
 - g. after sneezing or coughing into hands;
 - h. after using the restroom;
 - i. before and after patient contact, even when gloves are used and regardless of whether patient is living or dead;
 - j. before and after performing any vascular access procedures;
 - k. before and after performing other invasive procedures.
4. Hand-wipe towelettes and antiseptic hand cleaners do not provide the necessary dilution and detergent action and are generally not followed by rinsing. Therefore, they are only allowed whenever running water is not available. They are not to be used as a substitute for handwashing.
5. In addition to the indications listed in the Plan, accidental non-gloved contact with blood, body fluids, secretions, excretions and contaminated items warrant complete handwashing.
6. Use hand lotion to prevent chapping of hands, but be sure to use the appropriate type of lotion, to avoid degradation of gloves.

D. Personal Protective Equipment (PPE)

1. UCD personnel shall be offered and will use the appropriate PPE for the tasks they perform, to prevent occupational exposure to infectious materials.
2. Gloves

NOTE: Glove allergies and sensitivities

Individuals with suspected or known allergies to the standard gloves provided in the work unit must report to the UCD authorized and designated Workers' Compensation

Clinic for confirmation and documentation of diagnosis. If allergy is confirmed by the UCD authorized and designated Workers' Compensation provider, the work unit shall attempt to make reasonable accommodations, which may include the provision of special hypoallergenic gloves to these personnel.

- a. Wear gloves when working with blood, body fluids, secretions, excretions, and contaminated items.
- b. Remove gloves promptly after use, before touching uncontaminated items and environmental surfaces, and before leaving the work area.
- c. Wash hands immediately after removing gloves to avoid transfer of microorganisms.
- d. Discard gloves with visible defects.
- e. Disposable gloves should **never** be washed and reused.
- f. Gloves contaminated with potentially infectious waste should be discarded into red biohazard bags.
- g. Double gloving is recommended in situations when gross contamination of gloves with blood/body substances is likely and during exposure-prone procedures or invasive procedures where there is simultaneous presence of the workers' fingers/hands and needles or other sharp objects in a poorly visualized or highly confined anatomical site. Examples include autopsies and fine needle aspirates.
- h. Cut-resistant gloves should be used in situations that pose high risk for percutaneous injury (e.g., washing potentially contaminated sharp instruments and glassware, when using sharp knives for anatomical or surgical dissections, etc.).
- i. Petroleum-based hand lotions rapidly deteriorate latex. Therefore, only water-based hand lotions should be used. Organic solvents rapidly deteriorate latex.
- j. General-purpose rubber utility glove should be used for cleaning the environment, equipment, and instruments. Intact rubber gloves may be decontaminated and reused, but must be discarded if they are cracked, peeling, torn, punctured, or exhibit other signs of deterioration.

3. Gowns, Lab Coats, Sleeves and Protective Clothing

- a. Wear a clean gown or lab coat to protect skin and prevent soiling of clothing during procedures and activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions or to cause soiling of clothing.
- b. Remove soiled protective items as promptly as possible and launder.
- c. Laundering instructions
 - i. Uniforms and non-impervious laboratory coats used and purchased by personnel should not be taken home to be laundered.
 - ii. Central laundry services are not available for the University.
 - iii. These items should be cleaned and laundered on a routine or as-needed basis.
 - iv. Disposable gowns are recommended.

4. Facial/Mucous Membrane Protection

- a. All personnel are to wear the appropriate facial protection for all procedures that have the potential for generating facial splashes, spray, or spatter.
- b. Appropriate facial protection barriers include:
 - i. Goggles or glasses with sidebars or molded sidepieces that cover both front and sides of the eyes.
 - ii. Face shields that fully cover the face above the eyes and below the chin (fastened securely to the head).

5. Puncture and Needlestick Precautions

- a. All employees must take precautions to prevent injuries when using needles, scalpels, and other sharp instruments or devices during procedures, when cleaning used instruments, during disposal of used needles and sharps, and when handling sharp instruments after procedures.
- b. Needles must NOT be recapped, purposely bent or broken, removed from disposable syringes, or otherwise manipulated by hand.
- c. Broken, contaminated glassware must not be handled directly with hands, but must be cleaned up by mechanical devices such as brush and dustpan or forceps.
- d. After use, disposable syringes and needles, scalpel blades, and other sharp items must be placed in puncture-resistant containers for disposal. The puncture-resistant containers must be located as close as practical to areas where disposable needles or sharps are used. The needle disposal containers are to be replaced before they become full (2/3 full or to the designated line on the container is considered time to replace).
- e. Leak proof, puncture-resistant containers must be used to transport any reusable sharps to the reprocessing area.

6. Other Work Practice Controls

- a. The standard reference for biosafety in laboratories is the CDC Biosafety in Microbiological and Biomedical Laboratories (4th edition, May 1999). Copies are generally available through the Biosafety Office, HSD, for a nominal fee. It may also be downloaded in its entirety from the CDC website.
- b. Understand the tasks you are assigned to perform, per your job description, as they involve the use of infectious or potentially infectious materials.
- c. Know the exposure category that is in keeping with your tasks.
- d. Know the routes of exposure of any infectious or OPIM you may work with.
- e. Know the procedure for requesting and receiving appropriate vaccinations or occupational health screening within your laboratory or division or department.
- f. Know the location of, fitting of and proper use of PPE within in your laboratory prior to starting work with BBP and/or OPIM.
- g. If you will be working with human blood, bodily fluids or tissues, or with bloodborne pathogens in culture or animals, request and receive the Hepatitis B vaccine immediately, if you have not previously been vaccinated. It is the responsibility of the employer to provide access to the vaccine for occupationally exposed workers. Employee health services are not covered by Workers' Compensation. These services are paid by the UCD department or division in which you work.
- h. Protect your face, eyes, mucous membranes and any broken, irritated or abraded skin from BBP and/or OPIM.
- i. Report all accidental exposures to your supervisor (in writing). Administer appropriate first aid and report to the appropriate Workers Compensation provider for infectious disease exposures. See University Risk Management website for the form for reporting exposures and for current UCD provider information.

