FORWARD

This policy and procedures manual was developed by the University of Washington Environmental Health and Safety Department to provide information to protect workers and the surrounding environment and to achieve compliance with applicable standards and regulations. The University of Washington Institutional Biosafety Committee (IBC) approved this revision with the expectation that updates will be necessary as changes in regulations, policies and procedures dictate.

The premise is that safety is a top priority for all experiments. Planning for and implementation of biohazard controls to prevent laboratory-associated infections and to control the spread of contamination must be a part of every laboratory activity in which biohazardous agents, including recombinant or synthetic DNA/RNA, are used.

The handling of biohazardous agents, including recombinant or synthetic nucleic DNA/RNA, requires the use of various precautionary measures depending on the agent(s) involved. It is the purpose of this manual to provide general guidelines for evaluation, containment, and control of biohazards, categorized as to degree of risk of infection.

Implementation of these policies and procedures is the responsibility of the Principal Investigator and depends largely on the efforts of laboratory supervisors and employees. It is essential that they seek additional advice and training when needed to conduct research in a manner that is safe to employees, students, and the surrounding community. To assist in this endeavor, the services of the Department of Environmental Health and Safety are available at the University of Washington.

Updated – July 1997
Administrative Changes – January 2003
Updated – March 2013
Updated – October 2014
EMERGENCY INFORMATION

Principal Investigator/Supervisor__________________________________________

Building Coordinator___________________________________________________

Custodial or Environmental Services_______________________________________

University of Washington (UW) Police (On Campus) 911

Seattle Fire Department (On Campus) 911

Employee Health Center
   Seattle Campus, South Lake Union 206-685-1026
   Harborview 206-744-3081

Environmental Health and Safety (EH&S)
   EH&S Main Office 206-543-7262
   Research and Occupational Safety Section 206-221-7770

AFTER HOURS, WEEKENDS AND HOLIDAYS

UW Police (On Seattle Campus) 911
Seattle Fire (On Seattle Campus) 911
Environmental Health and Safety Staff-On-Call Page through 206-685-UWPD

WHEN REPORTING A BIOHAZARD EMERGENCY

(1) State that this is a Biohazard Emergency
(2) Give Your Name
(3) Give Your Location (Room and Building)
(4) Give the Phone Number You Are Using
(5) Describe the Nature of the Emergency
(6) Report Personal Injury or Threat of Injury
CONTENTS

SECTION 1 – INTRODUCTION ........................................................................................................................................ 1-1

A. PURPOSE OF MANUAL .............................................................................................................................. 1-1
B. DEFINITION OF BIOHAZARDOUS AGENTS ........................................................................................... 1-1
C. THE OCCURRENCE OF LABORATORY-ASSOCIATED INFECTIONS .......................................................... 1-2
D. RULES, REGULATIONS, AND GUIDELINES GOVERNING USE OF BIOHAZARDS AND recDNA MOLECULES .................................................................................................................. 1-3
   1. NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules .................. 1-3
   2. CDC/NIH Biosafety in Microbiological and Biomedical Laboratories .................................................. 1-3
   3. The Select Agent Rule ........................................................................................................................... 1-3
   4. Washington Industrial Safety and Health Act ......................................................................................... 1-4
   5. Bloodborne Pathogens Standard ........................................................................................................... 1-4
   7. Washington State Definition of Biomedical Waste ............................................................................. 1-4
   8. Department of Transportation .............................................................................................................. 1-5
E. UNIVERSITY POLICY ..................................................................................................................................... 1-5
F. ROLES AND RESPONSIBILITIES FOR CONTROL OF BIOHAZARDOUS RESEARCH ......................... 1-5
   1. Principal Investigator ............................................................................................................................. 1-6
   2. Department of Environmental Health and Safety .................................................................................. 1-6
   3. Institutional Biosafety Committee (IBC) ............................................................................................... 1-7
   4. Deans, Directors, Chairpersons, and Organizational Supervisors ........................................................ 1-7
   5. Department of Comparative Medicine ................................................................................................ 1-7
   6. Washington National Primate Center ................................................................................................ 1-8

SECTION 2 – REVIEW PROCEDURES FOR RESEARCH AT THE UNIVERSITY OF WASHINGTON 2-1

A. RESEARCH PROJECT REVIEWS ............................................................................................................... 2-1
   1. Policy ..................................................................................................................................................... 2-1
   2. Procedures ............................................................................................................................................. 2-1
B. LEVELS OF REVIEW REQUIRED FOR recDNA RESEARCH ................................................................. 2-2

SECTION 3 – RISK ASSESSMENT ............................................................................................................................ 3-1

A. RISK ASSESSMENT AND ROUTES OF EXPOSURE ............................................................................ 3-1
   1. Oral Infection .......................................................................................................................................... 3-1
   2. Respiratory Route Infection .................................................................................................................. 3-1
   3. Puncture and Contact Infections .......................................................................................................... 3-1
   4. Fomites .................................................................................................................................................. 3-1
SECTION 4 – PROCEDURES FOR BIOHAZARD CONTROL

A. FACILITY REQUIREMENTS ................................................................................. 4-3
   1. BSL-1 Laboratory Facilities ........................................................................... 4-3
   2. BSL-2 Laboratory Facilities (in addition to BSL-1 requirements stated above) ........................................................................... 4-3
   3. BSL-2 with BSL-3 practices Laboratory Facilities (in addition to BSL-2 and BSL-1 requirements stated above) ........................................................................... 4-4
   4. BSL-3 Laboratory Facilities (in addition to BSL-2 requirements stated above) ........................................................................... 4-4

B. GOOD LABORATORY PRACTICES AND TECHNIQUES ........................................... 4-4
   1. Technical Proficiency ..................................................................................... 4-4
   2. Hazard Awareness Training .......................................................................... 4-5
   3. Prohibited Activities ...................................................................................... 4-5
   4. Personal Protective Equipment ...................................................................... 4-6
   5. Restrict Traffic in Laboratories ..................................................................... 4-7
   6. Biohazard Warning Door Sign ....................................................................... 4-8
   7. Handwashing .................................................................................................. 4-8
   8. Biosafety Manual and Laboratory-Specific Biosafety Manual ..................... 4-8
   9. Good Housekeeping ...................................................................................... 4-8
   10. Pest Control .................................................................................................. 4-8
   11. Biohazardous Waste ..................................................................................... 4-8
   12. Minimization of Aerosols ............................................................................ 4-9

C. LABORATORY EQUIPMENT AND PROCEDURES .................................................. 4-9
   1. Laboratory Equipment .................................................................................. 4-9
   2. Laboratory Procedures .................................................................................. 4-14

D. CONTROL OF BIOHAZARDS ASSOCIATED WITH LABORATORY ANIMALS ............. 4-18
   1. Responsibility ................................................................................................. 4-18
   2. Animal Blood and Blood Products .................................................................. 4-19
   3. Animal Biosafety Levels and Vivarium Research Facilities ........................ 4-19
   4. Animal Work Practices and Engineering Controls ....................................... 4-20
   5. Occupational Health Program ....................................................................... 4-20
   6. Pest Control Program .................................................................................... 4-21
   7. Animal Waste Handling Procedures .............................................................. 4-21

E. DECONTAMINATION ............................................................................................... 4-21
   1. Introduction .................................................................................................... 4-21
   2. Resistance ..................................................................................................... 4-22
   3. Ineffectiveness .............................................................................................. 4-22
   4. Residual Action .............................................................................................. 4-22
   5. Exposure Time ............................................................................................... 4-22
   6. Sterilization ................................................................................................... 4-26
   7. Disinfection .................................................................................................... 4-27
   8. Sanitization .................................................................................................... 4-28

F. BIOHAZARDOUS WASTE ...................................................................................... 4-29
   1. Responsibility ................................................................................................. 4-29
2. Identifying Biohazardous Waste ........................................ 4-29
3. Collection and Handling of Biohazardous Waste .................. 4-30
4. Transporting Biohazardous (including recDNA) Waste ............ 4-32
5. Autoclave Quality Control ........................................ 4-33
6. Refusal to Collect Waste ........................................ 4-34

G. CONTROL OF recDNA EXPERIMENTATION ............................ 4-35
   1. Responsibility ........................................ 4-35
   2. Physical Containment ..................................... 4-35
   3. Biological Containment ..................................... 4-35

SECTION 5 – EMPLOYEE OCCUPATIONAL HEALTH PROGRAM ............... 5-1
   A. OVERVIEW ........................................ 5-1

   B. ROLES AND RESPONSIBILITIES .................................. 5-1
      1. Environmental Health and Safety ............................. 5-1
      2. Principle Investigators ..................................... 5-2
      3. Employees ........................................ 5-3
      4. UW Employee Health Centers ................................ 5-3

   C. IMMUNIZATION GUIDELINES ....................................... 5-4

   D. ANIMAL USE MEDICAL SCREENING .............................. 5-4

   E. RESEARCH PROTOCOL REVIEW .................................... 5-4

   F. POST EXPOSURE TREATMENT ..................................... 5-5

   G. EMPLOYEE HEALTH AND IMMUNIZATION RECORDS .................. 5-5

   H. SERUM BANKING AND MONITORING ................................ 5-5

SECTION 6 – EMERGENCY PREPAREDNESS AND RESPONSE ...................... 6-1

   A. BIOHAZARDOUS SPILL CLEAN-UP PROCEDURES .................. 6-1
      1. Responsibility ........................................ 6-1
      2. Biohazard Spill Kit ..................................... 6-1
      3. Spill Advice ........................................ 6-2
      4. Biohazardous Spill Inside a BSC ............................ 6-2
      5. Biohazardous Spill outside a BSC ............................ 6-3
      6. Spills Outside the Laboratory in Public Spaces ............... 6-5
      7. Radioactive Biohazardous Spill ............................... 6-5

   B. INJURY POLICY AND ACCIDENT REPORTING ....................... 6-5
      1. Injury Policy ........................................ 6-5
      2. Immediate Response ..................................... 6-5
      3. Accident Reporting ....................................... 6-7

APPENDIX A – BLOODBORNE PATHOGENS EXPOSURE CONTROL PLAN .......... A-1

   A. INTRODUCTION ........................................ A-2

   B. ROLES AND RESPONSIBILITIES .................................. A-2
      1. Principal Investigator/Supervisor ............................. A-2
      2. Employee ........................................ A-3
      3. Employee Health Center .................................... A-3
      4. Environmental Health and Safety Department ............... A-3

   C. EXPOSURE DETERMINATION ....................................... A-3
D. UNIVERSAL PRECAUTIONS ................................................................. A-4
E. ENGINEERING/WORK PRACTICE CONTROLS .................................... A-4
   1. Engineering Controls ................................................................. A-4
   2. Hand Hygiene ......................................................................... A-4
   3. Sharps ....................................................................................... A-4
   5. Mouth Pipetting/Suctioning is Prohibited. ................................. A-5
   7. Centrifuging .............................................................................. A-5
   8. Transporting and Shipping Biohazardous Materials .................... A-6
   9. Equipment Servicing and Maintenance ........................................ A-6
F. PERSONAL PROTECTIVE EQUIPMENT ............................................. A-6
   1. Requirements ............................................................................ A-6
   2. Gloves ....................................................................................... A-7
   3. Face Protection .......................................................................... A-7
   4. Use and Removal ...................................................................... A-7
   5. Cleaning, Laundering or Disposal ............................................... A-7
G. WORKSITE CONDITIONS .................................................................... A-7
   1. Responsibility ........................................................................... A-7
   2. Spill Clean-up .......................................................................... A-8
   3. Cleaning Schedule ..................................................................... A-8
   4. Protective Coverings ................................................................... A-8
   5. Biohazardous Waste .................................................................. A-8
H. BIOHAZARD SIGNS AND LABELS .................................................... A-9
I. HEPATITIS B IMMUNIZATION ............................................................ A-9
   1. Offering Hepatitis B Vaccine ....................................................... A-9
   2. Administering Hepatitis B Vaccine .............................................. A-10
J. POST-EXPOSURE REQUIREMENTS .................................................. A-10
   1. Exposure Incident ...................................................................... A-10
   2. Immediate Response ................................................................ A-10
   3. Principal Investigator/Supervisor Responsibility ........................ A-11
   4. Evaluation Post Exposure .......................................................... A-11
K. TRAINING PROGRAM ......................................................................... A-12
   1. Responsibility ........................................................................... A-12
   2. Training Requirements .............................................................. A-12
L. RECORDKEEPING ............................................................................. A-13
   1. Medical Records ....................................................................... A-13
   2. Training Records ...................................................................... A-14
   3. Availability ................................................................................ A-14
M. ACCESSIBILITY OF THE ECP .......................................................... A-14
N. ANNUAL UPDATE OF THE ECP ......................................................... A-14
O. ADDITIONAL REQUIREMENTS FOR HIV, HBV, AND HCV
   RESEARCH LABORATORIES ............................................................ A-14
   1. Application ................................................................................ A-14
   2. Facility Requirements ............................................................... A-15
   3. Access Policy ............................................................................. A-15
   5. Containment .............................................................................. A-15
   6. Protective Clothing and Practices .............................................. A-16
   7. Use of Sharps ............................................................................ A-16
APPENDIX B – POSTING BIOHAZARD SIGNS AND LABELS

A. PURPOSE

B. RESPONSIBILITY

C. BIOHAZARD WARNING SIGN USE

D. BIOHAZARD WARNING LABELS USE

APPENDIX C – TRANSPORTING AND SHIPPING BIOHAZARDOUS AGENTS (INCLUDING LABORATORY SPECIMENS)

A. TRANSPORTING BIOHAZARDOUS AGENTS AND LABORATORY SPECIMENS
   1. Within Building
   2. Between Buildings

B. SHIPPING BIOHAZARDOUS MATERIALS

APPENDIX D – CURRENT RECORDS MAINTAINED IN BIOSAFETY MANUAL

A. BIOSAFETY AND BLOODBORNE PATHOGENS TRAINING RECORDS

B. CDC, U.S. DEPARTMENT OF AGRICULTURE (USDA), ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS) PERMITS

C. SHIPPING PAPERS

D. EXPOSURE INCIDENTS

APPENDIX E – WEBSITE LINKS

A. REGULATIONS, GUIDELINES, STANDARDS, AND WEBLINKS

B. FORMS AND CHARTS
Section 1 – Introduction

Contents
A. PURPOSE OF MANUAL ........................................................................................................ 1-1
B. DEFINITION OF BIOHAZARDOUS AGENTS ................................................................. 1-1
C. THE OCCURRENCE OF LABORATORY-ASSOCIATED INFECTIONS ............................. 1-2
D. RULES, REGULATIONS, AND GUIDELINES GOVERNING USE OF BIOHAZARDS AND recDNA MOLECULES ........................................................................ 1-3
   1. NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules ................................................................. 1-3
   2. CDC/NIH Biosafety in Microbiological and Biomedical Laboratories ......................................................... 1-3
   3. The Select Agent Rule .................................................................................................... 1-4
   4. Washington Industrial Safety and Health Act ......................................................... 1-4
   5. Bloodborne Pathogens Standard ................................................................................. 1-4
   7. Washington State Definition of Biomedical Waste ................................................. 1-4
   8. Department of Transportation .................................................................................... 1-5
E. UNIVERSITY POLICY ....................................................................................................... 1-5
F. ROLES AND RESPONSIBILITIES FOR CONTROL OF BIOHAZARDOUS RESEARCH ......................................................................................... 1-6
   1. Principal Investigator ................................................................................................... 1-6
   2. Department of Environmental Health and Safety ................................................. 1-6
      a. EH&S Biosafety Officers ....................................................................................... 1-6
      b. Employee Health Services .................................................................................... 1-7
   3. Institutional Biosafety Committee .............................................................................. 1-7
   4. Deans, Directors, Chairpersons, and Organizational Supervisors ......................... 1-7
   5. Department of Comparative Medicine ....................................................................... 1-7
   6. Washington National Primate Center ........................................................................ 1-8

A. PURPOSE OF MANUAL

This manual has been prepared for the purpose of providing students, staff, and faculty at the University of Washington (UW) with information that is necessary to protect them and the surrounding community from possible hazards associated with the use of biohazardous agents and recombinant or synthetic DNA/RNA (recDNA) molecules. Refer to the UW Radiation Safety Manual and the UW Laboratory Safety Manual for additional laboratory safety guidelines.