7. Standard Microbiological Practices

- a. Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where there is a reasonable likelihood of occupational exposure to potentially infectious material.
- b. Food and drink are not to be kept in refrigerators, freezers, shelves, and cabinets or in the laboratory.
- c. All procedures involving blood or other potentially infectious materials are to be performed in such a manner as to minimize splashing, spraying, spattering, and generation of droplets of these substances.
- d. Avoid exposure to aerosols and conduct aerosol-generating procedures in a biosafety cabinet (BSC). These engineered controls are also referred to as "tissue culture hoods."
- e. Mechanical devices should be used for manipulating liquids in the laboratory. Mouth pipetting/suctioning of blood or other potentially infectious materials is prohibited. Always use good hygienic practices. Use appropriate experimental techniques, appropriate waste containment and appropriate cleaning techniques.
- f. Laboratory work surfaces should be disinfected/decontaminated with an appropriate cleaner after work is completed or if a spill occurs. See Appendix ? for further information.
- g. Know the correct segregation of and disposal of infectious materials in your laboratory. This includes but is not limited to disposable tissue culture lab ware, pipettes and tips, etc.

E. Engineering Controls

1. Biological Safety Cabinets (BSC)

- a. Biological safety cabinets (also referred to as laminar flow hoods, or tissue culture hoods) will be used to handle potentially infectious materials that pose a threat of exposure via the generation of aerosols.
- b. Examples of these potential aerosol-generating activities include: sonification, homogenizing, vigorous mixing, blending, opening of centrifuged tubes, culture work, mixing, plate streaking, harvesting infected tissues from animals and embryonated eggs, etc.
- c. Removing rubber stoppers from specimen tubes frequently causes minor splattering of blood or serum. This can be minimized by covering the tube with a gauze pad soaked in alcohol.
- d. Biological safety cabinets should be certified on an annual basis by a competent certifying company, per CDC and NIH guidance, in accordance with National Sanitation Foundation (NSF) standards.
- e. For additional information regarding the proper use and maintenance of biological safety cabinets call the Biosafety Office, 303-724-0345.

2. Vacuum Systems

- a. Vacuum systems will be fitted with filters to keep potentially infectious material out of the system.
- b. Vacuum lines shall be protected with liquid disinfectant traps and HEPA filters, which must be routinely maintained and replaced.
- c. Sufficient disinfectant shall be placed in the disinfectant trap, so that the disinfectant does not become less dilute than manufacturer recommendations.

NOTE: Potentially Contaminated Equipment

Equipment that has been contaminated with blood or other body fluids or potentially infectious materials must be cleaned and disinfected or decontaminated upon discovery of a spill or loss of containment. In general such spills are handled by laboratory personnel. They should be reported to the Biosafety Office as well. Some incidents may be reportable to the Institutional Biosafety Committee.

Equipment that has been contaminated with blood or other body fluids or potentially infectious materials must be cleaned and disinfected or decontaminated before being repaired in the laboratory or transported for repair; before being transferred to another laboratory or campus; and before being discarded into the trash for disposal. This process is referred to on our campus as "green-tagging" Contact the Biosafety Office, for additional information.

VII. Additional Requirements For HIV, HBV and HCV Research Laboratories and Production Facilities Propagating or Concentrating HIV, HBV and HCV

A. This section applies to UCD HIV, HBV and HCV research laboratories and production facilities that culture, produce, concentrate, manipulate, or otherwise experiment with HIV, HBV and/or HCV viruses in the laboratory.

B. Design of HIV, HBV and HCV Production Facilities

HIV, HBV and HCV production facilities shall meet the requirements as described in the most current edition of the CDC BMBL, the UCD Exposure Control Program and as recommended by current NIH and other appropriate design guidelines.

C. These requirements are in addition to other requirements listed in this Exposure Control Program.

1. HIV and HBV research labs shall meet the following additional criteria:

- a. Exposure to these infectious materials shall be minimized or eliminated by implementing appropriate engineering controls, work practices and/or use of personal protective equipment.
- b. A handwashing sink with elbow, automatic or foot pedal controls and eyewash facility must be present near the entrance of the laboratory. All personnel must thoroughly wash their hands upon leaving the laboratory.
- c. An autoclave must be available in the facility where HIV, HBV or HCV are propagated or concentrated in large volume.

2. Special Practices

- a. Standard microbiological practices will be used.
- b. A biosafety manual must be prepared and present in the lab, reviewed annually, and used to train all employees working in these laboratories in all operational procedures. Each worker must be advised of potential biohazards.
- c. The proficiency of each worker to safely perform basic duties in handling human biohazards must be ensured by the lab supervisor, lab Principal Investigator, or director.
- d. Laboratory doors will be kept closed while work is in progress.
- e. Established written procedures regarding access to the laboratory must be followed. Access shall be restricted to authorized personnel who comply with these requirements.

- f. The laboratory must have a biohazard warning sign with emblem at the entrance. The sign must designate the hazard; state the biosafety level measures to be practiced, and the name of the supervisor and emergency contact information.
 - g. All work with infectious materials will be conducted in a certified biological safety cabinet or controlled by other means.
 - h. Protective lab coats or gowns shall be worn at all times in the containment laboratory. Single use wear, i.e., gowns, booties, masks, must be discarded in infectious waste red bags. Provisions will be made for the decontamination, cleaning, laundering or disposal of and the repair or replacement of reusable lab wear.
 - i. Skin exposure to potentially infectious materials must be prevented by the use of gloves. Gloves should be replaced frequently in situations where they may be punctured in work activities.
 - j. House vacuum lines should not normally be used in these labs. If used, they must be protected by proper traps containing fresh disinfectant and appropriate HEPA filters (hydrophobic preferred). These systems must be checked by the lab director or his/her assignee to prevent vacuum line and pump contamination.
 - k. Needle and syringe use should strictly be limited to parenteral injections, removal of materials from diaphragm bottles, and very few other applications. Needles must be of the locking type or fused to the syringe, should be disposed of without recapping in a proper sharps container, and never otherwise processed.
 - l. Before disposal, all waste from work areas and from any animal rooms shall be decontaminated by a method, such as autoclaving, known to effectively destroy bloodborne pathogens. For appropriate disposal Standard Operating Procedures, contact the Biosafety Officer.
 - m. Contaminated materials and wastes that are to be decontaminated away from the immediate area must be transported in closed, color-coded, leakproof, labeled containers following UCD policy and procedures for disposing of infectious wastes, as specified in the UCD Biosafety Manual.
 - n. All spills of human blood, other potentially infectious materials, and other potentially infectious materials must be cleaned-up immediately by trained personnel using appropriate disinfectants and equipment maintained at the site. If the hazard is unknown or personnel do not have appropriate training or equipment, contact the Biosafety Office for assistance.
 - o. Spills or accidents that result in personnel exposures must be reported to the supervisor and the authorized and designated Workers' Compensation Clinic, which will provide proper follow-up.
 - p. All spills of human blood, and other potentially infectious materials or other accidents that result in personnel exposures must be reported to the Biosafety Office, and may require reporting to the Institutional Biosafety Committee.
3. Containment Equipment
- a. Certified biological safety cabinets (BSCs) and/or appropriate personal protective equipment must be used in all handling of human blood, other potentially infectious materials, and other biohazardous materials where possible.
 - b. Aerosol generating activities must use available biosafety containment technology to prevent exposures (e.g., safety cups for centrifuges, sealed rotors, containment animal caging, etc.) Appropriate steps must be taken to prevent skin exposure in situations where splashes are likely (e.g., use of protective screens, barriers, HEPA masks, etc.).