B. DEFINITION OF BIOHAZARDOUS AGENTS

For the purpose of this manual, potentially hazardous biological agents and by-products are called biohazardous agents. The UW IBC’s working definition of a biohazardous agent includes the following:

1) Pathogenic agents (bacteria, rickettsia, fungi, viruses, protozoa, parasites, prions, and
Select Agents

2) Recombinant or synthetically derived nucleic acid, including those that are chemically or otherwise modified analogs of nucleotides (e.g., morpholinos) or both. The NIH defines synthetically derived nucleic acid molecules as follows:
   a. Molecules that (a) are constructed by joining nucleic acid molecules and (b) can replicate in a living cell (i.e., recombinant nucleic acids);
   b. Nucleic acid molecules that are chemically or otherwise modified but can pair with naturally occurring nucleic acid molecules (i.e., synthetic nucleic acids);
   c. Molecules that result from the replication of those described in (a) or (b) above

3) Recombinant DNA molecules, organisms, vectors (e.g., plasmids, viral vectors), and viruses containing recombinant DNA molecules

4) Human and non-human primate blood, tissue, body fluid, and cell culture (primary and established cell lines)

5) Plants, animals, or derived waste which contains or may contain pathogenic hazards (including xenotransplantation tissue)

This manual also includes guidelines for containment of biohazards to control the spread of contamination. The control practices contained in this manual are meant to supplement conventional safety efforts, including accident and fire prevention.

C. THE OCCURRENCE OF LABORATORY-ASSOCIATED INFECTIONS

Research and clinical laboratories are work environments that pose unique risks to persons working in or near them. Personnel have contracted infections in the laboratory throughout history.

The following information on the occurrence of Laboratory-Associated Infections (LAIs) in clinical (diagnostic) and research laboratories is taken from Section I of the Centers for Disease Control and Prevention (CDC)/National Institutes of Health (NIH) publication, _Biosafety in Microbiological and Biomedical Laboratories (BMBL)._ 

Published reports of LAIs first appeared around the start of the twentieth century. By 1978, four studies by Pike and Sulkin collectively identified 4,079 LAIs resulting in 168 deaths occurring between 1930 and 1978. These studies found that the ten most common causative agents of overt infections among workers were _Brucella_ spp., _Coxella burneti_, hepatitis B virus (HBV), _Salmonella typhi_, _Francisella tularensis_, _Mycobacterium tuberculosis_, _Blastomyces dermatitidis_, Venezuelan equine encephalitis virus, _Chlamydia psittaci_, and _Coccidioides immitis_. The authors acknowledged that the 4,079 cases did not represent all LAIs that occurred during this period since many laboratories chose not to report overt cases or conduct surveillance programs to identify sub-clinical or asymptomatic infections.

In addition, reports of LAIs seldom provided data sufficient to determine incidence rates, complicating quantitative assessments of risk. Similarly, there were no distinguishable accidents or exposure events identified in more than 80% of the LAIs reported before 1978. Studies did show that in many cases the infected person worked with a microbiological agent or was in the vicinity of another person handling an agent.

During the 20 years following the Pike and Sulkin publications, a worldwide literature search by Harding and Byers revealed 1,267 overt infections with 22 deaths. Five deaths were of fetuses aborted as the consequence of a maternal LAI. _Mycobacterium tuberculosis_, _Coxiella burnetti_, hantavirus, arboviruses, HBV, _Brucella_ spp., _Salmonella_ spp., _Shigella_ spp., hepatitis C virus (HCV), and _Cryptosporidium_ spp. accounted for 1,074 of the 1,267 infections. The authors also identified an additional 663 cases that presented as sub-clinical infections. Like Pike and
Sulkin, Harding and Byers reported that only a small number of the LAIs involved a specific incident. The non-specific associations reported most often by these authors included working with a microbiological agent, being in or around the laboratory, or being around infected animals.

The findings of Harding and Byers indicated that clinical (diagnostic) and research laboratories accounted for 45% and 51%, respectively, of the total LAIs reported. This is a marked difference from the LAIs reported by Pike and Sulkin prior to 1979, which indicated that clinical and research laboratories accounted for 17% and 59%, respectively. The relative increase of LAIs in clinical laboratories may be due in part to improved employee health surveillance programs that are able to detect sub-clinical infections, or to the use of inadequate containment procedures during the early stages of culture identification.

Comparison of the more recent LAIs reported by Harding and Byers with those reported by Pike and Sulkin suggests that the number of LAIs is decreasing. Harding and Byers note that improvements in containment equipment, engineering controls, and greater emphasis on safety training may be contributing factors to the apparent reduction in LAIs over two decades. However, due to the lack of information on the actual numbers of infections and the population at risk, it is difficult to determine the true incidence of LAIs with any degree of certainty.

Publication of the occurrence of LAIs provides an invaluable resource for the microbiological and biomedical community. For example, one report of occupational exposures associated with Brucella melitensis, an organism capable of transmission by the aerosol route, described how a staff member in a clinical microbiology laboratory accidentally sub-cultured B. melitensis on the open bench. This error and a breach in containment practices resulted in eight LAIs with B. melitensis among 26 laboratory members, an attack rate of 31%. Reports of LAIs can serve as lessons in the importance of maintaining safe conditions in biological research.

D. RULES, REGULATIONS, AND GUIDELINES GOVERNING USE OF BIOHAZARDS AND recDNA MOLECULES

The following is a brief summary of the regulatory authorities that either regulate or provide guidelines for the use of biohazards.

1. NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules

In the early 1970s the NIH established a committee to provide advice on recDNA technology. The NIH Guidelines, which were announced on June 23, 1976 and which continue to be updated, established carefully controlled conditions for conducting experiments involving recDNA molecules. These guidelines describe the roles and responsibilities of the Institution, the IBC, and the Principal Investigator (PI).

2. CDC/NIH Biosafety in Microbiological and Biomedical Laboratories

In 1984, the CDC and NIH published BMBL. The publication was last updated in 2009 and provides specific descriptions of combinations of microbiological practices, laboratory facilities, safety equipment, and recommendations for use in the four biosafety levels of laboratory operation with selected human infectious agents.
3. **The Select Agent Rule**

The CDC is required to regulate the possession of biological agents and toxins that have the potential to pose a severe threat to public health and safety. CDC's [Select Agent Program](#) oversees these activities. The Select Agent Program currently requires registration of facilities including government agencies, universities, research institutions, and commercial entities.

4. **Washington Industrial Safety and Health Act**

Under provisions of the [Washington Industrial Safety and Health Act (WISHA)](#), occupational safety and health standards are promulgated by the Department of Labor and Industries as chapters of the Washington Administrative Code (WAC). It is the intent of the UW to comply fully with the standards and regulations developed by the Department of Labor and Industries.

5. **Bloodborne Pathogens Standard**

[WAC 296-823, Occupational Exposure to Bloodborne Pathogens](#) is an extension of the Bloodborne Pathogens Standard promulgated by the Federal Occupational Safety and Health Administration (OSHA). It applies to staff with reasonably anticipated exposure to blood or other potentially infectious materials (including human cell lines) during the course of their work.


In 1989, the City of Seattle and the [King County Board of Health](#) adopted [SMC 21.43](#) covering regulations on infectious waste management. These regulations include requirements for a waste management plan that includes a policy on storage and containment of infectious waste, infectious waste treatment, disposal (including special disposal requirements for needles and other sharps waste), and transportation of this type of waste. These regulations were updated in 1992, the major modification being the change in terminology from infectious waste to biomedical waste.

7. **Washington State Definition of Biomedical Waste**

The Washington State legislature adopted a statewide definition of biomedical waste that preempts any definitions previously established by individual local health departments or governments. This definition is the minimum requirement for defining infectious (biomedical) waste in the State of Washington:

- **a.** “Animal waste” consists of animal carcasses, body parts, and the bedding from animals that are known to be infected with or that have been inoculated with human pathogenic microorganisms infectious to humans.

- **b.** “Cultures and stocks” consist of wastes infectious to humans and include specimen cultures, cultures and stocks of etiologic agents, wastes from production of biologicals and sera, discarded live and attenuated vaccines, and laboratory waste that has come in contact with cultures and stocks of etiologic agents or blood specimens. Such waste includes, but is not limited to, culture dishes, blood specimen tubes, and devices used to transfer, inoculate, and mix cultures.

- **c.** “Human blood and blood products” are discarded human blood and blood components and materials containing free-flowing blood and blood products.

- **d.** “Pathological waste” consists of human source biopsy materials, tissues, and anatomical parts that emanate from surgery, obstetrical procedures, and autopsy. Pathological waste
does not include teeth, human corpses, remains, or anatomical parts that are intended for interment or cremation.

e. "Sharps waste" - The term "sharps" is a regulatory waste classification associated with those instruments used to puncture, cut, or scrape body parts and that, in a waste container, can cause punctures or cuts to solid waste handlers or the public. This means that all sharps waste must be placed in appropriate sharps containers and decontaminated prior to disposal.

Sharps include the following:

a. Needles, including syringes with needles and IV tubing with needles attached
b. Syringes without needles when removed from their original sterile containers (part of Oregon's definition of sharps)
c. Lancets
d. Scalpel blades
e. Other sharps items not defined above only if contaminated with biohazardous material including recDNA (e.g., broken glass; razor blades; fragile glass tubes, vials, or ampoules including glass Pasteur pipettes; glass slides and cover slips)

8. Department of Transportation

Department of Transportation Title 49 regulations apply to all untreated biohazardous waste that is shipped off-site for treatment and disposal by a UW waste contractor. Employees who prepare biohazardous waste for collection by a waste contractor must complete mandatory training before offering shipments.

E. UNIVERSITY POLICY

The UW has an established policy on safety programs.

The University shall create, maintain and enhance a safe and healthful environment for all individuals associated with the institution, including students, faculty, staff employees, hospital patients and visitors. Environmental health and safety activities and procedures shall be administered so as to achieve the highest ethical and professional standards in accord with legal and contractual requirements. Accident prevention measures shall be integrated in all academic and operational activities.

Each dean, director, chairperson and supervisor is responsible for safety performance in their respective units. The Department of Environmental Health and Safety will provide technical assistance in establishing procedures and monitoring performance in activities involving public health and safety and environmental protection.

Because of the personal nature of safety performance, everyone with supervisory responsibility will be expected to participate directly in the supervision of programs to assure that safe working conditions are maintained. Faculty and staff shall be directly responsible for their own safety, for the safety of students and employees under their supervision, and for the safety of their fellow employees. This responsibility can neither be transferred nor delegated. Supervisors shall provide training for accident prevention, as necessary, for those working under their direction. (UW Handbook Volume Four, Part VI, Chapter 4: University Safety Programs).
F. ROLES AND RESPONSIBILITIES FOR CONTROL OF BIOHAZARDOUS RESEARCH

The responsibility for the control of biohazards and the safety of employees and the public rests with:

1. Principal Investigator

At the UW, the primary responsibility for establishing, following, and enforcing rules, procedures, and methods for the proper control of biohazardous agents, including the use of recDNA, rests with the PI.

The PI is responsible for ensuring all research with biohazardous agents, including recDNA, is reviewed and approved by the IBC and/or the EH&S Research and Occupational Safety (ROS). The PI must complete the EH&S Biosafety Training every three years if their research includes the use of biohazardous agents.

The PI must be adequately trained on the NIH Guidelines and laboratory specific procedures involving use of recDNA. The PI must be adequately trained in good microbiological techniques and is responsible for seeing that laboratory staff are adequately trained in safety practices. The PI is responsible for correcting work errors, identifying defective working conditions that could result in personal injury, and developing a positive attitude among laboratory staff toward accident prevention. The PI is responsible for informing the laboratory staff of the reasons and provisions for any precautionary medical practices advised or requested (e.g., vaccinations or serum collection).

The PI is responsible for adhering to IBC approved emergency plans for handling accidental spills and personnel contamination. The PI is also responsible for complying with shipping requirements for recDNA or other biohazardous materials.

While conducting research, the PI is responsible for supervising the safety performance of the laboratory staff to ensure that the required safety practices and techniques are employed. The PI is responsible for investigating and reporting any significant problems pertaining to containment practices and procedures to EH&S and correcting any work errors and conditions that could result in the release of biohazardous agents, including recDNA.

UW-affiliated clinical investigators doing research with recDNA in human research participants have the responsibility to be familiar with the NIH Guidelines and ensure all aspects pertaining to NIH and local IBC review and reporting obligations are appropriately addressed. UW-affiliated clinical investigators must have Institutional Review Board (IRB) and IBC approval before enrolling subjects, regardless of the funding source or the molecular nature of the gene transfer reagent (plasmid or viral vector, vaccines).

2. Department of Environmental Health and Safety

This department is responsible for evaluating existing and potential biohazardous conditions at the UW, establishing safety standards, and providing staff support to the IBC (UW Administrative Policy Statements 12.3 and 10.1).

a. EH&S Biosafety Officers

The EH&S BSOs have expertise in developing and supporting the Biosafety Program (including BSL-1, BSL-2, BSL-3 laboratories, and select agents). They develop and implement policies, procedures, and processes required for an effective, compliant, and efficient biosafety program. They play a lead role in providing technical support to the UW IBC. They review research proposals, laboratory operations, and laboratory facilities for all aspects of biosafety to assure appropriate safety controls, containment, and
compliance with federal, state, and local regulatory agencies as well as seeing that UW requirements are met. They work closely with research staff, faculty, students, university units, and institutional committees to promote safe laboratory practices, procedures, and proper use of containment equipment and facilities. They conduct compliance audits, identify corrective actions, and prepare written status and compliance reports. They develop and provide educational materials and training. They also respond to, investigate, and follow up with biological safety incidents.

b. Employee Health Services

The Occupational Health Nurses (OHN) at EH&S screen written protocols and the Biological Use Authorization (BUA) application form for research-related risks, including those associated with animals. Specific requirements for personal and laboratory-based protections are determined by the potential for exposure to chemical, biological, or physical hazards. When necessary, referrals for immunizations and/or other clinically-based medical services are made to the appropriate Campus Health Service’s Employee Health Center (EHC), located at Hall Health Center, the University of Washington Medical Center (UWMC) and/or Harborview Medical Center (HMC) (UW Administrative Policy Statement 12.3).