- c. Certification must be performed on each biosafety cabinet when it is installed, or moved, and at least annually. The cabinet must be decontaminated prior to filter removal and before modifications affecting contaminated cabinet spaces are executed.

VIII. General Disinfection and Decontamination

- A. Whether preparing infectious materials for disposal, or cleaning up a spill, there are 3 recognized levels of cleaning: disinfection, decontamination and sterilization.
 1. Sterilization the complete elimination or destruction of all forms of microbial life, including high numbers of bacterial spores. It is accomplished by either physical or chemical processes. Steam sterilization (autoclaving), dry heat, ethylene oxide gas (gas sterilization), and liquid chemicals are common methods.
 2. Disinfection is the elimination of most or all pathogenic microorganisms on inanimate objects (with the exception of bacterial spores.) A disinfectant generally destroys a specific target organism. This is usually accomplished by use of liquid chemicals or wet pasteurization.
 3. Decontamination is the destruction of microorganisms to some lower level, but not necessarily to zero.
 4. Disinfection is appropriate for daily cleaning of work areas and work surfaces. The type of work, instruments, and potentially infectious materials in use best determines the proper level of cleaning.
- B. Chemical Disinfectants
 1. The proper selection and use of disinfectants is essential for safety and quality control. Disinfectants have various characteristics that must be considered before one is selected for a particular use. The disinfectant formulations registered by the EPA can be used for environmental surface cleaning, but the actual physical removal of microorganisms by scrubbing is probably as important, if not more so, than any antimicrobial effect of the cleaning agent used. Therefore, cost, safety, and acceptability with respect to laboratory procedures can be the main criteria for selecting any such registered agent.
 2. Chemical disinfection is accomplished by dosing an infectious material with an appropriate amount of disinfectant. An appropriate disinfectant is one that will kill or reduce the numbers of the targeted agent to an acceptable level.
 3. If a material is -cidal, it kills or inactivates an agent (ie. bacteri-, viru-, fungi-, tuberculo-, microbi-, spori-, or germi-.) Many disinfectants will list it's "cidal" activity. To determine whether a specific agent will be killed, the label must be read thoroughly. Usually a manufacturer will include a listing of agents for which industry standard testing has been conducted.
 4. The common classes of chemical disinfectants are alcohols, chlorine compounds, phenolic compounds, quaternary ammonium compounds, and iodophors.
 5. Manufacturers of the types of disinfectants combine detergents with these materials to improve cleaning capabilities of their products. The manufacturer's comments must always be read carefully to assure appropriateness for a particular agent or agents.

6. The disinfectant table in Appendix lists the disinfectants most commonly used in laboratories, some commercially available products, general use parameters, important characteristics, potential applications, and general types of organisms they are effective against. This list should be used as a general guide for selection in meeting your particular requirements. Additional references should be obtained and, if necessary, actual testing should be done to determine the most effective disinfectant and use parameters.

NOTE: The EPA has defined disinfectants (antimicrobials) as pesticides. All EPA registered antimicrobials must be used according to manufacturers' instructions.

7. Particular care should be observed when handling concentrated stock solutions of disinfectants. A majority of disinfectants are toxic to the human body by skin contact or inhalation. Personnel assigned the task of making up concentrations from stock solutions must be properly informed as to the potential hazards and trained in the safe procedures to follow.
8. Concentrated quaternary and phenolic disinfectants are particularly harmful to the eyes. Even a small droplet splashed into the eyes may cause blindness. Eye protection, long sleeved garments and chemically resistant gloves, aprons, and/or boots should be worn to protect you from the corrosive and toxic effects of the disinfectant.
9. Special Considerations
 - a. The effectiveness of a disinfectant to kill or deactivate infectious agents will depend upon many factors. The following factors must be considered before assuming a disinfectant will be suitable for the particular application:
 - b. Type of Microorganism. Chemicals are not equally effective against the different types of microorganisms (see Appendix).
 - c. Degree of Contamination. The degree of contamination affects the time required for disinfection, the amount of chemical required, and other variables. For example, the greater the degree of contamination, the longer the contact time needed for effective treatment.
 - d. Protein Content or Organic Load. Protein containing material (blood, plasma, tissue, etc.) absorbs and inactivates some chemical disinfectants. Halogens, i.e., chlorine, combine readily with proteins. Therefore, when protein-containing materials are present in the waste, sufficient quantities of chlorine bleach must be added to provide the excess needed to react with the microorganism.
 - e. Type of Chemical--Different chemicals have different modes of action and levels of activity (see Appendix ?). It is important to understand the mode of action in order to select the appropriate chemical. For example, household bleach is ineffective as a disinfectant in either acidic or basic conditions because the hypochlorous acid is no longer available to penetrate the cell wall.
 - f. Chemical Concentration/Quantity--Most chemicals have a range of concentrations that are suitable for use for disinfection (see Appendix ?). In the development of standard operating procedures, it is important to choose the proper concentration and quantity of chemical that are best used for the disinfection of each type of waste.
 - g. Contact Time--It is essential that contact time be sufficient to allow for action of the chemicals on the microorganisms. The amount of contact time required for disinfection is proportional to the degree of contamination. Contact time with certain surfaces can cause damage to the surface (e.g. pitting of work surfaces in BSCs).

- h. Other Considerations--Other factors that should be considered in establishing standard operating procedures for chemical disinfection include temperature, pH, mixing requirements, and aggregations of microorganisms.