3. Institutional Biosafety Committee

IBCs were originally established under the NIH Guidelines local institutional oversight for nearly all forms of research utilizing recDNA. Over time, however, the role of the IBCs has been expanded to include review and oversight of a variety of experimentation that involves biological materials (e.g., infectious agents) and other potentially hazardous agents (e.g., carcinogens).

The IBC is composed of an IBC Chair; Biosafety Officer; public members not affiliated with UW who represent the interest of the surrounding community with respect to health and protection of the environment; research faculty with adequate expertise and training in human gene transfer protocol reviews, in plant, plant pathogen or plant pest containment principles, and in animal containment principles in accordance with the NIH Guidelines. This committee is responsible for advising the Executive Director for the Health Sciences Administration (HSA) and the Director of EH&S, in establishing standards, providing consultant services, reviewing research proposals for compliance with standards, approving or denying these proposals, and recommending training and education methods for laboratory personnel (UW Administrative Policy Statements 12.3). The IBC also reviews research protocols involving recDNA in human research participants. This review compliments the IRB review (UW Human Subject Division) as both are necessary prior to subject enrollment.

4. Deans, Directors, Chairpersons, and Organizational Supervisors

These supervisors are responsible for all employees, students, faculty, and visitors in their areas of control. They must be aware of the hazards of research and approve control methods used by the PI (UW Administrative Policy Statements 12.3 and 10.3).

5. Department of Comparative Medicine

The Department of Comparative Medicine is responsible for the operation and maintenance of centralized animal vivarium facilities including centralized Animal Biosafety Level 1 (ABSL-1), Animal Biosafety Level 2 (ABSL-2) and Animal Biosafety Level 3 (ABSL-3) facilities, excluding the Washington National Primate Center (WaNPRC).
6. **Washington National Primate Center**

   The WaNPRC is responsible for the operation and maintenance of all non-human primate (NHP) facilities.
Section 2 – Review Procedures for Research at the University of Washington

Contents
A. RESEARCH PROJECT REVIEWS........................................................................................................... 2-1
   1. Policy ........................................................................................................................................... 2-1
   2. Procedures.................................................................................................................................... 2-1
B. LEVELS OF REVIEW REQUIRED FOR RECDNA RESEARCH .................................................. 2-2

Tables
Table1: Levels of Review Required for recDNA research ......................................................... 2-2

A. RESEARCH PROJECT REVIEWS

1. Policy

Grant and contract proposals that involve any use of, or exposure to, potential biohazards, including recDNA, are reviewed by the IBC and/or EH&S. All such research proposals, regardless of funding source, are subject to this review. The IBC, not the investigator or department, is charged with the final determination of hazard classifications. Certain funding agencies also require the UW to assure the biosafety compliance of the PI with the submittal of the proposal.

2. Procedures

a. Initiating Review

Project review is initiated when a PI submits the BUA application.

b. Approval Process

The information is reviewed by a BSO and/or the IBC, depending, in part, upon the project’s complexity and risk. The BSO and/or the IBC may request additional information from the PI to aid in the review of the proposal. Incomplete applications may be returned to the PI.

The PI will receive notification of IBC review and determination of approval or denial. If the notification letter indicates a conditional approval, it will also indicate actions or information that the IBC must receive before final approval notification can be issued. Projects may be subject to other UW approvals (e.g., IRB and Institutional Animal Care and Use Committee (IACUC); see Table 1: Levels of review required for recDNA research). If the project involves animals, IACUC approval is always required prior to project initiation.

c. Renewals and Changes to Previously Approved Research

Additional IBC review and approval is required:

1) Every three years for projects involving biohazardous agents, including recDNA, and, if animal work is involved, concurrent with expiration of IACUC protocols. To renew the approval, PIs should submit a BUA application two months prior to the expiration
date of their current BUA letter or animal protocol. PIs can check the submission deadlines online.

2) Before modifying or making any significant changes to a research protocol already approved by the IBC (e.g., any changes related to laboratory equipment that may generate aerosols, research procedures, lab locations, gene inserts, biohazardous agents, etc.). This is done by submitting a Request for Change to BUA form to the IBC.

B. LEVELS OF REVIEW REQUIRED FOR RECDNA RESEARCH

Table 1 summarizes the types of approvals and reviews required from various boards and committees for the use of recombinant DNA research.

Table 1: Levels of Review Required for recDNA research

<table>
<thead>
<tr>
<th>NIH Guidelines Section</th>
<th>Experiments covered under NIH Guidelines</th>
<th>NIH/Recombinant DNA Advisory Committee (RAC) Review</th>
<th>NIH/OBA Approval</th>
<th>Institutional Approval/Review</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IBC Approval</td>
</tr>
<tr>
<td>Section III-A</td>
<td>Transfer of drug resistance trait to a microorganism not known to acquire the trait naturally</td>
<td>YES</td>
<td>YES (NIH Director)</td>
<td>YES</td>
</tr>
<tr>
<td>Section III-B</td>
<td>Cloning of toxin molecules with LD50 less than 100ng/kg body weight</td>
<td>YES</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td>Section III-C</td>
<td>Gene transfer into humans by recDNA</td>
<td>YES</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>recDNA in vaccines</td>
<td>YES</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Section III-D          | Recombinant risk group 2, 3, or restricted agents  
|                        | a. As host-vector systems  
<p>|                        | b. DNA is cloned into non-pathogenic prokaryotic or lower eukaryotic host-vector systems | YES | | | |
|                        | Infectious virus or replication defective virus in presence of helper virus in tissue culture systems (e.g., viral vectors) | YES | | | |
|                        | Whole transgenic animals and recDNA-modified microorganisms tested on whole animals | YES | | IACUC |</p>
<table>
<thead>
<tr>
<th><strong>NIH Guidelines Section</strong></th>
<th>Experiments covered under <strong>NIH Guidelines</strong></th>
<th>NIH/Recombinant DNA Advisory Committee (RAC) Review</th>
<th>NIH/OBA Approval</th>
<th>Institutional Approval/Review</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>recDNA modified whole plants</td>
<td></td>
<td>YES</td>
<td>IBC Approval</td>
</tr>
<tr>
<td></td>
<td>More than 10 L of recDNA culture</td>
<td></td>
<td>YES</td>
<td>EHS Review</td>
</tr>
<tr>
<td></td>
<td>Influenza viruses (specific strains) generated by recombinant methods</td>
<td></td>
<td>YES</td>
<td>IRB/IACUC Approvals</td>
</tr>
<tr>
<td><strong>Section III-E</strong></td>
<td>Those not above</td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Less than 2/3 eukaryotic virus genome</td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>recDNA modified whole non-pathogenic plants and plants associated microorganisms</td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generation of transgenic rodents that require BSL-1 containment</td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td><strong>Section III-F</strong></td>
<td>Not in organisms, cells, or viruses</td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nonchromosomal or viral DNA of single source</td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prokaryotic DNA with indigenous plasmids or viruses when propagated in same system or when transferred</td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eukaryotic DNA, propagated in same system</td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physiological exchangers</td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not a significant risk to health or environment</td>
<td></td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>

Note: For work with human embryonic stem cells (hESC) and induced pluripotent stem cells (iPS), contact the UW Embryonic Stem Cell Research Oversight Committee (ESCRO). These studies require IBC review.
Section 3 – Risk Assessment

Contents

A. RISK ASSESSMENT AND ROUTES OF EXPOSURE ........................................... 3-1
   1. Oral Infection .............................................................................................. 3-1
   2. Respiratory Route Infection ...................................................................... 3-1
   3. Puncture and Contact Infections ............................................................... 3-1
   4. Fomites ...................................................................................................... 3-1

B. CLASSIFICATION BY RISK GROUPS AND BIOSAFETY
   CONTAINMENT LEVELS .............................................................................. 3-2
   1. General Introduction to Risk Groups ....................................................... 3-2
   2. General Introduction to Biosafety Containment Levels ....................... 3-2

A. RISK ASSESSMENT AND ROUTES OF EXPOSURE

Risk assessment is a process used to identify the degree of risk to the laboratory worker, other personnel, and the environment. The degree of risk takes into consideration the virulence, pathogenicity, biological stability, and communicability of the organisms as well as the route of transmission. The following summarizes routes of transmission or infection.

1. Oral Infection

   A variety of organisms used in the laboratory are enteric pathogens and carry the prime risk of infection by ingestion. Examples are ova and parasites, *Salmonella typhimurium*, Hepatitis A virus, poliovirus, and enteropathogenic *E. coli* strains.

2. Respiratory Route Infection

   A variety of agents infect by the respiratory route. The major source of such infections is by aerosolization of biohazards. The more hazardous agents which cause respiratory infections are those which withstand drying such as *Mycobacterium tuberculosis* and *Coccidioides immitis*. Two hazards can be defined: the immediate risk from an aerosol which will be limited if the agent cannot withstand drying and the delayed risk (secondary aerosol) if the organism can withstand drying.

3. Puncture and Contact Infections

   A variety of agents are transmitted through puncture such as arthropod-borne virus infections, protozoal infections (malaria), human immunodeficiency virus (HIV), and HBV. However, those bacterial agents that can cause septicemia can also cause infections by injection, a phenomenon particularly dangerous when a rapidly growing and pathogenic organism is injected.

4. Fomites

   Fomites are particularly hazardous and subtle because the organisms are spread via deposition on surfaces. Careless handling of materials can lead to situations in which individuals unknowingly infect themselves by hand-to-mouth infection. The transmission of
organisms from fomites to the hands and then to the mucus membranes of the eyes or nose are other examples of the route of viral infections or ingestion.

Fomites can also be created by aerosols settling on laboratory furniture, apparatus, etc. Rapid dispersal of aerosols by high air flow is an indispensable means of preventing this problem. Creation of fomites from minor spills and droplets formed during transfer of cultures is a common hazard in laboratories. The reality of this problem can readily be appreciated by transferring a dye (e.g., crystal violet) as though it were a bacterial culture. The amount of dye scattered in the work area after several such manipulations is an excellent measure of the effectiveness of containment techniques.

The telephone provides a good example of a fomite. Ideally, no telephones should be included in a BSL-2 or BSL-3 laboratory as they are easily contaminated and interfere with concentration on work. Personnel must refrain from answering telephones when gloved or while conducting hazardous procedures. In the event that the telephone is handled by gloved personnel or is otherwise contaminated, it must be surface decontaminated at the end of the work day.

B. CLASSIFICATION BY RISK GROUPS AND BIOSAFETY CONTAINMENT LEVELS

The classification of human etiological agents into risk groups on the basis of hazard and the biosafety levels assigned to them are described below.

1. General Introduction to Risk Groups

Microorganisms have been classified according to degree of risk in terms of infectivity, pathogenicity, and the availability of preventive measures and effective treatments for the disease. The NIH Guidelines have established a classification and assigned human etiological agents into four risk groups on the basis of hazard. The risk groups correlate with, but do not always equate to, biosafety levels. A risk assessment will determine the degree of correlation between an agent’s risk group classification and biosafety level. The NIH Guidelines, Section II provides additional information on the differences and relatedness of risk groups and biosafety levels.

**Risk Group I (RG-1)** - Agents not associated with disease in healthy adult humans.

**Risk Group II (RG-2)** - Agents associated with human disease that is rarely serious and for which preventive or therapeutic interventions are often available.

**Risk Group III (RG-3)** - Agents associated with serious or lethal human disease for which preventive or therapeutic interventions may be available (high individual risk but low community risk).

**Risk Group IV (RG-4)** - Agents likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not usually available (high individual risk and high community risk). There is no research with Risk Group IV agents at the UW.

2. General Introduction to Biosafety Containment Levels

Biosafety, when working with biohazards, is dependent on three elements: standard microbiological laboratory practices and techniques, safety equipment, and facility design. Combinations of these three elements are used to describe the four biosafety levels. Additional information is also available in the CDC/NIH BMBL.
Biosafety Level 1 (BSL-1) is suitable for work involving well-characterized agents not known to cause disease consistently in immunocompetent adult humans; such agents present minimal potential hazard to laboratory personnel and the environment.

Biosafety Level 2 (BSL-2) builds upon BSL-1. BSL-2 is suitable for work involving agents that pose moderate hazards to personnel and the environment.

Biosafety Level 3 (BSL-3) is applicable to research facilities where work is performed with indigenous or exotic agents that may cause serious or potentially lethal disease through the inhalation route of exposure.

Biosafety Level 4 (BSL-4) is required for work with dangerous and exotic agents that pose a high individual risk of aerosol-transmitted laboratory infections and life-threatening disease that is frequently fatal, for which there are no vaccines or treatments; or a related agent with unknown risk of transmission.

There is no research requiring BSL-4 containment at the UW.

For more details regarding specific facility design elements for BSL-1, BSL-2, and BSL-3 laboratories, see Section 4.A on facility requirements.
Section 4 – Procedures for Biohazard Control

Contents

SECTION 4 – PROCEDURES FOR BIOHAZARD CONTROL ................................................. 4-1

A. FACILITY REQUIREMENTS .................................................................................. 4-3
   1. BSL-1 Laboratory Facilities ............................................................................ 4-3
   2. BSL-2 Laboratory Facilities (in addition to BSL-1
      requirements stated above) ........................................................................... 4-3
   3. BSL-2 with BSL-3 practices Laboratory Facilities (in
      addition to BSL-2 and BSL-1 requirements stated above) ....................... 4-4
   4. BSL-3 Laboratory Facilities (in addition to BSL-2
      requirements stated above) ........................................................................... 4-4

B. GOOD LABORATORY PRACTICES AND TECHNIQUES ........................................ 4-4
   1. Technical Proficiency .................................................................................... 4-4
   2. Hazard Awareness Training ......................................................................... 4-5
      a. Biosafety Training ..................................................................................... 4-5
      b. Bloodborne Pathogens Training ............................................................... 4-5
   3. Prohibited Activities ..................................................................................... 4-5
   4. Personal Protective Equipment ..................................................................... 4-6
      a. Laboratory Coats ..................................................................................... 4-6
      b. Gloves ....................................................................................................... 4-6
      c. Facial Protection ........................................................................................ 4-7
   5. Restrict Traffic in Laboratories .................................................................... 4-7
   6. Biohazard Warning Door Sign ..................................................................... 4-8
   7. Handwashing ............................................................................................... 4-8
   8. Biosafety Manual and Laboratory-Specific Biosafety
      Manual ........................................................................................................... 4-8
   9. Good Housekeeping ..................................................................................... 4-8
   10. Inventory Control .......................................................................................... 4-8
   11. Pest Control ................................................................................................ 4-8
   12. Biohazardous Waste .................................................................................... 4-9
   13. Minimization of Aerosols .......................................................................... 4-9

C. LABORATORY EQUIPMENT AND PROCEDURES ............................................. 4-9
   1. Laboratory Equipment .................................................................................. 4-9
      a. BSC ......................................................................................................... 4-9
      b. Blenders, ultrasonic disintegrators, grinders, mortar, and pestle .......... 4-12
      c. Automated equipment .............................................................................. 4-12
      d. Water baths and incubators .................................................................... 4-12
      e. Refrigerators, deep freeze, and dry ice chests ....................................... 4-12
      f. Laboratory vacuum lines ......................................................................... 4-12
      g. Using a Microtome/Cryostat ................................................................... 4-13
   2. Laboratory Procedures .................................................................................. 4-14
      a. Pipetting ................................................................................................... 4-14
      b. Working Outside a BSC Using a Splash Guard
         and/or Additional PPE ............................................................................ 4-14
      c. Using Syringes and Needles .................................................................. 4-14
      d. Opening Culture Plates, Tubes, Bottles, and Ampoules ...................... 4-15
      e. Using Test Tubes and Other Laboratory Glassware ............................. 4-15
      f. Cell Sorting .............................................................................................. 4-16
      g. Centrifugation ......................................................................................... 4-16
D. CONTROL OF BIOHAZARDS ASSOCIATED WITH LABORATORY ANIMALS

1. Responsibility .......................................................... 4-18
2. Animal Blood and Blood Products .................................. 4-19
   b. Animal (non-primate) Blood, Body Fluids and Tissues, and Cell Lines ........................................ 4-19
3. Animal Biosafety Levels and Vivarium Research Facilities .......................................................... 4-19
4. Animal Work Practices and Engineering Controls ............. 4-20
5. Occupational Health Program ........................................ 4-20
6. Pest Control Program ................................................... 4-21
7. Animal Waste Handling Procedures ................................ 4-21
   a. Disposal of Animal Carcasses and Body Parts ........ 4-21
   b. Disposal of Animal Blood and Blood Products ........ 4-21

E. DECONTAMINATION .............................................................. 4-21

1. Introduction .................................................................. 4-21
2. Resistance .................................................................. 4-22
3. Ineffectiveness ............................................................ 4-22
4. Residual Action ............................................................ 4-22
5. Exposure Time ............................................................. 4-22
6. Sterilization ................................................................ 4-26
   a. Wet Heat (Autoclave or Steam Sterilizer) ............. 4-26
   b. Dry Heat ............................................................... 4-26
   c. Chemical Sterilant .................................................. 4-26
7. Disinfection ................................................................ 4-27
   a. Halogens ............................................................... 4-27
   b. Formalin .............................................................. 4-28
   c. Hydrogen Peroxide and Peracetic Acid ................. 4-28
8. Sanitization ................................................................ 4-28
   a. Alcohol ................................................................. 4-28
   b. Quaternary Ammonium Compounds or Quats ........ 4-28
   c. Phenolic Compounds ............................................ 4-28
   d. UV Light ............................................................... 4-28
9. General Procedures ....................................................... 4-29
10. Selecting Chemical Decontaminants for Research on recDNA Molecules .................................. 4-29

F. BIOHAZARDOUS WASTE .......................................................... 4-29

1. Responsibility .............................................................. 4-29
2. Identifying Biohazardous Waste ..................................... 4-29
3. Collection and Handling of Biohazardous Waste .............. 4-30
   a. Sharps Container Waste ........................................ 4-30
   b. Liquid Biohazardous Waste .................................... 4-31
   c. Solid Biohazardous Waste ..................................... 4-31
4. Transporting Biohazardous (including recDNA) Waste ...... 4-32
   a. Within Building .................................................... 4-32
   b. Between Buildings ................................................ 4-33
5. Autoclave Quality Control ............................................ 4-33
   a. A good quality assurance program includes the following: .................................................. 4-33
   b. Biological Indicator Test Procedure ...................... 4-34
6. Refusal to Collect Waste ............................................... 4-34
Section 4 – Procedures for Biohazard Control

G. Control of RecDNA Experimentation
   1. Responsibility .......................................................... 4-35
   2. Physical Containment ........................................... 4-35
   3. Biological Containment .......................................... 4-35

A. FACILITY REQUIREMENTS

1. BSL-1 Laboratory Facilities
   1. Laboratories have doors that can be locked for access control.
   2. Laboratories have a sink for hand washing.
   3. The laboratory is designed so that it can be easily cleaned. Carpets and rugs in the laboratory are not permitted.
   4. Laboratory furniture must be capable of supporting anticipated loads and uses. Spaces between benches, cabinets, and equipment are accessible for cleaning.
   5. Bench tops must be impervious to water and resistant to heat, organic solvents, acids, alkalies, and other chemicals.
   6. Laboratories with windows that open to the exterior are fitted with screens.

2. BSL-2 Laboratory Facilities (in addition to BSL-1 requirements stated above)
   1. Laboratory doors are locked when not occupied.
   2. Laboratories must have a sink for hand washing. The sink may be manually, hands-free, or automatically operated. It should be located near the exit door.
   3. Chairs used in the laboratory work are covered with a non-porous material that can be easily cleaned and decontaminated with appropriate decontaminant. Fabric chairs are not allowed.
   4. An eye wash station is readily available (within 50 feet of workspace and through no more than one door).
   5. Ventilation - Planning of new facilities should consider ventilation systems that provide an inward flow of air without recirculation to spaces outside of the laboratory. See the Laboratory Safety Design Guide for specifications.
   6. Laboratory windows that open to the exterior are not recommended. However, if a laboratory does have windows that open to the exterior, they must be fitted with screens.
   7. Biological Safety Cabinets (BSCs) are installed so that fluctuations of the room air supply and exhaust do not interfere with proper operations. BSCs should be located away from doors, windows that can be opened, heavily traveled laboratory areas, and other possible sources of airflow disruptions.
   8. Vacuum lines should be protected with in-line High Efficiency Particulate Air (HEPA) filters.
   9. HEPA-filtered exhaust air from a Class II BSC can be safely recirculated back into the laboratory environment if the cabinet is tested and certified at least annually and operated according to manufacturer’s recommendations. BSCs can also be connected to the laboratory exhaust system either by a thimble (canopy) connection or by exhausting to the outside directly through a hard connection. Proper BSC performance and air system operation must be verified at least annually.
3. **BSL-2 with BSL-3 practices Laboratory Facilities (in addition to BSL-2 and BSL-1 requirements stated above)**

   1. Laboratory doors are self-closing and locked at all times. The laboratory is separated from areas that are open to unrestricted traffic flow within the building. Laboratory access is restricted.
   2. An entry area for gowning and degowning is taped off on the floor.
   3. The laboratory has a ducted air-exhaust system capable of directional air flow that causes air to be drawn into the work area.
   4. Vacuum lines are protected with in-line HEPA filters.
   5. All windows must be sealed.

4. **BSL-3 Laboratory Facilities (in addition to BSL-2 requirements stated above)**

   1. Laboratory doors are self-closing and the outside door must be locked at all times. The laboratory is separated from areas that are open to unrestricted traffic flow within the building. Laboratory access is restricted. Access to the laboratory is through two self-closing doors. A clothing change room (anteroom) may be included in the passageway between the two self-closing doors.
   2. Hands-free or automatically operated sinks for hand washing are installed near exit door and in each laboratory.
   3. Walls and ceiling surfaces are sealed and have a smooth finish.
   4. Floors are slip resistant, impervious to liquids, and resistant to chemicals.
   5. All windows in the laboratory are sealed.
   6. Ventilation - A ducted air ventilation system provides directional airflow by drawing air into the laboratory from clean areas toward potentially contaminated areas. The laboratory is designed such that, under failure conditions, the airflow is not reversed. Laboratory personnel are able to verify directional air flow with a visual monitoring device. Laboratory exhaust air does not recirculate to any other area of the building.
   7. At the UW, the laboratory building exhaust air is HEPA filtered and dispersed away from occupied areas and from building air intake locations. The filters and the housing are certified at least annually.
   8. Decontamination - A method for decontaminating all lab wastes is available in the facility (e.g., autoclave, chemical disinfection, incineration, or other validated method).
   9. Verification and Documentation - At the UW, the BSL-3 facility design, operational parameters, and procedures are verified and documented by an outside contractor prior to operation. Facilities are verified that they meet the intent of the current edition of the CDC/NIH *BMBL* and documented at least annually.

**B. GOOD LABORATORY PRACTICES AND TECHNIQUES**

1. **Technical Proficiency**

   Laboratory personnel must be aware of the potential hazards and must be trained and proficient in the necessary practices and techniques required for safe handling of biohazardous agents. Laboratory personnel must have documented training in handling biohazardous
agents. The PI is responsible for providing or arranging for appropriate training for all personnel working in their laboratory.

Additional training for BSL-2 laboratories following BSL-3 practices and BSL-3 laboratories

Laboratory personnel working in BSL-2 laboratories with BSL-3 practices or in BSL-3 laboratories must have documented training on the laboratory-specific biosafety manual and practical training with the PI. All required EH&S safety classes (e.g., biosafety training, bloodborne pathogens training) must be current.

2. Hazard Awareness Training
   a. Biosafety Training
      Completion of the EH&S online Biosafety training is required every three years for PIs if their research includes the use of biohazardous agents. It is also required for students, fellows, laboratory managers, research staff, and all other staff who have the potential for exposure to recDNA and other biohazardous agents. This training is required before initiating research with biohazardous agents, including recDNA, and every three years thereafter.
   b. Bloodborne Pathogens Training
      Staff with reasonably anticipated potential for exposure to human blood, human source material, all human cell lines, and other potentially infectious materials must take either the in-person or online EH&S bloodborne pathogens (BBP) training. The training is required initially and every year thereafter.

3. Prohibited Activities
   a. Eating, drinking, handling contact lenses, applying cosmetics, chewing gum, and storing food for human consumption is not allowed in the work area of the laboratory. Smoking is not permitted in any University building. Food shall not be stored in laboratory refrigerators or prepared/consumed with laboratory glassware or utensils. Food may be stored in cabinets and refrigerators marked for “FOOD ONLY.” These must be located outside the laboratory work area and physically separated by a door from the main laboratory.
   b. Mouth pipetting is prohibited in research laboratories; only mechanical pipetting devices can be used.
   c. Storage of laboratory equipment in public corridors - There are restrictions on storage of laboratory equipment in public corridors. Information on storage in hallways and stairwells is available online.
   d. Animals and plants not associated with the work being performed are not permitted in the laboratory.
   e. Personal protective equipment (e.g., lab coats, gloves) cannot be worn in public hallways.
   f. Biohazardous agents (including biohazardous waste) cannot be transported in public corridors without a secondary container.
4. Personal Protective Equipment

Specific rules concerning personal and protective clothing must be devised by the PI. It is important to recognize that hair, beards, personal clothing, and shoes can effectively disseminate infection. (See fomites in Section 4.A.4).

a. Laboratory Coats

BSL-1 Laboratories - Laboratory coats are recommended for general biological work in a BSL-1 laboratory and when working with BSL-1 biohazardous agents, including BSL-1 recDNA. Laboratory coats may also be necessary when working with chemicals, radioisotopes, etc.

BSL-2 Laboratories - Dedicated laboratory coats, gowns, or smocks are worn while working in the BSL-2 laboratory area. Before moving from the BSL-2 laboratory area to a non-BSL-2 laboratory area (e.g., BSL-1 laboratory, hallway, cafeteria, library, administrative offices), protective clothing must be removed and left in the laboratory. Reusable laboratory coats must be laundered on a regular basis and are never to be taken home.

BSL-2 with 3 practices and BSL-3 practices Laboratories - All the rules for BSL-2 laboratory apply. In addition, laboratory clothing that protects street clothing (solid front or wrap-around gowns, scrub suits or coveralls) is worn in the laboratory. Laboratory clothing is not worn outside the laboratory; the clothing is autoclaved before laundering or disposal. Tight fitting cuffs on laboratory clothing or sleeve protectors are useful.

b. Gloves

Glove selection should be based on an appropriate risk assessment. In laboratory settings, the most common gloves are latex and nitrile. Both are appropriate for protection against biohazardous agents. However, these gloves are not intended to provide protection from punctures caused by sharp instruments or broken glass.

If work involves the use of chemicals with biohazardous agents, select gloves according to recommendations in the Laboratory Safety Manual, Appendix G and refer to the associated Material Safety Data Sheet (MSDS). Many chemicals destroy the integrity of latex gloves (e.g., do not use 70% ethanol with latex gloves).

1) Gloves must always be visually checked for defects before using (e.g., look at gloved hands).

2) Gloves should be changed when contaminated, torn, or punctured. Care should be taken not to touch your skin with the outer surface of the gloves when removing them. Wash hands immediately after gloves are removed and before leaving the laboratory.

3) Gloves are removed prior to handling non-contaminated items such as doorknobs or telephones. Gloves are not worn outside the laboratory area.

4) Do not wash or disinfect and then reuse disposable gloves. Detergents may cause enhanced penetration of liquids through undetected holes and disinfectants may cause deterioration.

5) Used gloves must be treated as biohazardous waste and decontaminated prior to disposal.

BSL-2 laboratories with BSL-3 practices and BSL-3 laboratories – Double glove practices must be used in BSL-2 laboratories following BSL-3 practices and BSL-3 laboratories.
c. Facial Protection

Facial barrier protection is required for activities in which there is a potential for splash/splatter of biohazardous agents onto the mucous membranes of the mouth, nose, and eyes.

Eye and face protection - Goggles, mask, face shield, or other splatter guards are used for anticipated splashes or splatters of biohazardous agents when the agents must be handled outside the BSC or containment device. Eye and face protection must be disposed of with other contaminated laboratory waste or decontaminated before reuse. Persons who wear contact lenses in laboratories must also wear eye protection.

Face Shields - Full face shields made of lightweight transparent plastic are the preferred means of facial protection. They offer excellent protection of the entire face and neck region. They are easily decontaminated. Face shields can also be used with a mask or respirator. If face shields are not used, a combination of mask and eye protection should be used whenever splashes, spray, or splatter of biohazardous agents may be generated and where eyes, nose, or mouth contamination can be reasonably anticipated.

Surgical Masks with liquid barriers - A surgical mask offers protection of the nose and mouth. Either soft or preformed masks are effective. Surgical masks protect the mucous membranes in the mouth and nose from splashes or splatters. Surgical masks do not protect against aerosols.