D. Standard Disinfectants

1. Standard disinfectants for cleaning work area(s) are listed here.
2. Household bleach used in a stock dilution of 1:10 (1 part of bleach to 10 parts of water). This solution should be made daily. However, it must be noted that a bleach solution is corrosive and will corrode stainless steel surfaces if not thoroughly rinsed with water.
3. 70% Ethanol has commonly been used in the laboratory for disinfecting surfaces. Although it is somewhat effective as a general disinfectant it is extremely flammable and has been responsible for lab fires, which traveled along the path of the disinfectant vapor trail.
4. An iodophor disinfectant is a good general-purpose laboratory disinfectant, particularly in recombinant DNA work areas. It is not flammable, nor significantly corrosive. It does however, discolor starch-containing materials.
5. An alternate disinfectant is a phenolic containing solution, (e.g. EXPOSE). It can be used effectively for disinfecting many infectious agents. It is however, quite toxic in concentrated form. Caution must be used when handling it.
6. All disinfectants must be made per the manufacturer specifications. Examples of alternate disinfectants are listed in Appendix .

E. Steam Sterilization

1. Steam sterilization is recommended for various types of infectious materials. Some examples are: cultures and stocks of potentially infectious agents, fermentation wastes, and other infectious liquids not associated with radioactive or chemical materials.
2. Before steam sterilization is used routinely, the effectiveness of the method should be demonstrated for standard loads.
3. Steam sterilization is effective because the moisture available in the load sterilizes the material. The sterilization process, heating under pressure, causes the liquid materials to bubble or boil and may cause the bottles to break or explode if overfilled or improperly contained. This is sometimes referred to as a "hot-bottle explosion". For this reason, when autoclaving liquids use only vented closures - do not tightly seal bottles. Use glass bottles intended for autoclaving such as Type I borosilicate glass. **Ordinary glass bottles are not designed for sterilization.**
4. Never autoclave flammable or other hazardous chemicals.
5. Always carefully remove hot bottles from the autoclave and do not allow the bottles to be jolted. Do not move bottles if boiling or bubbling is present. The bottles should be allowed to cool to the touch before attempting to move them from the sterilizer shelf or tray(s). For more detailed information on proper autoclaving techniques and procedures refer to the manufacturer's operations manual for your autoclave.
6. Solid Infectious Materials
Materials categorized as infectious solids include pathological wastes, needles and sharps, tissue and culture plates, flasks, tubes, containers, etc.
7. All infectious wastes from this institution are disposed of through a third party vendor under contract. With some exceptions, there is rarely a requirement for pre-treatment or disinfection of such materials prior to disposal in the designated biomedical waste streams.

8. In the rare case where materials are autoclaved it is important to note such materials can **not** be disposed of as regular trash. The autoclaved bags must be disposed of as infectious waste.

IX. Infectious Waste Disposal

A. Classification of Infectious Wastes

1. Infectious wastes are a special (solid) waste in Colorado that require special handling prior to disposal (6 CCR 1007-2 Section 1.2), nor shall infectious waste be deemed hazardous waste solely because it is characterized as infectious waste.
2. In the most general sense, infectious waste is defined as waste, which is capable of transmitting disease, based on the quantity and type of infectious agents present, route of transmission and resistance of host. The practical approach to defining infectious waste is to identify those categories of waste that have the greatest potential for harboring infectious materials.
3. For the purpose of infectious waste disposal for this campus, the following categories of waste are designated as infectious:
 - a. Microorganisms (Cultures and Stocks)
Cultures and stocks of infectious agents and associated biologicals, including: cultures from medical and pathological laboratories; cultures and stocks of infectious agents from research and industrial laboratories; wastes from the production of biologicals; discarded live and attenuated vaccines; and culture dishes and devices used to transfer, incubate and mix cultures.
 - b. Human Blood and Blood Products and Human Bodily Fluids
Waste human blood: products of blood: items saturated and/or dripping with human blood: or items that were saturated and/or dripping with human blood that are now caked with dried human blood; including serum, plasma, and other blood components; and their container, which were used in either patient care, testing and laboratory analysis or the development of pharmaceuticals; and specimens of bodily fluids and their containers.
 - c. Pathological Wastes
Human pathological waste, including tissues, organs, and body parts that are removed during surgery or autopsy, or other medical procedures, Cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, vaginal secretions, semen, pericardial fluid, and amniotic fluid from humans are all classified as infectious.
 - d. Sharps (including needles and blades)
Sharps that have been used in animal or human patient care or treatment or in medical, research, or industrial laboratories, including hypodermic needles, syringes, Pasteur pipettes, scalpel blades, razor blades, and needles with attached tubing, and culture dishes (regardless of presence of infectious agents). Also included are other types of broken or unbroken glassware that were in contact with infectious agents, such as used slides or cover slips. Unused discarded sharps, hypodermic needles, suture needles, syringes and scalpel blades must also be disposed of as infectious waste.
 - e. Contaminated Animal Carcasses and Bedding
Contaminated animal carcasses, body parts, and bedding of animals that were known to have been exposed to infectious agents during research (including research in veterinary hospitals), production of biologicals, or testing of pharmaceuticals.

f. Recombinant DNA and Modified Genetic Materials

Under certain circumstances, viable organisms containing altered genetic material may present a potential for causing diseases or toxic effects. All recombinant DNA materials from this Institution will be treated as infectious waste. For further information, contact the Biosafety Office.

B. Segregation of Infectious Waste

1. All waste products, which meet the definition of an infectious waste, must be collected in red bags and placed in an infectious waste container. Standing liquids are **NOT** permitted.
2. Currently most of the Institution's laboratories are provided with rigid, color-coded tubs with lids and liners for transport containers. Containers should not weigh more than 35 pounds when they are closed for disposal. This is to prevent injury to those who must lift and move the containers.
3. Do **not** place non-infectious wastes (empty chemical reagent containers, pop cans, newspapers, pizza boxes, etc.) into red bags or autoclave bags. This unnecessarily increases disposal costs for the campus.
4. Once properly packaged and labeled, infectious waste is picked up EHS personnel for transport to a central holding facility until picked up by the waste disposal vendor.
5. It is imperative that generators of infectious waste properly package the waste so that exposures and spill incidents do not occur. If there is a spill due to improper preparation of the infectious wastes, the laboratory will be contacted to remedy the situation.