Goggles/Safety Glasses with side shields - Ordinary prescription glasses are not adequate eye protection. Plastic safety glasses with side shields that fit over regular glasses should be used. If there is a substantial hazard for splattering, safety goggles with a plastic cushion seal should be used. Goggles, which seal around your eyes, are preferred over safety glasses with side shields.

Respirators - A respirator protects the mouth and the respiratory tract from aerosols. Based on EH&S risk assessment, a respirator may be needed if aerosols are generated outside of appropriate containment.

Handling Infected Animals - Eye, face, and respiratory protection should be used in rooms containing infected animals as determined by the risk assessment. Molded surgical masks or respirators are worn in ABSL-3 rooms containing infected animals. Gloves are worn when handling infected animals and when there is potential skin contact with biohazardous agents.

Alternatives of facial barrier protection:

1) Use a BSC - Perform the manipulations in a Class II BSC.
2) Use a splash shield - Purchase or construct a splash shield that can be placed on the bench top to provide a physical barrier. A clear plastic shield provides an effective barrier for potential splashes from opening tubes. It is not effective for manipulations that create major aerosols. Such manipulations must be performed in a BSC.

5. Restrict Traffic in Laboratories

Traffic should be restricted in a BSL-1 laboratory. How that is enforced is at the discretion of the PI. However, this requirement must be enforced rigorously with respect to biohazards and recDNA in BSL-2, BSL-2 laboratories with BSL-3 practices, and BSL-3 laboratories. There is no research requiring BSL-4 containment at the UW.
a. Access to a BSL-2 laboratory is restricted - The door to the laboratory is closed and the BSL-2 Biohazard Warning Sign is displayed when use of biohazardous agents is in progress. The door to the laboratory is locked when unoccupied.

b. Access to BSL-2 laboratories and BSL-2 laboratories with BSL-3 practices is restricted - The door to the laboratory remains locked at all times and the BSL-2 with BSL-3 practices Biohazard Warning Sign is permanently affixed to the door.

c. Entry to BSL-3 laboratories is restricted by a double set of doors. The outer door of the BSL-3 laboratory is locked at all times and the Biohazard Warning Sign is permanently affixed to the door.

6. Biohazard Warning Door Sign

The sign must include the name of the agent(s) in use, and the name and phone number of the PI or other responsible personnel. See Appendix B for additional information on the use of the Biohazard Warning Sign.

7. Handwashing

Laboratory workers must wash their hands after handling biohazardous agents or animals, after removing gloves, and before leaving the laboratory area.


BSL-1 and BSL-2 laboratories must have access to a current copy of the UW Biosafety Manual by a prominently displayed icon on a computer desktop or a hard copy. BSL-2 laboratories with BSL-3 practices and BSL-3 laboratories must also have a laboratory specific biosafety manual with written standardized safety procedures that have been reviewed by an EH&S BSO.

9. Good Housekeeping

Work areas must be free of clutter and cleaned regularly. Wet mopping is the preferred method over dry sweeping or the use of ordinary vacuums which create aerosols.

Work surfaces are decontaminated once a day and after any spill of potentially viable material. Decontamination is covered in Section 4.E and spill cleanup is in Section 6.A of this manual.

10. Inventory Control

Laboratories should have a process for controlling inventory of infectious agents. All microorganisms stored in the lab should be documented and labeled. Any stocks or cultures that are not needed should be decontaminated and disposed of properly. If any Select Agents or Toxins are discovered, contact EH&S immediately for assistance.

11. Pest Control

Pest control is best accomplished by maintaining good housekeeping. A good sanitation program is fundamental to the control of vermin and should include a program of storage, collection, and disposal of solid wastes. Caulking of cracks and crevices in the room is also important.

The UW employs a licensed pest control operator to control vermin in strict accordance with applicable laws and regulations. Contact EH&S (206-543-7209) if vermin problems are suspected so that a control program can be implemented.
12. Biohazardous Waste

All biohazardous liquid or solid wastes are decontaminated before disposal. This includes waste from research with all forms of recDNA. **Sharps** containers must not be filled to more than two-thirds full. Decontamination is covered in Section 4.E and waste disposal is covered in Section 4.F.

13. Minimization of Aerosols

All procedures are performed carefully to minimize the creation of aerosols. Use BSCs or other physical containment devices whenever aerosol generating procedures at BSL-2 are conducted (e.g., pipetting, centrifuging, grinding, blending, shaking, mixing, sonicating, or opening containers of biohazardous agents).

In BSL-2 laboratories with BSL-3 practices and BSL-3 laboratories, open manipulations of all biohazardous agents must be conducted inside a BSC or other physical containment device.

C. LABORATORY EQUIPMENT AND PROCEDURES

This section describes the different types and proper use of laboratory safety equipment (e.g., BSCs, blenders, ultrasonic disintegrators, grinders, mortar and pestle, automated equipment, water baths, incubators, refrigerators, deep freeze, dry ice chests, vacuum lines, and microtome/cryostat).

This section further describes proper techniques used when working with biohazardous agents (e.g., pipetting; working outside a BSC; using syringes and needles; opening culture plates, test tubes, bottles, or ampoules; handling laboratory glassware; cell sorting; and centrifugation).

1. Laboratory Equipment

Equipment must be marked with the biohazard symbol or the word biohazard where it is necessary to alert personnel of the potential for exposure. Refer to Appendix B for additional labeling information.

Equipment which may be contaminated with blood or potentially infectious materials must be decontaminated prior to servicing. When a portion of the equipment cannot be decontaminated, the equipment must be labeled with the biohazard label and a sign stating which portion of the equipment remains contaminated. This information must be conveyed to all repair workers and servicing representatives and/or the manufacturer as necessary prior to handling, servicing, or shipping so that appropriate precautions can be taken.

Equipment being repaired, surplused, or disposed of must be decontaminated. A **Notice of Laboratory Equipment Decontamination** (Form UoW 1803) must be completed to certify decontamination.

The proper use of some commonly used laboratory equipment is described below.

a. BSC

The **BSC** is designed to reduce the potential escape of research material into the worker's environment and to remove contaminants from the research work zone.

The following types of Class II BSCs provide a clean work zone (product protection), aerosol protection for the operator (personnel protection), and environmental protection through use of a HEPA filter. HEPA filters are effective at trapping particulates and thus infectious agents. They do not capture volatile chemicals or gases. Only Type A2 exhausted or Types B1 and B2 BSCs exhausting to the outside should be used when
working with volatile toxic chemicals. In any case, amounts of these chemicals must be limited.

1) Equipment to protect the worker, product, and environment

Class II, Type A1 BSCs are suitable for work with low to moderate risk biological agents requiring BSL-1, BSL-2, or BSL-3 containment in the absence of volatile toxic chemicals and volatile radionuclides. The buildup of chemical vapors in the cabinet (by recirculated air) and in the laboratory (from exhaust air) could create health and safety hazards.

Class II, Type A2 BSCs (formerly designated Type B-3) are suitable for work with low to moderate risk biological agents requiring BSL-1, BSL-2, or BSL-3 containment. Minute quantities of volatile toxic chemicals or volatile radionuclides can be used in a Type A2 cabinet only if the cabinet exhausts to the outside via a properly functioning canopy connection.

Class II, Type B1 BSCs are suitable for work with biological agents requiring BSL-1, BSL-2, or BSL-3 containment. They may also be used with biological agents treated with toxic chemicals and trace amounts of radionuclides required as an adjunct to microbiological studies if work is done in the direct exhausted portion of the cabinet or if the chemicals or radionuclides will not interfere with work when recirculated in the downflow.

Class II, Type B2 BSCs are suitable for work with biological agents requiring BSL-1, BSL-2, or BSL-3 containment. They may also be used with biological agents treated with toxic chemicals and radionuclides required as an adjunct to microbiological studies. This type of cabinet is sometimes referred to as a “Total Exhaust Cabinet.”

2) Equipment that can be used to provide limited personnel protection but no product protection

A Class I BSC is similar to a fume hood in its basic design and personnel protection capabilities. This cabinet can be used for work at BSL-2 containment when minimal personnel protection and no product protection is required. The cabinet’s exhaust air is filtered through a HEPA filter. The filter provides a significant degree of environmental protection, which a fume hood does not offer.

3) Equipment that can be used to provide limited product protection and no personnel protection

**Non-ventilated tissue culture boxes** provide an air circulation free enclosure for sterile techniques. It provides no personnel protection and some product protection. Its use is limited to BSL-1 laboratories.

**Horizontal laminar flow units** provide a work area free of contaminants. The HEPA filtered air blows directly onto the operator so no personnel protection is provided. The use of this type of unit is limited to the preparation of sterile media, assembly of sterile components into complete units, the examination of sterilized equipment and materials for possible contamination, and other similar operations. Work with live agents is not permitted. “The equipment must be labeled "NOT for Use with Pathogenic Organisms."”

**Vertical laminar flow units** provide a work area free of contaminants. The HEPA filtered air does not blow directly on to the operator but is exhausted either from the top or bottom of the unit. The use of this type of unit is limited to the preparation of sterile media, assembly of sterile components into complete units, the examination of sterilized equipment and materials for possible contamination, and other similar
operations. The equipment must be labeled "NOT for Use with Pathogenic Organisms."

4) BSC certification

Equipment must be decontaminated prior to performance of maintenance work, repair, testing, moving, changing filters, changing work programs, and after gross spills. Decontamination can be done using paraformaldehyde. Contact EH&S at 206-543-9510 for information on decontamination.

The methods and requirements for testing BSCs vary depending upon the design of the cabinet and its intended use. While structural certification of the BSC is made by the manufacturer prior to shipment, stress during shipment can alter the integrity and efficiency of the BSC.

All research materials must be removed from the BSC prior to testing and certification. Plan and schedule in advance as the BSC cannot be used until certification is complete.

The University's IBC requires that all BSCs be tested and certified prior to initial use, relocation, after HEPA filters are changed, and at least annually.

The testing and certification process includes:

- A leak test to assure that the airflow plenums are gas tight in certain installations.
- A HEPA filter leak test to assure that the filter, the filter frame, and filter gaskets are all properly in place and free from leaks. A properly tested HEPA filter will provide a minimum efficiency of 99.99% on particles 0.3 microns in diameter and larger.
- Measurement of airflow to assure that velocity is uniform and unidirectional.
- Measurement and balance of intake and exhaust air.

Users must receive training prior to use of BSCs. This training is the responsibility of the PI.

5) Basic guidelines for working in a BSC

- Never place anything over the intake or rear exhaust grill. Keep equipment at least four inches inside the cabinet window and perform all transfer operations of viable material as deeply into the BSC as possible.
- Do not overload BSC with equipment and other items. Only bring in items needed for work.
- Plan in advance to have all required equipment inside the BSC. Good laboratory technique minimizes arm movements through the air barrier until the procedure is completed.
- During manipulations inside the BSC, segregate contaminated and clean items. Keep clean items out of the work area, and place discard containers to the rear of the BSC.
- Avoid entrance and exit from the workroom. Foot traffic can cause disruptive drafts that allow microorganisms to escape through the air barrier of the BSC.
• Equipment should be kept as parallel as possible to the downflow of the airstream.

• To purge airborne contaminants from the work area, allow the BSC to run following completion of work. The BSC can be turned off after 20 minutes but it is recommended that it be left on continuously.

• Decontaminate the BSC after use (see Section 4.E).

• Do not use an open flame Bunsen burner inside a BSC. If required, a touch-automatic burner or infrared loop sterilizer should be used. An open flame Bunsen burner disrupts the unidirectional air stream. The flame could damage the filter or set fire to the BSC when the BSC is turned off.

• Do not use the BSC for storage when not in use.

b. Blenders, ultrasonic disintegrators, grinders, mortar, and pestle

All of these devices release considerable aerosols during their operation. For maximum protection to the operator during the blending of biohazards, the following practices should be observed:

1) Operate blending, cell-disruption, and grinding equipment in a BSC.

Or

2) Use a heat-sealed flexible plastic film enclosure for a grinder or blender. The grinder or blender must be opened in a BSC.

c. Automated equipment

Clinical or other laboratory personnel handling human blood, non-human primate blood, and other biohazards should be aware of aerosols produced by the micro-hematocrit centrifuge, the autoanalyzer, and the microtonometer.

d. Water baths and incubators

After use, water baths and incubators must be decontaminated with an appropriate decontaminant (see Section 4.E).

Maintenance service on water baths and incubators that appear to be improperly used and/or contaminated may be denied. It is not the responsibility of maintenance personnel to clean up after laboratory personnel.

e. Refrigerators, deep freeze, and dry ice chests

Deep freezers, liquid nitrogen, dry ice chests, and refrigerators should be checked and cleaned out periodically to remove any broken ampoules, tubes, etc., containing biohazards.

Containers must be stored in proper order and sequence and properly labeled to preclude withdrawal of the wrong ampoules or tubes. Use of gloves and respiratory protection during cleaning of refrigerators, deep freeze or dry ice chests is recommended. All materials that are stored should be properly labeled with the scientific name, the date stored, and the name of the individual storing the material.

Flammable solutions that require 4 degree storage conditions must be stored in a refrigerator approved for flammable storage. Contact EH&S at 206-543-2835 or visit the EH&S page for additional information on flammable storage.

f. Laboratory vacuum lines

Appropriate in-line safety reservoirs and filters ensure that laboratory vacuum lines do not become contaminated with biohazardous agents. Aspirator bottles or suction flasks
Figure 1 Protecting Laboratory Vacuum Line

One method to protect a house vacuum system during aspiration of infectious fluids. The left suction flask (A) is used to collect the contaminated fluids into a suitable decontamination solution; the right flask (B) serves as a fluid overflow collection vessel. An in-line HEPA filter (C) is used to protect the vacuum system (D) from aerosolized microorganisms.

g. Using a Microtome/Cryostat

The microtome and the cryostat are used for cutting thin sections of fixed and unfixed tissue. The use of microtomes and cryostats in the laboratory presents a laceration hazard in addition to generating potentially infectious aerosols. Unfixed tissues should be considered capable of causing infection and should be treated with care. Employees who handle or could be exposed to tissue of human origin must be enrolled in the UW BBP Program (Appendix A).

Observe the following procedures when using microtomes/cryostats:

1) Always keep hands away from blades.
2) Position the sample first and then put in the blade with the blade edge positioned away from hands.
3) Use engineering controls like forceps, tweezers, dissecting probes, and small brushes to retrieve samples, change blades, dislodge blocks, or clean equipment.
4) Use protectors/guards for knife-edges that may extend beyond the microtome knife holder.
5) Wear appropriate personal protective equipment (PPE) such as gloves, lab coat or gown, mask, and safety glasses or goggles. Consider the use of surgical grade Kevlar gloves when using a cryostat to provide additional protection from cuts and scrapes.

6) Do not leave motorized microtomes running unattended.

7) Discard and handle trimmings and sections of tissue as biohazardous waste.