C. Infectious Liquids

1. Infectious liquids have historically been chemically disinfected or steam sterilized. When there is a significant change in protocol or use of a different pathogen is involved, the method should be discussed with the Biosafety Office prior to implementing experiments.
2. Any disinfected liquid wastes can be safely disposed into the sanitary sewer if the proper steps are followed. UCD infectious wastes must always be properly treated prior to sewer disposal since there is no pretreatment prior to entering the city sewer.
3. Infectious Liquids (bulk quantity, 25 ml or greater)
 - a. Infectious liquids cannot be poured or discarded directly into red bags due to the risk of leaking. Infectious bulk liquids can be properly disinfected or autoclaved prior to sink disposal. Most mixed wastes (chemical and radioactive wastes with infectious wastes) are unsuitable for disposal into the sanitary sewer.
 - b. Liquid infectious wastes must be chemically treated (with a liquid disinfectant in sufficient concentration) or autoclaved prior to disposal into any drain. Not all materials are suitable for treatment with bleach or autoclaving, particularly when volatile chemicals and/or radioactive materials may have been part of an analytical process generating wastes.
 - c. Concentrated infectious agents from large fermenters must be disinfected prior to sewer disposal.
 - d. Those infectious liquids (e.g. whole blood) which cannot be easily disinfected for sink disposal, will be solidified, in an appropriate container, and placed into the

- infectious waste stream. Contact the Biosafety Office, to purchase a commercial product to solidify such liquids.
- e. Large volumes of human blood, plasma or serum (greater than 100 ml) should be treated by solidification and proper disposal. The Biosafety Office maintains a supply of material suitable for solidifying aqueous infectious wastes. It can be purchased on an IN.
4. Sewer disposal of properly treated infectious liquids
 - a. Wear disposable gloves, eye protection, and a laboratory coat or gown.
 - b. Do not pour liquid waste into sinks where people wash their hands!
 - c. Pour the liquid close to the surface of the water to prevent the generation of droplets and aerosols.
 - d. When the last of the properly treated liquid is poured into the waste basin, carefully rinse the remaining fluid down the drain with water. Do this carefully to minimize the formation of infectious aerosols. Rinse waste down the drain with plenty of running water.
 - e. Disinfect the container if it is to be reused. Discard non-reusable containers into the infectious waste container.
 5. Other wet waste materials
Wet waste materials or wastes susceptible to leakage will be packaged with sufficient absorbent material to contain residual liquid and to minimize leakage. Animal bedding (wood chips), sawdust, newspaper, or paper towels are acceptable absorbent materials.

D. Sharps

1. The following items are defined as "sharps" for all applications at UCD campuses: Needles, Syringes, Scalpel Blades, Razor Blades, all Pasteur Pipettes, Contaminated Broken Glass, Slides of infectious materials.
2. All of these products must be discarded into rigid plastic sharps containers which have secure lids, whether they are known to be infectious or not.
3. It is strictly prohibited to dispose of loose needles or syringes directly into red bags or household trash.
4. Do not attempt to place sharps items into needle buckets that are too small or too full.
5. Full sharps containers shall be placed in the red bags inside the infectious waste box after the lid and closure are secured tightly. (Plastic sharps containers can be purchased through a variety of suppliers.)
6. Syringe cartridges and empty IV bags will also be collected for disposal regardless of infectious potential.
7. The following items should be evaluated for potential infectious characteristics: **Plastic Pipettes, large glass Pipettes, any other glass containers, including Broken Glass,** and appropriate disposal steps must be taken.
8. The following wastes, when contaminated with infectious materials, are considered to be "sharps" and must be placed inside rigid plastic buckets which have a secure lid before placing in the red bag lined infectious waste box: Test tubes, Culture Tubes, Centrifuge Tubes
9. Tubes Containing Liquids:
Test tubes, culture tubes, and centrifuge tubes containing very minimal amounts of blood or other infectious liquids must be placed inside leak resistant plastic containers, prior to disposal in the infectious waste tubs.

E. Cell Culture Materials

1. Cell culture petri dishes, tissue culture flasks, ELISA plates and similar materials which may be perceived by the general public as infectious wastes, whether infectious or not, must be disposed of in the infectious waste tubs.
2. There must be very minimal amounts of liquids remaining in containers.
3. Particular attention should be paid when disposing of agar plates, to avoid overloading infectious waste containers. The tubs must not weigh more than 35 pounds at disposal.

F. Tissue Samples, Organs, Anatomical Waste:

1. Tissue samples and other body parts will be disposed of in the following manner:
 - a. If the tissue is stored in formalin solution, carefully decant formalin into a chemical waste container inside a working fume hood. Do not breathe the toxic formaldehyde vapors. Dispose of waste formalin through EHS Hazardous Waste Office.
 - b. All tissue, organs, or anatomical waste will be placed into a leakproof container. If there is any chance for leakage, place sufficient absorbent material in the leakproof container with the waste. This container can then be placed into a red bag-lined Yellow, infectious waste tub for disposal by incineration.
2. These materials must be refrigerated if they are not disposed of immediately.

G. Animal Carcasses And Bedding

1. All reusable animal cages and any bedding must be returned to the vivarium for appropriate cleaning and disposal.
2. Animals and bedding which may be contaminated with infectious materials, toxic chemicals, carcinogens, or antineoplastic drugs, or radioactive materials must be collected for proper disposal through EHS. The OLAR-CCM has set up specific procedures for segregation of contaminated materials.
3. Animal carcasses and bedding which is generated by animals affected with a potential zoonotic disease (i.e., infectious to humans) must be handled as an infectious pathological waste.
4. Animal carcasses and bedding, which contain potentially infectious materials, will be placed into carcass bags and labeled appropriately. Animal carcasses must be refrigerated or frozen if they are not disposed of immediately.

H. Mixed Wastes

1. Mixed wastes are those which contain infectious materials and hazardous chemicals, and/or radioactive waste, in any combination. Mixed wastes may not be disposed of in infectious waste boxes.
2. A waste that contains radioactive and infectious materials must be disinfected by an appropriate chemical disinfectant or autoclaving, if that is appropriate, per the RAM authorizations. Autoclaving is not an acceptable method for disinfecting a radiolabeled infectious material in every instance, as there is a potential for emissions of radiolabeled vapors or aerosols. Contact the Radiation Safety Office, to verify the process you intend to use is appropriate.

3. If the mixture is an aqueous based solution, disinfect infectious materials with a disinfectant solution. (Do not mix bleach with an acidic solution, this may evolve hydrogen chloride gas.)
4. If the mixed waste is organic based, disinfect the infectious solution with a phenolic disinfectant such as Lysol (hospital grade), Expose, or Beaucoup. When the mixture has been appropriately disinfected, contact the Radiation Safety Office for pick-up.
5. A mixed waste stream involving infectious materials and hazardous chemical wastes must be evaluated for appropriate disposal. The hazardous waste stream does not allow the disposal of infectious materials. "De minimus" or trace amounts of certain chemical and cytotoxic wastes are often difficult to dispose of appropriately. Contact the Hazardous Waste Manager, and/or the Biosafety Office for additional assistance.
6. If your waste stream does not meet these criteria, please call the Biosafety Office for further assistance.