8) Do not move or transport a microtome with the knife in position.

9) Always lock the chuck rotating mechanism (wheel) to immobilize the block when not actively cutting tissue and before insertion or removal of the blade.

10) Never walk away from an exposed blade.

11) At the end of each session with the microtome or cryostat, either dispose of the blade immediately in a sharps container or secure reusable blades in a container.

2. Laboratory Procedures

a. Pipetting

Delivery with the tip of the pipette resting against the container allows the fluid to flow down the surface and minimizes aerosols.

Allowing a droplet to fall from the tip of a pipette, intentionally or accidentally, results in aerosol production, the extent of which depends on the height of the fall and the surface upon which the droplet lands. The following procedures should be followed for pipetting:

1) Mouth pipetting is strictly prohibited. Mechanical pipetting aids must be used.

2) Infectious mixtures should not be prepared by bubbling air through the liquid with the pipette.

3) Infectious materials should not be forcibly discharged from pipettes (e.g., the last drop forcefully removed).

4) A towel wetted with disinfectant or a soft absorbent pad covering the immediate work surface is most useful in absorbing droplets and small spills.

b. Working Outside a BSC Using a Splash Guard and/or Additional PPE

In cases where the biohazardous agent is not transmitted via a route of inhalation (e.g., opening tubes containing blood or body fluids), it is permissible to work outside a BSC using a splash guard. A splash guard is an example of a barrier type engineering control that protects by providing a shield between the user and any activity that could cause an aerosol or splatter. An example of such a splash guard is a simple clear plastic panel formed to stand on its own and provide a barrier between the user and activities such as opening tubes that contain blood or other potentially infectious materials (OPIMs). Additional PPE (e.g., safety goggles, glasses, face shield) may be required for splash protection when working with biohazardous materials outside a BSC.

c. Using Syringes and Needles

Extreme caution should be used to avoid accidental injection and the generation of aerosols during use and disposal. Use syringes and needles only for injection and aspiration of fluid from laboratory animals and diaphragm bottles.

1) Do not use a syringe and needle as a substitute for a pipette when making dilutions of fluids. Syringe type pipettes with blunt ended delivery are permissible.
2) Use needle locking syringes or disposable syringe-needle units in which the needle is an integral part of the syringe.

3) Prior to beginning an animal inoculation, be sure the animal is properly restrained. Swab the site of the injection with a suitable disinfectant. Inoculate the animal with a hand behind the needle to avoid punctures. Swab the injection site again with a suitable disinfectant.

4) Following use, needles should not be bent, sheared, replaced in the sheath or guard (capped), or removed from the syringe. The needle and syringe unit should promptly be placed in a leak-proof, rigid, puncture, and break resistant sharps container. The container is red in color and equipped with a tight fitting lid for use during handling and transport. The container must be decontaminated by autoclaving before discarding. Additional information on waste disposal is found in Section 4.F.

d. Opening Culture Plates, Tubes, Bottles, and Ampoules

Aerosol formation is the primary concern when plugs or screw caps are removed from tubes and bottles. Slow and smooth manipulations will minimize aerosols. See Section 4.B.4.c Facial Protection for additional information.

Opening ampoules is potentially hazardous since, after the seal is broken, the air rushes in causing the dry contents to be dispersed. A BSC should be used. The bottom of the ampoule should be held in several layers of lab wipes to protect the hands. Nick the neck of the ampoule with a file. A hot glass rod should be carefully applied to the mark. The glass will crack, allowing air to enter the ampoule and equalize the pressure. After a few seconds the ampoule should be wrapped in a few layers of lab wipes and broken along the crack.

An alternative method of opening an ampoule involves wearing gloves and other PPE, nicking the ampoule with a file, and wrapping the ampoule in disinfectant-wetted cotton for breaking.

In both methods the ampoule neck and other waste is handled as biohazardous sharps waste. Additional information on Waste Disposal is found in Section 4.F.

e. Using Test Tubes and Other Laboratory Glassware

Tubes containing biohazards should be manipulated with extreme care. Studies have shown that simple procedures such as removing the tube cap or transferring an inoculant can create a potentially hazardous aerosol. Tubes and racks of tubes containing biohazards should be clearly marked with agent identification.

Safety test tube trays should be used in place of conventional test tube racks to minimize spillage from broken tubes. A safety test tube tray is one that has a solid bottom and sides that are deep enough to hold all liquids if a tube should break.

Glassware breakage is a major risk for puncture infections. It is most important to use non-breakable containers where possible and carefully handle the material. Avoid unnecessary use of glass Pasteur pipettes. Whenever possible, use flexible plastic pipettes or other alternatives.

It is the responsibility of the PI and/or laboratory manager to assure that all glassware/plasticware is properly decontaminated prior to washing or disposal. See Section 4.E for additional information on decontamination.

For disposal recommendations see Section 4.F.
f. **Cell Sorting**

Clinical or other laboratories handling human blood, non-human primate blood, recDNA, and other biohazardous agents should be aware of aerosols produced by the cell sorter. High-speed cell sorting can produce aerosols that may present a health hazard to workers. To help ensure the safety of staff, the following additional safety measures are used:

1) Engineering controls, that may include an Aerosol Management System (AMS) that rapidly evacuates and filters aerosolized particles from the cell sorter chamber.

2) Safe practices, that may include additional PPE and training, are unique to each UW facility and must be followed as specified in the cell sorter core facility Manual of Standard Operating Procedures (SOPs).

3) EH&S and IBC approval may be required prior to sorting specific cell types, (e.g., all human cells including human cell lines, cells containing recDNA, cells exposed to virus or bacteria). Contact EH&S ROS for more information, ehsbio@uw.edu, 206-221-7770.

g. **Centrifugation**

Accidents resulting from the improper use of centrifuges and associated equipment occur less frequently than from the use of pipettes, syringes, and needles. However, if accidents do occur, aerosols are created and the possibility of causing multiple infections is considerably greater.

A mechanical failure (broken drive shaft, a faulty bearing, or a disintegrated rotor) can produce not only aerosols, but also hazardous fragments at great velocity. These fragments, if they escape the protective bowl of the centrifuge, could produce traumatic injury to personnel. Risk of mechanical failure can be minimized by meticulous observance of the manufacturer’s instructions.

Even a well-functioning centrifuge is capable of producing biohazardous aerosols. However, aerosols can be avoided by observing sound laboratory practices and using appropriate centrifuge safety equipment and containment cabinets as described below. Centrifugation of biohazardous agents including recDNA should be:

1) Performed in a centrifuge that is contained within a BSC

or

2) If no such centrifuge is available, an aerosol containment device must be used. Aerosol containment devices include centrifuge sealed rotor heads or sealed safety cups.

Activities such as filling centrifuge tubes, removing cotton plugs and rubber caps on tubes after centrifugation, removing the supernatant, and resuspending the pellet can release aerosols into the environment. Centrifuge tubes and bottles should be filled and opened in a BSC. Do not fill tubes to the point that the rim of the closure becomes wet with culture. Special attention needs to be given when filling tubes to be placed in a fixed angle centrifuge.
Screw caps, or other tight-fitting skirted caps that fit outside the rim of the centrifuge tube, are safer to use than plug-in closures. Some fluid usually collects between a plug-in closure and the rim of the tube. Even screw capped bottles are not without risk; if the rim is soiled and seals imperfectly, some fluid will escape down the outside of the tubes. Aluminum foil should never be used to cap centrifuge tubes containing toxic or biohazards because these light-weight caps often become detached or ruptured during handling and centrifuging. When centrifuging biohazards, including clinical specimens, do not use cotton plugs. Instead, use tight-fitting tabbed or hinged caps made of plastic or rubber, screw caps, or other tight-fitting plastic or metal closures.

The aerosol containment device must be removed from the centrifuge and opened in the BSC. These devices often have clear tops to alert the operator to problems such as broken or leaking tubes prior to opening.

The greatest hazard associated with centrifuging biohazards is created when a centrifuge tube breaks. Avoid use of glass centrifuge tubes. Plastic tubes and bottles are a better option than glass centrifuge tubes because they resist breakage. However, they are not indestructible. Plastic containers may begin to show signs of deterioration after several runs as a result of the interaction of centrifugal forces, chemical effects from samples and cleaning solutions, and autoclaving cycles of heat and pressure. Deterioration may appear as crazing, cracking, or spotting. Tubes showing these signs should be used only at low speeds, used as storage containers, or discarded. Some plastics are subject to chemical interaction with samples being processed. For complete specific information, the PI/lab manager should refer to the material compatibility data provided by the manufacturers of the centrifuge equipment.

Proper balancing of the centrifuge is important. Care must be taken to ensure that matched sets of safety devices and adapters do not become mixed. If the components are not inscribed with their weights by the manufacturer, colored stains can be applied for identification to avoid confusion. The basic concern is that the center of gravity of the
tubes is equidistant from the axis of rotation. To illustrate the importance of this, two identical tubes containing 20 g of mercury and 20 g of water, respectively, will balance perfectly on the scales; however, their performance in motion is totally different, leading to violent vibration with all its attendant hazards.

Cleaning and disinfection of tubes, aerosol containment devices, rotors, and other components require considerable care. It is unfortunate that no single process is suitable for all items. The various manufacturers’ recommendations must be followed meticulously if fatigue, distortion, and corrosion are to be avoided. All components, including the sealing gaskets, must be inspected periodically for wear. When problems are noted, the components must be replaced.

In the event of a centrifuge malfunction and/or spill that may create hazardous aerosols, the room should be vacated by all personnel for a suitable period to allow the aerosol to dissipate (at least 30 minutes). Contaminated areas, broken glass, etc. should then be properly decontaminated and cleaned up promptly. The person using the centrifuge, along with the PI and/or laboratory manager, are responsible for ensuring that clean-up and decontamination is achieved.

Maintenance service may be refused on centrifuges which appear to be improperly used and/or contaminated. It is not the responsibility of maintenance personnel to clean up after laboratory personnel.

h. Resuspending Sediment of Centrifuged Material

Use a swirling, rotary motion, rather than shaking, to resuspend the sediment of packed biohazardous materials. This motion is preferred in order to minimize the amount of aerosol created. When performing these operations, a BSC may be required to assure the safety of the laboratory worker. If vigorous shaking is essential to suspend the material or achieve homogeneity, a few minutes should elapse before opening the container to allow the aerosol to settle. Shaking always contaminates the closure and there is the added hazard of liquid escaping and running down the outside of the container or dropping from the closure when it is removed.

D. CONTROL OF BIOHAZARDS ASSOCIATED WITH LABORATORY ANIMALS

1. Responsibility

Procedures designed to prevent exposure to or transmission of biohazards from laboratory animals to human beings must be taken into account. Both naturally occurring diseases of laboratory animals transmissible to humans and experimentally induced disease, which may be harmful to humans, must be considered. The ultimate responsibility for reducing or eliminating such risks lies with the PI.

Programs for the safe handling and ultimate disposition of potentially contaminated animals and animal wastes must protect the health and well-being of the employee, maintain the integrity of the experimental program, and minimize the hazard to non-program personnel or animals in adjacent areas. Such programs are based on an understanding of the hazard potential involved in working with animals. Procedures, equipment, and facilities must be selected to minimize or eliminate such risks. A carefully conceived animal care program and properly designed animal facility are necessary to reduce biohazard exposure in animal facilities. Definitive procedures that encompass all potential exposure possibilities are beyond the scope of this document.
PIs are responsible for providing specific information to their personnel concerning the biohazardous agent involved (carcinogen, radioactive isotope, etc.), its host range, the ability of experimentally infected animals to infect non-exposed animals or to excrete the agent in urine or feces, special caging or animal isolation requirements, the need to autoclave isolation cages and their content prior to processing, and the selection and use of appropriate PPE.

2. Animal Blood and Blood Products

This section describes how to work safely with non-human primate and animal (non-primate) blood, body fluids, tissues, and cell lines.


Investigators working with non-human primates or non-human primate blood, body fluids, tissues, and cell lines should be concerned about safe-handling because of the extreme severity of some of the agents that primates can harbor without showing any clinical disease. Some of the agents that can result in fatal infections in humans are Macacine herpesvirus 1, Marburg virus, and *Shigella* spp. A significant proportion of monkeys have latent shigellosis and about 65% of Macaca spp. have antibodies to Macacine herpesvirus 1.

In addition, in September 1992, the CDC reported that two laboratory workers seroconverted following occupational exposure to simian immunodeficiency virus (SIV), a lentivirus that causes acquired immunodeficiency syndrome (AIDS)-like illnesses in susceptible Macaca spp.

The same blood and body fluid precautions used for humans (Appendix A) must consistently observed with all specimens from non-human primates. All laboratory personnel must be familiar with these precautions prior to working with primate body fluids.

b. Animal (non-primate) Blood, Body Fluids and Tissues, and Cell Lines

Non-primates generally present a less immediate hazard potential than do primates. However, bats, dogs, cats, rabbits, rats, mice, etc. can carry microorganisms that are infectious to humans. In particular, animals acquired from unregulated sources must be considered a potential source of infection. For example, dogs and cats can carry rabies. Other infectious agents may be present without producing clinical illness in the animal. Generally, the same good laboratory practices used when working with primate source materials are followed when working with non-primate blood, body fluids, and tissue.

3. Animal Biosafety Levels and Vivarium Research Facilities

As a general principle, the biosafety level (facilities, practices, and operational requirements) recommended for working with biohazardous agents *in vivo* and *in vitro* are comparable. All facility requirements discussed for biosafety laboratories in Section 4.A.3 apply to research with animals as well. The animal room can present unique problems. The activities of the animals themselves can present special hazards not found in standard microbiological research laboratories. Animals may generate aerosols, they may bite and scratch, and they may be infected with a zoonotic agent. All additional animal facility SOPs must be followed.

The Animal Biosafety Levels 1-4 in *NIH Guidelines: Appendix G* and *BMBL*, describe in detail the animal facilities and practices applicable to work with animals that have been infected with agents assigned to Biosafety Levels 1-4. These four biosafety combinations provide increasing levels of protection to research staff and to the environment, and are recommended as minimal standards for activities involving infected laboratory animals. There is no research requiring ABSL-4 containment at the UW.
Existing standards and regulations govern animal facilities, operational practices, and the quality of animal care. These standards and regulations are beyond the scope of this manual. Additional information on those aspects of animal facilities is available from the IACUC.

Animals that have received a biohazardous agent should be housed in separate animal rooms, preferably in limited access rooms on a separate ventilation system. Animal room doors, as well as individual cages, should be conspicuously labeled with information regarding the agent used, date of exposure, the biohazard symbol, and the names and telephone numbers of the PI and responsible technician.