X. Exposure Incidents & Reporting

NOTE: If it is a life-threatening emergency, call 9-1-1 from any campus phone for emergency services to respond.

- A. If an event occurs resulting in a potential exposure incident, specific steps must be followed in reporting the incident and receiving a medical evaluation and follow up.
 1. Employees who have been exposed to human blood and other potentially infectious materials (e.g., cut, needle stick, inhalation of aerosols, spills, infected animal bites, other accidents involving human blood and other potentially infectious materials, etc.) shall take the following actions:
 2. Report immediately to the authorized and designated Workers' Compensation Clinic for a confidential medical evaluation.
 3. For anyone experiencing an acute sharps injury (e.g. needlestick) eye or mucous membrane exposure, they may also report to **the UCH Infectious Disease Clinic**, Anschutz Outpatient Pavilion, Anschutz Medical Campus, Aurora, CO for a confidential medical evaluation. **Monday through Friday, 8 a.m to 4 pm.
 4. All other hours, report to the **UCH Emergency Department**, Anschutz Inpatient Pavilion, Anschutz Medical Campus, Aurora, CO for a confidential medical evaluation.
- B. The individual must report the exposure/injury in writing within four (4) business days to the supervisor.
- C. The [URM Workers Compensation Claim Form Employee First Report of Injury/Exposure](#) should also be completed within four business days. It can serve as the written notice to the supervisor as well.
- D. If the event involves any potential exposure to recombinant DNA materials, it must also be reported to the Biosafety Office and is reportable to the Institutional Biosafety Committee.

XI. Spill Management

A. General Instructions

1. For spills of what appears to be human or animal blood, or bodily fluid, **outside a laboratory environment** (e.g. hallways, stairwells, etc.), but within a building, contact Building Services for cleaning.
2. For spills of what appears to be human or animal blood, or bodily fluid, **outside a building**, contact EHS for assistance in cleaning. Such materials may not be washed into the storm sewer system.

B. Laboratory Spills

1. Most laboratory spills of infectious materials can be safely cleaned up by the laboratory personnel who work with and are familiar with the hazards of the particular infectious agent. Most hazards are associated with bloodborne pathogens, however, for some laboratories, there is a risk of exposure to ingested or inhaled agents.
2. Spills of infectious materials that exceed the ability of laboratory personnel to manage should be reported to EHS and assistance will be provided. If you believe an agent is aerosolized or airborne, call EHS for immediate assistance.
3. PPE to be worn
 - a. Wear a laboratory coat or disposable gown.
 - b. Gloves: Always wear two pairs of gloves. An inner set of disposable nitrile or latex gloves is recommended. An outer impermeable glove is recommended if there is broken glassware or other sharps in the spill area. Immediately replace the gloves if they are torn or become grossly contaminated. If spilled material comes into contact with skin, immediately remove the gloves and wash hands or other exposed skin with soap and water.
 - c. Eye protection--consisting of goggles or face shield.
 - d. A HEPA filter on a half-face respirator is required for potential airborne agents. Most laboratorians are not routinely fitted for these respirators. If you believe an agent is aerosolized or airborne, call EHS for immediate assistance.
4. When cleaning up a spill use forceps, tongs, or needle-nose pliers to pick up any broken glass. Place the broken glass into a rigid sharps container. Use a dustpan and broom to clean up small shards of glass.
5. Decontaminate all equipment used in cleaning the spill before placing it back into service. Wash hands thoroughly with soap and water after the clean-up is completed.
6. Small spills (less than 100 ml)
 - a. Surround the spill with absorbent materials, working from the outside toward the center. Absorb as much of the material as possible.
 - b. Prepare a fresh solution disinfectant (follow the manufacturer's directions on the bottle).
 - c. Carefully spray the spill area with disinfectant, until soaking wet. Allow at least 20 minutes of contact time before attempting further clean up.
 - d. Wipe up as much as possible, then repeat the procedure. Place all waste in a red biohazard bucket.
 - e. Wipe any cleaning aids (tongs, etc.) with the disinfectant solution or dispose of them in a rigid container.
7. Large spills (more than 100 ml)
 - a. An appropriate absorbent (Isolyzer) may be used to pick-up much of the spill if it is aqueous. Diatomaceous earth (Ultrasorb 248), paper towels or absorbent pads may

- be used. Carefully apply the absorbent at the outside edges of the spill working towards the center.
- b. After 20 minutes of contact time, scrape up the absorbent material and place it into a red biohazard waste bucket. Repeat as necessary.
 - c. Place the waste into a red biohazard waste tub. Be sure that the initial clean up is thorough (no visible contaminant), so that complete disinfection can occur.
 - d. Carefully spray the spill area with disinfectant, until soaking wet. Allow at least 20 minutes of contact time before attempting further clean up.
 - e. Wipe up as much as possible, then repeat the procedure. Place all waste in a red biohazard tub.
 - f. Wipe any cleaning aids (tongs, etc.) with the disinfectant solution or dispose of them in a rigid container.
3. In cases where the spill is large, the infectious agent may be airborne, or lab personnel do not possess the skills and/or equipment to clean up a spill, call for immediate assistance from Environmental Health and Safety.
 4. If the spill involves a BSL3 containment facility, contact the UCD Biosafety Officer, through the UCD Campus Police, 303-724-4444.

C. Emergency Response to Infectious Materials Spills

5. If circumstances warrant and the laboratory staff cannot clean the spill on their own, the following emergency response will be in effect.
6. When a spill is reported, have the caller evacuate the immediate area, close the biosafety cabinet and/or room door and prevent others from entering the affected area. Have the caller remain available to assist in the spill response.

APPENDIX A

DEFINITIONS

The following terms are used throughout the ECP, all employees should be familiar with the following definitions:

Blood - Human blood, human blood components, and products made from human blood.

Bloodborne Pathogens - Means pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include but are not limited to HBV and HIV.

Engineering Controls - Controls (e.g., sharps disposal containers, self-sheathing needles) that isolate or remove the bloodborne pathogens hazard from the workplace.

Exposure Incident - A specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee's duties.

Occupational Exposure - Reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties.

Other Potentially Infectious Materials (OPIM)- All human body fluids; any unfixed tissue or organ (other than intact skin) from a human; HIV-containing cell or tissue cultures, organ cultures, and HIV- or HBV-containing culture medium or other solutions; and blood organs, or other tissues from experimental animals infected with HIV or HBV.