The following work practices and engineering controls apply in addition to the biosafety practices discussed in Section 4.B of this manual. **BMBL: Section V. Table 3** provides a summary of recommended animal biosafety levels for activities in which experimentally or naturally infected vertebrate animals are used.

a. Gloves - Personnel who handle animals must wear gloves appropriate for the task. Hands must be washed after gloves are removed.

b. Additional PPE - Personnel handling animals that have received biohazardous agents must wear a face mask, gloves, and gown or other appropriate PPE.

c. Animal cages - Animals that are infected with a biohazardous agent are isolated within specific barriers such as filter-top cages, isolation racks, or ventilated racks. In all of these systems, the effectiveness of the barrier is determined by its design and the personnel using it. Thus, employee training is of paramount importance.

d. Transport of animals - Extreme care must be taken in transferring animals from biohazard animal rooms to laboratories or other facilities. Personnel should wear proper masks, gloves, gowns, caps, and footwear. The animal must be in a sealed container (or filter-top cage) and transport equipment must be sanitized or sterilized immediately after transport.

e. Necropsy - Postmortem dissection or necropsy is often performed on laboratory animals. Personnel conducting necropsies must wear appropriate PPE.

Post-mortem examinations of small animals exposed to biohazards should be conducted in Class II BSCs when possible. If such equipment is not available, extreme care must be taken to guard against the creation of aerosols and the contamination of conventional necropsy facilities.

The necropsy table should be stainless steel and have suitable flushing devices.

Appropriate disinfectant should be used to completely and thoroughly disinfect all instruments and working surfaces that come into contact with animal tissues.

f. Perfusions - Perfusions of animals infected with biohazardous agents must be performed in a fume hood or a non-recirculating BSC.

5. Occupational Health Program

All employees assigned to animal facilities, or having significant contact with animals or potentially contaminated animal wastes, should have pre-employment and periodic medical examinations. This service is provided by Employee Health Services.

The Animal Use Medical Screening (AUMS) program is a component of the UW’s animal use Occupational Health and Safety Program required by Federal authorities. For more information on the UW AUMS program refer to Section 5 of this manual.
6. Pest Control Program

The University provides a pest control program to control or eliminate crawling and flying insects, wild rodents, or similar pests. All pest associated breeding sites should be sealed or eliminated. Pesticides or traps are to be used as appropriate in conjunction with a strict program of sanitary maintenance. To prevent toxic effects and possible interference with experimental procedures, pesticides (including insecticide-impregnated plastics) must be administered by a licensed professional. Contact EH&S Public Health at 206-616-1623 or 206-543-7209 concerning pest control issues.

7. Animal Waste Handling Procedures

Animal waste collection and disposal should be scheduled on a regular and timely basis. When storage of animal waste is required, the area selected should be physically separate from other storage facilities and free of insects and rodents. Refrigerated storage facilities are recommended when waste must be held in excess of four to six hours.

a. Disposal of Animal Carcasses and Body Parts

Animal carcasses and animal body parts are a type of biological waste that requires special handling depending on whether it is radioactive, infectious, or non-hazardous. Procedures may also vary depending on location. Consult the location specific Biohazardous Waste Flow Charts for your location to determine how to dispose of animal carcasses and parts.

b. Disposal of Animal Blood and Blood Products

Animal blood and blood products and animal waste/bedding from animals infected with recDNA or other biohazardous agents are handled as biomedical waste that can be chemically decontaminated or autoclaved according to established guidelines prior to disposal. The Biohazardous Waste Flow Charts describe the process. In particular, blood, blood products, tissue, and tissue suspension, including blood contaminated items, must be decontaminated prior to disposal. Exempted are small amounts of non-primate blood, which can be flushed down sink drains without chemical treatment.

Additional information on waste disposal is found in Section 4.F.

E. DECONTAMINATION

1. Introduction

The primary target of decontamination is the microorganism that is under active investigation. Laboratory preparations of infectious agents usually have titers grossly in excess of those normally observed in nature. The decontamination of these high-titer materials presents certain problems.

Maintenance systems for bacteria or viruses are specifically selected to preserve the viability of the agent. Agar, proteinaceous nutrients, and cellular materials can be extremely effective in physically retarding or chemically binding active moieties of chemical decontaminants. Such interference with the desired action of decontaminants may require the use of decontaminant concentrations and contact times in excess of those shown to be effective in the test tube.

Similarly, a major portion of decontaminant contact time required to achieve a given level of agent inactivation may be expended in inactivating a relatively small number of the more resistant members of the population. The current state of the art provides little information on which to predict the probable virulence of these survivors. These problems are, however,
2. **Resistance**

Microorganisms exhibit a range of resistance to chemical decontaminants. In terms of practical decontamination, most vegetative bacteria, fungi, and lipid-containing viruses are relatively susceptible to chemical decontamination. The non-lipid-containing viruses and bacteria with a waxy coating such as tubercle bacillus occupy a mid-range of resistance. Bacterial spores are the most resistant.

The relative resistance to the action of chemical decontaminants can be substantially altered by factors such as concentration of active ingredient, duration of contact, pH, temperature, humidity, and presence of extrinsic organic matter. Depending upon how these factors are manipulated, the degree of success achieved with chemical decontaminants may range from minimal inactivation of target microorganisms to an indicated sterility, within the limits of sensitivity of the assay systems employed.

3. **Ineffectiveness**

Ineffectiveness of a decontaminant is due primarily to the failure to contact the microorganisms rather than failure of the decontaminant to act. If an item is placed in a liquid decontaminant, the item becomes covered with tiny bubbles. The area under the bubbles is dry, and microorganisms in these dry areas will not be affected by the decontaminant. If there are spots of grease, rust, or dirt on the object, microorganisms under these protective coatings will also not be contacted by the decontaminant. Scrubbing an item when immersed in a decontaminant is helpful.

4. **Residual Action**

Many chemical decontaminants have residual properties that may be considered a desirable feature in terms of aiding in the control of background contamination. However, consider residual properties carefully. Ethylene oxide can leave residues which cause skin irritation. In a concentrated form, phenol readily penetrates the skin and causes severe burns. Animal cell cultures, as well as viruses of interest, are also inhibited or inactivated by decontaminants persisting after routine cleaning procedures. Therefore, reusable items that are routinely held in liquid decontaminants prior to autoclaving and cleaning require careful selection of detergents for washing and must be thoroughly rinsed.

5. **Exposure Time**

Specific exposure times for the decontamination of soiled items by autoclaving, dry heat, or chemical decontaminants cannot be specifically stated. The volume of material treated, its contamination level, the soil load and type(s), moisture content, and other factors all play a role in the inactivation rate of microorganisms.

Inactivation of microorganisms by chemical decontaminants may be achieved in one or more of the following ways:

- Coagulation and denaturation of protein
- Lysis
c. Binding to enzymes, inactivation of an essential enzyme by binding, or destruction of enzyme substrate

d. Oxidation

Dozens of decontaminants are available under a wide variety of trade names. Table 2 provides information on commonly used laboratory decontaminants. A decontaminant selected on the basis of its effectiveness against microorganisms on any range of the resistance scale will be effective against microorganisms lower on the scale. Therefore, if decontaminants that effectively control spores are selected for routine laboratory decontamination, it can be assumed that any other microorganisms generated by laboratory operations, even in high concentrations, would also be inactivated.

Practical concentrations and contact times that may differ markedly from the recommendations of manufacturers of proprietary products are suggested. It has been assumed that microorganisms will be afforded a high degree of potential protection by organic matter in the material being decontaminated. It has not been assumed that a sterile state will result from application of the indicated concentrations and contact times.

It should be emphasized that these data are only indicative of efficacy under artificial test conditions. The efficacy of any of the decontaminants should be conclusively determined by individual PIs. It is readily evident that each of the decontaminants has a range of advantages and disadvantages as well as a range of potential for inactivation of a diverse microflora. Equally evident is the need for compromise as an alternative to maintaining a veritable "drug store" of decontaminants.

To assist in the selection of an appropriate decontaminant, consider the answers to the following questions:

- What is the target microorganism(s)?
- What decontaminants, in what form, are known to, or can be expected to, inactivate the target microorganism(s)?
- What degree of inactivation is required?
- Is the situation complicated by the presence of organic matter such as blood, agar, etc.?
- What types of surfaces are being targeted: solid or porous and/or airborne?
- What is the highest concentration of cells anticipated to be encountered?
- Can the decontaminant, either as an aqueous solution, a vapor, or a gas, reasonably be expected to contact the microorganisms and can effective duration of contact be maintained?
- What restrictions apply with respect to compatibility of materials?
- Do the anticipated procedures require immediate availability of an effective concentration of the decontaminant or will sufficient time be available for preparation of the working concentration shortly before its anticipated use?
- Will the toxicity of the decontaminant harm the researcher or other workers in the area?

Several terms are used when discussing decontamination. Sterilization refers to methods that destroy all forms of microbial life. Disinfection refers to methods that remove or destroy pathogens. It is important that the distinction between the two terms be understood. Sanitization refers to methods that reduce the level of microorganisms. Additionally, it is useful
to know that the ending "cide" (as in "bactericide") refers to killing, while the ending "stat" (as in "bacteriostat") refers to inhibiting growth.
### Table 1: Summary of Practical Laboratory Decontaminants

<table>
<thead>
<tr>
<th>Chemical Decontaminants</th>
<th>Concentrations</th>
<th>Contact Time</th>
<th>Agents Inactivated</th>
<th>Characteristics</th>
<th>Potential Uses</th>
<th>Common Trade Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Ingredient Concentration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorine Compounds</td>
<td>5250 ppm</td>
<td>30</td>
<td>XXXX X X X X X X X</td>
<td>No</td>
<td>YY Y Y Y Y Y U U U U U</td>
<td>Bleach</td>
</tr>
<tr>
<td>Iodophor</td>
<td>75-750 ppm</td>
<td>30</td>
<td>XXXX X X X X X X</td>
<td>Y Y Y Y Y Y Y Y U U U U U U</td>
<td>Wescodyne, Biocide</td>
<td></td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>1-8%</td>
<td>30</td>
<td>XXXX X X X X X</td>
<td>- Y Y Y Y Y Y Y Y U U U U U</td>
<td>Staphene, Amphyl</td>
<td></td>
</tr>
<tr>
<td>Ethyl Alcohol</td>
<td>85%</td>
<td>N.E.</td>
<td>10 X X X X X X X</td>
<td>- Y Y Y Y Y Y Y Y U U U U U</td>
<td>Formalin</td>
<td></td>
</tr>
<tr>
<td>Isopropyl Alcohol</td>
<td>70%</td>
<td>N.E.</td>
<td>10 X X X X X X X</td>
<td>Y Y Y Y Y Y Y Y U U U U U</td>
<td>Megasol</td>
<td></td>
</tr>
<tr>
<td>Phenolic compounds</td>
<td>2%</td>
<td>N.E.</td>
<td>10 X X X X X X X</td>
<td>Y Y Y Y Y Y Y Y U U U U U</td>
<td>Liquid or Vapor</td>
<td></td>
</tr>
<tr>
<td>Quaternary ammonium compounds</td>
<td>2%</td>
<td>N.E.</td>
<td>10 X X X X X X X</td>
<td>Y Y Y Y Y Y Y Y U U U U U</td>
<td>Cidex, Procide, Metricide</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Peroxide</td>
<td>3-6%</td>
<td>30</td>
<td>XXXX X X X X X X</td>
<td>Y Y Y Y Y Y Y Y U U U U U</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Glutaraldehyde</td>
<td>0.02</td>
<td>30</td>
<td>XXXX X X X X X X</td>
<td>Y FT Y Y Y Y Y Y U U U U U</td>
<td>Ethylene Oxide</td>
<td></td>
</tr>
<tr>
<td>Peracetic Acid</td>
<td>0.02</td>
<td>30</td>
<td>XXXX X X X X X X</td>
<td>FT Y Y Y Y Y Y Y Y U U U U U</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Ethylene Oxide 1</td>
<td>45 gram/liter</td>
<td>60</td>
<td>XXXX X X X X X X</td>
<td>FT N/A Y Y Y Y Y Y U U U U U</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Paraformaldehyde 2</td>
<td>3 gram/ cu. ft</td>
<td>60</td>
<td>XXXX X X X X X X</td>
<td>N/A Y Y Y Y Y Y Y Y U U U U U</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

**N.E.** = NOT EFFECTIVE
**FT** = REQUIRES FURTHER TESTING
**N/A** = NOT APPLICABLE

1. **REQUIRES TEMPERATURES OF 37°F AND 30% RELATIVE HUMIDITY**
2. **REQUIRES TEMPERATURES OF 23°C AND > 60% RELATIVE HUMIDITY**
3. **XX = GOOD**
4. **Y = HAS INDICATED CHARACTERISTICS.**
5. **U = POTENTIAL USE**

**SEE MSDS**
6. Sterilization

a. **Wet Heat (Autoclave or Steam Sterilizer)**

The use of an autoclave or steam sterilizer is the preferred method for treating biohazardous waste as well as decontaminating labware. See Section 4.F.5 for additional information on autoclaving.

b. **Dry Heat**

The use of dry heat for the decontamination of biohazardous materials and contaminated items is less efficient than autoclaving and requires a longer exposure time with higher temperature. It may be possible to decontaminate materials or soiled items by exposing them to $160^\circ\text{C} (320^\circ\text{F})$ for four hours. This is suitable for destruction of viable agents on impermeable non-organic material such as glass but is not reliable in even shallow layers of organic material that can act as insulation. If items are heat sensitive, a temperature of $120^\circ\text{C} (248^\circ\text{F})$ can be used and the exposure time necessary for decontamination is usually greater than 24 hours.

The use of biological indicators with dry heat is necessary to determine the most effective temperature and/or exposure time for decontamination of materials or equipment. The proper organism to use for challenging a gas or dry heat sterilization process is *Bacillus subtilis var*. The test protocol used is found above (under wet heat) except that the spore strips are incubated at $370^\circ\text{C}$ according to manufacturer's instructions.

c. **Chemical Sterilant**

In the laboratory, chemical decontamination is necessary because the use of pressurized steam, the most rapid and reliable method of sterilization, is not normally feasible for decontaminating large spaces, surfaces, and stationary equipment. Moreover, high temperatures and moisture will damage delicate instruments.

1) **Ethylene Oxide**

Ethylene oxide is not a practical decontaminant in most laboratory settings due to the potential toxic exposure to the worker. Ethylene oxide is used in hospital sterilizers for sterilizing heat sensitive equipment. The sterilizers are provided with dedicated ventilation canopies and monitoring equipment.

2) **Paraformaldehyde and Formaldehyde Gas**

Formaldehyde gas can be liberated by heating paraformaldehyde to depolymerize it. This vapor is an effective space decontaminant for decontaminating biological safety cabinets, rooms or buildings, but in the vapor state with water, it tends to polymerize on surfaces and form paraformaldehyde, which remains persistent.

In the absence of high moisture content in the air, formaldehyde released in the gaseous state forms fewer polymerized residues on surfaces and less time is required to clear treated areas of fumes than formaldehyde released in the vapor state.