Parenteral - Mucous membrane exposures or piercing the skin barrier through such events as needlesticks, human bites, cuts, and abrasions.

Personal Protective Equipment - Specialized clothing or equipment worn by an employee for protection against a hazard. General work clothes (e.g., uniforms, pants, shirts, or blouses) not intended to function as protection against a hazard are not considered to be personal protective equipment.

Standard Precautions – Those practices and precautions, so that all potentially infectious material are treated as if known to be infectious

Work Practice Controls - Controls that reduce the likelihood of exposure by altering the manner in which a task is performed (e.g., prohibiting recapping of needles by a two-handed technique).

Appendix B

UCD Bloodborne Pathogens Exposure Control & Hepatitis B Vaccination Policy

On the web at:

<http://www.ucdenver.edu/academics/research/AboutUs/health-safety/policies-procedures/Documents/pdf/UCDBBPExpHepBVacPolicy.pdf>

APPENDIX C

NIH/CDC Risk Groups

On the web at:

http://oba.od.nih.gov/oba/rac/Guidelines/APPENDIX_B.htm

APPENDIX D

UCD FORMS

Exposure Determination Forms

Hepatitis B Vaccine Declination

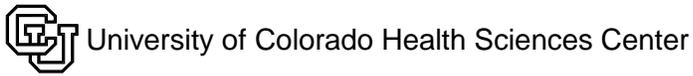
HSD Form 1030-2
 BLOODBORNE PATHOGEN EXPOSURE CATEGORY ASSESSMENT SHEET

Identify the tasks and protective equipment/barriers for employees determined to be at risk of exposure to human blood, OPIM and other sources of bloodborne pathogens.

Dept/Division: _____ Principal Investigator: _____
 Completed by: _____ Title: _____ Phone: _____ Date: _____

Exposure Category I: - All employees are at risk of exposure to human blood and OPIM
 Exposure Category II: - Some employees are at risk of exposure to human blood and OPIM

Employee Name	Exposure Cat.	Tasks	Infectious Materials						Exposed Body Parts						Contamination of Clothing					
			Human			Other			Hands			Face			Soiling			Saturation		
			Req	Avail	None	Req	Avail	None	Req	Avail	None	Req	Avail	None	Req	Avail	None	Req	Avail	None



Mailstop
4200 East Ninth Avenue
Denver, Colorado 80262

DECLINATION OF HEPATITIS B VACCINE

UCD EMPLOYEE STATEMENT

I understand that due to my occupational exposure to blood or other potentially infectious materials I may be at risk of acquiring hepatitis B virus (HBV) infection. I have been given the opportunity to be vaccinated with hepatitis B vaccine, at no charge to me. However, I decline the hepatitis B vaccination at this time.

I understand that by declining this vaccine, I continue to be at risk of acquiring hepatitis B. If in the future, I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with the hepatitis B vaccine, I can receive the vaccination series at no charge to me.

Employee Name (printed)

Employee Signature

Date

Supervisor Name (printed)

Supervisor Signature

Date

APPENDIX E

EPA APPROVED DISINFECTANTS

Note: Alcohol as a disinfectant may not be appropriate for the work you do. It is not a sterilant, nor is it a high level disinfectant. According to the Association for Professionals in Infection Control and Epidemiology (APIC), ethyl and isopropyl alcohol are not effective sterilizing instruments. They lack sporicidal activity. They cannot penetrate protein-rich materials. Isopropyl alcohol is not effective with hydrophilic viruses.

	Paraformaldehyde (gas)	Quaternary Ammonium Compounds	Phenolic Compounds	Chlorine Compounds	Iodophor Compounds	Alcohol (ethyl or isopropyl)	Formaldehyde (liquid)	Glutaraldehyde
USE PARAMETERS								
Concentration of active ingredient	0.3 g/ft ³	0.1-2%	0.2-3%	0.01-5%	0.47%	70-85%	4-8%	2%
Temperature, °C	>23							
Relative humidity, %	>60							
Contact time, min	60-180	10-30	10-30	10-30	10-30	10-30	10-30	10-600
EFFECTIVE AGAINST^a								
Vegetative bacteria	+		+	+	+	+	+	+
Bacterial spores	+	+	+	±	+	+	±	+
Lipo viruses	+	+	±	+	±	±	+	+
Hydrophilic viruses	+		+	+	+	+	+	+
Tubercle bacilli	+	+	+	+	+	+	+	+
HIV	+		±	+	±	±	+	+
HBV	+			+			+	+
APPLICATIONS^a								
Contaminated liquid discard							±	
Contaminated glassware		+		+			±	
Contaminated instruments			+				±	+
Equipment total decontamination	+							

^a + denotes very positive response; ±, a less positive response; and a blank, a negative response or not applicable.

SOURCE:

Table adapted from *Laboratory Safety: Principles and Practices*, p.188 [83]. Found in: *Biosafety on the Laboratory*. National Research Council (1989). National Academy Press. Washington, D.C.

APPENDIX F

Vacuum Filtration Protection

Vacuum Line Protection

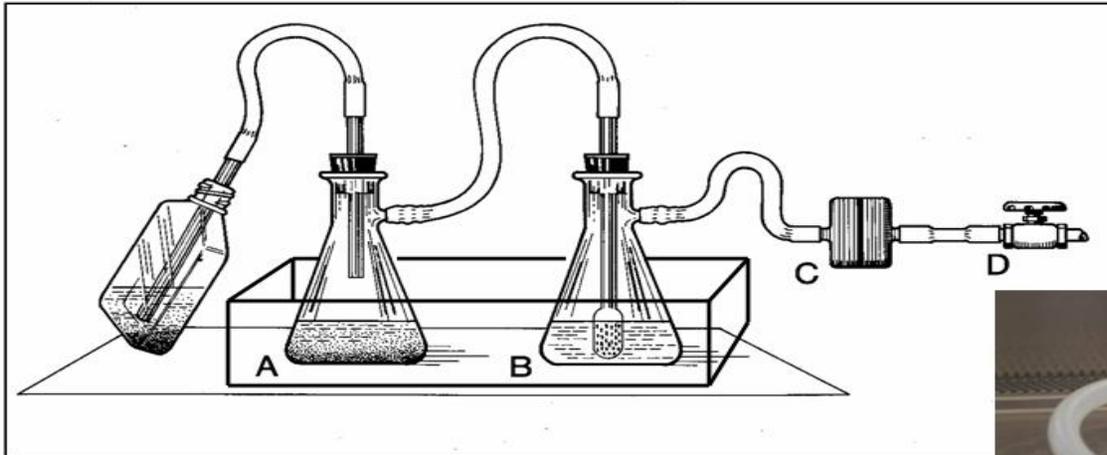
Vacuum Set-up for use with Biologicals

Place a hydrophobic filter before the vacuum line.

Add a sufficient amount of disinfectant to the primary flask to disinfect the final volume of liquid. For example, a 1:10 (v/v) dilution of concentrated bleach to liquid culture is sufficient. Since bleach loses disinfecting properties over time, add additional bleach to the flask weekly.

If the flasks are on the floor, place them in a secondary container, such as a plastic bucket or bin.

Place a clearly visible biohazard sticker on the flasks or secondary container.



- A = primary collection flask with disinfectant
- B = overflow flask with disinfectant
- C = hydrophobic or HEPA filter
- D = to vacuum pump
- Bin = secondary containment for flasks

APPENDIX G

Biohazard Symbol



APPENDIX H

ON-THE-JOB TRAINING

On-the-job training is a requirement by state law for those individuals working with Radioactive Materials (RAM) and generating any type of hazardous waste. It is also required by NIH, DOD and other grant agencies for those individuals working with rDNA materials, bloodborne pathogens or other infectious agents. This document has been prepared by the UCD Health and Safety Division, to be customized by supervisors for OJT for their individual laboratories.

Examples of items to be considered for inclusion in OJT.

- General Safety
 - Attendance at mandatory University/Health and Safety Division training
 - Nature of the research projects in which you are involved
 - Laboratory security procedures, if applicable
 - Personal protective equipment: availability of PPE and proper use of PPE;
 - Appropriate lab attire: lab coats/aprons; PPE; gloves; shoes
 - Handwashing protocols
 - Emergency procedures, to include phone numbers posted
 - Emergency procedures for occupational exposures, spills, fire, explosion
 - Labeling of containers/interpretation of labels
 - Safety devices and their use, e.g. showers, eyewashes
 - Laboratory SOPs: where are they kept? Have you read and do you understand them?
 - Proper disposal of all wastes; spill clean-up as appropriate
-
- Equipment Safety
 - Safe and proper use of physical engineered controls: Biosafety Cabinets (BSCs) and fume hoods
 - Safe and proper use of equipment: How to operate centrifuges; HPLC; etc.
 - How to change cylinders on CO2 incubators
 - How to handle cryogenic materials
-
- Infectious Materials use
 - Hazard signage-- posting of warning signs as appropriate for work with infectious materials
 - Specimen storage
 - Medical issues related to work in your laboratory; required immunizations or waiver of immunizations; medical surveillance program as it applies to the work undertaken in your laboratory
 - Proper transport of materials across campus
 - Proper opening of containers which may contain infectious agents
 - Proper cleaning and decontamination of work surfaces, equipment, glassware, etc.
 - And any other procedures unique to the laboratory setting and the research being performed.



University of Colorado at Denver and Health Sciences Center

Environmental Health and Safety Department

**Employee's Hazardous Materials
On-The-Job Safety Training**

Employee Name: (Print) _____ (Sign) _____

Supervisor Name: (Print) _____ (Sign) _____

Job Title: _____

Dept/Division: _____ Date Completed: _____

Important Note:

On-the-job training is a requirement by state and federal law for those individuals working with and generating hazardous waste. This checklist has been prepared by the UCDHSC Environmental Health and Safety (EH&S) Department, to be used by supervisors for OJT for their individual laboratories. **This OJT must be documented and available for audit by outside agencies.**

	Supervisor Initials	Employee Initials	Date
Initial EH&S Training			
Hazardous Waste Generator Initial/Annual Online Training ¹			
Radiation Safety Modular Training Program ²			
Bloodborne Pathogens Initial/Annual Online Training ³			
General Safety Training			
Personal protective equipment required e.g. eye protection, lab coat, gloves, shoes			
Decontamination procedure for chemical, bio/infectious or radioactive exposure			
Location of safety equipment e.g. shower & eye wash stations, fire extinguishers, phones, fire pull stations, etc.			
Posting emergency response procedures, emergency contacts & phone numbers			
Informed of emergency evacuation procedure			
Informed of potentially hazardous equipment or environments in lab			
Reporting procedure for hazardous material spills			
Informed of policy for working in lab alone (after hours or under what conditions?)			
Informed of lab standard operating procedure (where/what are they & how to use them?)			
Informed of labeling protocol for all containers e.g. contents, conc., date, initials			
Informed of decontamination protocol for work area, equipment, glassware etc.			
Informed of procedure to secure chemical, bio/infectious & radioactive hazards			

**Employee On-The-Job Safety
Training**

**Employee's Hazardous Materials
On-The-Job Safety Training**

Hazardous Material Safety Training	Supervisor Initials	Employee Initials	Date
Aware of posted warning signs/symbols e.g. flammables, corrosives, toxins, carcinogens, biohazards, & radioactives. Informed of location & use of material safety data sheets (MSDS)			
Trained in proper chemical storage & segregation e.g. acids/bases, liquids/solids, oxidizers/flammables			
Informed of chemical location/inventory			
Aware of chemical hygiene plan, if applicable			
Informed of requirements to transport hazardous material across campus			
Trained to receive hazardous substances e.g. UPS, Fed Ex etc.			
Medical surveillance program availability			
Chemical Waste Disposal Training			
Training is required to handle chemical waste; new employees must be under direct supervision of a trained person until all training requirements have been completed (up to 6 months)			
Review Sink Disposal Guidelines sign posted above sink in laboratory (nothing can be dumped down the drain without prior EH&S approval)			
Location of chemical waste containers, labels & chemical waste disposal forms in lab			
Labeling requirement for chemical waste containers (label required for first drop added)			
Chemical waste removal/disposal procedure (submission of Chemical Waste Disposal Form)			
Segregation of different waste streams, e.g. chemical, bio/infectious, radioactive, household			
Segregation of chemical waste by hazard class, oxidizers, flammables, acids, bases, water-reactives, halogenated solvents			
Chemical waste containers must remain closed at all times, except when adding or removing waste from the container			
Weekly SAA inspection required to be completed and documented on EH&S form for waste containers—check for leaks, bulging, etc.			
Do not add incompatible wastes to the same container e.g. acid/base, acid/cyanide, oxidizer/flammable.			
Secondary containment is used where needed			