The pungent, irritating odors and its classification as a potential cancer hazard limit the use of formaldehyde in the laboratory. Refer to the *UW Laboratory Safety Manual* for information on chemical hazards.

3) **Glutaraldehyde**

In the past, 1%-2% solutions of glutaraldehyde have been used as cold sterilants on instruments that could not be heated. These solutions are being replaced by peratic acid solutions due to concerns about the toxicity of the glutaraldehydes.
7. Disinfection

The following chemical decontaminants are recommended when attempting to chemically disinfect materials. Disinfection is defined as destroying certain pathogens.

a. Halogens

The halogens (chlorine, iodine, bromine, and fluorine) will rapidly kill bacterial spores, viruses, rickettsiae, and fungi. These decontaminants are effective over a wide range of temperatures. In fact, chlorine has been shown to be effective at -400°F. (On the other hand, phenols and formaldehyde have high temperature coefficients.) The halogens have several undesirable features. They readily combine with protein, so that an excess of the halogen must be used if proteins are present. The halogens are relatively unstable so that fresh solutions must be prepared. The frequency of preparation is discussed below. Finally, the halogens corrode metals. A number of manufacturers of decontaminants have treated the halogens to remove some of the undesirable features. For example, sodium hypochlorite reacts with paratoluensulfonamide to form Chloramine T, and iodine reacts with certain surface-active agents to form the popular iodophors. These “tamed” halogens are stable, non-toxic, odorless, and relatively noncorrosive to metals. However, the halogens are highly reactive elements and, because they are reactive, they are good germicides. When a halogen acts as a decontaminant, free halogen is the effective agent. Raising the pH or combining the halogen with other compounds to decrease the corrosive effect also decreases the decontaminating effect of a halogen.

1) Chlorine

This halogen is a universal decontaminant that is active against all microorganisms, including bacterial spores. Chlorine combines with protein and rapidly decreases in concentration in its presence. Free, available chlorine is an active element. It is a strong oxidizing agent and corrosive to metals. Chlorine solutions will gradually lose strength so that fresh solutions must be prepared unless the free available chlorine in the solution is checked. Currently, there are no practical means of verifying the level of free available chlorine at the level used in the laboratory. Sodium hypochlorite is usually used as a base for chlorine decontaminants and is more stable than other forms of chlorine. An excellent decontaminant can be prepared from household or laundry bleach. These bleaches usually contain 5.25% available chlorine or 52,500 ppm. If they are diluted one to ten, the solution will contain 5,250 ppm of available chlorine. Diluting household bleach (sodium hypochlorite) with water produces a solution with lower pH and more free available chlorine. This solution is appropriate for sanitizing items or surfaces with high levels of organic matter. A one to 100 dilution with 525 ppm of available chlorine is appropriate for sanitizing items or surfaces with low levels of organic matter.

Bleach must never be mixed with ammonia or hydrochloric acid containing cleaners because toxic fumes are created.

2) Iodine

The characteristics of chlorine and iodine are similar. One of the most popular groups of decontaminants used in the laboratory is the iodophors; Wescodyne is perhaps the most popular. The dilution range of Wescodyne recommended by the manufacturer is one ounce in five gallons of water (which yields 25 ppm of available iodine) to three ounces in five gallons (which yields 75 ppm. At 75 ppm, the concentration of free iodine is .0075%. This small amount can be rapidly taken up by any extraneous protein present. Clean surfaces or clear water can be effectively treated by 75 ppm
available iodine. However, difficulties may be experienced if any appreciable amount of protein is present. For bacterial spores, a dilution of one to 40 (which yields 750 ppm) is recommended by the manufacturer. There are test strips available commercially to verify the strength of available iodine in the range of 25-75 ppm. These strips can be used in verifying the stability of prepared solutions.

b. Formalin
Formaldehyde for use as a decontaminant is usually marketed as a 37% solution referred to as formalin. Formaldehyde in a concentration of 5% active ingredient is an effective liquid decontaminant. It loses considerable activity at refrigeration temperatures.

Formalin has many of the same hazards mentioned for paraformaldehyde.

c. Hydrogen Peroxide and Peracetic Acid
Both are fast acting and effective. They are useful in the decontamination of medical instruments when used in specially designed washing units.

Additional information on decontaminants can be found in "Disinfection, Sterilization and Preservation" by S.S. Block (4th edition).

8. Sanitization
Sanitization refers to reducing the level of microorganisms present.

a. Alcohol
Ethyl or isopropyl alcohol in a concentration of 70-80% by weight is often used. Alcohols denature proteins and are somewhat slow in their action. However, they are effective decontaminants against mycobacterium and lipid-containing viruses; they are not effective for viruses such as Hepatitis B, spore forming bacteria, or the vegetative form of some gram negative organisms.

One of the disadvantages of the use of alcohols is their flammability. They should not be used in operations which require the use of an open flame.

b. Quaternary Ammonium Compounds or Quats
These compounds are not effective against gram negative organisms. Quats are cationic detergents, strongly surface-active, and effective against viruses containing lipids. Quats will attach to protein so that dilute solutions of quats will quickly lose effectiveness in the presence of proteins. Quats tend to clump microorganisms and are neutralized by anionic detergents such as soap. Quats have the advantages of being non-toxic, odorless, nonstaining, non-corrosive to metals, stable, and inexpensive.

c. Phenolic Compounds
Although phenol itself may not be in widespread use, phenol homologs and phenolic compounds are basic to a number of popular decontaminants. The phenolic compounds are effective decontaminants against some viruses, rickettsiae, fungi, and vegetative bacteria. The phenolics are not effective in ordinary usage against bacterial spores.

d. UV Light
UV (ultra-violet) light has limited effectiveness as an air decontaminant. It should never be relied upon to provide sole decontamination of surfaces. Additional surface decontamination with a chemical decontaminant is always warranted. UV lamps lose their effectiveness over time and when covered by a film of dust, etc. The lamp in a BSC should only be used when no one is in the room. UV light damages eyes, skin, and certain plastic materials.
9. General Procedures
a. Biohazardous liquid and solid wastes, as well as all items such as labware, equipment, or apparatuses contaminated with biohazards, must be decontaminated before being washed, sorted, or discarded.

   Each individual working with biohazardous material or contaminated items is responsible for its decontamination.

b. Whenever possible, contaminated items or biohazardous liquid or solid waste should be decontaminated by autoclaving.

c. All floors, laboratory benches, and other surfaces or areas where biohazardous materials are handled should be chemically decontaminated as often as deemed necessary by the PI/lab manager. The choice of the chemical decontaminant used is at the discretion of the PI/lab manager.

d. Upon completion of operations involving plating, pipetting, centrifugation, and similar procedures with biohazardous materials, the surrounding area should be chemically decontaminated.

e. Floors should be wet mopped. Dry sweeping and dusting leads to the formation of secondary aerosols.

f. Stock solutions of suitable chemical decontaminants should be maintained on each laboratory bench.

10. Selecting Chemical Decontaminants for Research on recDNA Molecules
Nucleic acids often have better survival characteristics under adverse conditions than do the intact virions and cells from which they were derived. Oxidizing agents such as bleach will destroy the nucleic acid. However, the chosen decontaminant's ability to destroy the nucleic acid should be confirmed in the laboratory.

F. BIOHAZARDOUS WASTE

1. Responsibility
PIs are responsible for developing protocols for identifying, segregating, and decontaminating biohazardous waste, including all recDNA waste, prior to disposal.

Biohazardous waste disposal at the UW is dependent upon the location of waste generation. Refer to the Biohazardous Waste Flow Charts on the EH&S website for your location.

2. Identifying Biohazardous Waste
The following materials are defined as biohazardous (biomedical) waste:

a. Sharps waste: The sharps waste stream is regulated by state law; they must not be disposed of in the regular waste stream. The term "sharps" is a regulatory waste classification associated with those instruments used to puncture, cut, or scrape body parts and that, in a waste container, can cause punctures or cuts to solid waste handlers or to the public. This means that all sharps waste should be placed in appropriate sharps containers and decontaminated prior to disposal.

   Sharps include the following:
   1) Needles, including syringes with needles and IV tubing with needles attached
   2) Syringes without needles, when removed from their original sterile containers
3) Lancets

4) Scalpel blades

5) Other sharps items not defined above only if contaminated with biohazardous material including recDNA (e.g. broken glass; razor blades; fragile glass tubes, vials, or ampoules including glass Pasteur pipettes; glass slides and cover slips)

b. Human and non-human primate blood, blood products, body fluids, tissues, and cells: includes human and non-human primate blood, blood components, and materials containing free-flowing blood and blood products. Both human and non-human primate cell lines, regardless of origin, are also defined as biohazardous waste.

c. Cultures and stocks of etiologic agents and associated biologicals: include but are not limited to specimen cultures, discarded live and attenuated vaccines, cultures and stocks of etiologic agents, and wastes from the production of biologicals and serums.

d. RecDNA: includes but is not limited to waste products from laboratory research procedures involving recDNA in plasmids, viral vectors, E. coli, yeast, cell cultures, as well as naked DNA from polymerase chain reaction (PCR) and sequencing reactions. This also includes tissue and cells harvested from animals containing recDNA (e.g., transgenic animals).

e. Laboratory waste that has come in contact with a biohazard as listed in a, b, c, or d. above: includes but is not limited to culture dishes, blood specimen tubes, devices used to transfer, inoculate, and mix cultures, and other materials that have come in contact with biohazards (including disposable PPE and clothing).

f. Animal waste, animal carcasses, and body parts exposed to pathogens or recDNA: includes animal bedding and other waste from such animals and all non-human primate tissue and carcasses.

g. Human pathological waste: includes human source biopsy materials, tissues, and anatomical parts. This does not include teeth, human corpses, remains, and anatomical parts that are intended for interment or cremation.

3. Collection and Handling of Biohazardous Waste

a. Sharps Container Waste

Sharps must be contained in leak proof, rigid, puncture-resistant, durable plastic containers. These containers are red in color and equipped with a tight-fitting lid for use during handling and transport. (Refer to Section 4.F.2 for additional information on sharps).

Treatment and disposal of sharps waste generated at the Seattle campus and other UW offsite research locations is dependent upon the location of the waste generation. Refer to the location-specific Biohazardous Waste Flow Charts for details.

Sharps containers must be autoclaved when 2/3 filled. When autoclaving on-site, place a strip of autoclave tape running from the lid and down across the biohazard symbol on the container to secure the lid prior to autoclaving. Do not cover the vent holes on the lid during the autoclave cycle. Label the container with the room number and the PI’s name. Sterilized sharps containers must be segregated from regular waste containers at all times. Follow your location-specific procedures for collection of sterilized sharps containers.

For additional information on segregation and handling, refer to the EH&S page on sharps and laboratory glass and plastic waste.
b. Liquid Biohazardous Waste

Liquid biohazardous (including recDNA) waste containing free flowing liquids is contained in leak proof, rigid, durable containers labeled with the biohazard symbol and the word "biohazard." These containers are closed and placed in leak proof containers for handling or transport.

Liquid wastes must not be disposed of as solid waste. Liquid biohazardous waste (e.g., liquid recDNA waste, liquid pathogenic waste, small amounts of human and non-human primate blood, blood products, and other free-flowing body fluids) must be treated prior to disposal in the sewer system EITHER by:

- **Bleaching** - Add freshly prepared chlorine bleach to a final concentration of 10% bleach. The solution must sit for at least 30 minutes prior to disposal in the sewer;

  Or

- **Autoclaving** - Remove or loosen caps before loading into the autoclave. Follow autoclaving instructions as outlined in # 5 below. After the autoclaved liquid has cooled, dispose of the fluid in the sewer.

Disposal of human and non-human primate blood, blood products, and other free-flowing body fluids in 10 liter or greater volumes: Prior to disposing of human and non-human primate blood, blood products, and other free-flowing body fluids in 10 liter or greater volumes, contact EH&S ROS at 206-221-7770.

Animal blood other than primate blood: Small quantities may be flushed into the sewer system without treatment. Due to coagulation when handling large quantities, flushing is impractical. Contact EH&S ROS at 206-221-7770 for additional information on the disposal of large volumes of blood. If the blood and/or body fluid is potentially infected with a pathogen, handle according to the guidelines for human blood.

c. Solid Biohazardous Waste

Solid recDNA or other biohazardous waste (e.g., contaminated gloves, culture dishes) is collected in the laboratory in plastic, autoclavable, biohazard waste bags which must be contained inside a rigid container. The outer container must be labeled or clearly display the bag’s biohazard symbol. A polypropylene bin can be used to hold biohazardous waste bags and can be placed in the autoclave with the waste bags. The recommended closure device is a loosely tied rubber band. Refer to the EH&S page on biohazardous waste for additional information on segregation and packaging of biohazardous waste.

The biohazardous waste bags must be decontaminated by autoclave prior to disposal within 14 days from the first generation of the waste. Bagged waste disposal, like all biological waste at the UW, is dependent upon the location of waste generation. Refer to the location-specific Biohazardous Waste Flow Charts for details.

Transport the biohazardous waste bags to autoclave in a rigid, leak-proof secondary container. Autoclave tape must be used on biohazard bags to notify Custodial Services that the waste has been treated. After autoclaving, bagged waste may be placed alongside the regular waste container for the laboratory.

Human pathological waste: Incinerate. This material must never be disposed of in the general waste stream. Arrangements for disposal are made through the Autopsy Coordinator at the UW Medical Center.

Non-human primate pathological waste: Incinerate. Arrangements for disposal are made through the WaNPRC, 206-543-8686.

Animal carcasses, animal parts, bedding, and waste: The disposal for all these materials is coordinated through the Department of Comparative Medicine. That department must
be consulted for current guidelines for packaging, handling, and returning these materials to their facility for disposal. You may also refer to the location-specific Biohazardous Waste Flow Charts for disposal of these materials at your location.

Radioactive/biohazardous animals: Contact EH&S Radiation Safety at 206-543-0463 for additional information.

Mixed biological waste and chemical waste: Should be avoided. Contact EH&S ROS at 206-221-7770 prior to generating the waste.

Non-infectious/non-recombinant/non-radioactive animals are disposed of by the Department of Comparative Medicine. You may also refer to the location-specific Biohazardous Waste Flow Charts for disposal of these materials at your location.

Radioactive/non-infectious animals: Dead animals treated with radioactive materials are disposed of in accordance with procedures listed in the UW Radiation Safety Manual.

Other biohazardous (biomedical) waste: Contact EH&S ROS at 206-221-7770 for advice and assistance.

4. Transporting Biohazardous (including recDNA) Waste

This section outlines the proper procedures for transporting biohazardous waste within buildings and between buildings. Biohazardous waste must be packaged so that PPE is not needed during transport. If PPE is necessary, then the waste is not properly packaged.

a. Within Building

1) Sharps Containers

Sharps containers with contaminated sharps, transported within the same building, must be securely closed and the outer surface decontaminated prior to transport.

- Attach a piece of autoclave tape over the lid and sides being careful not to cover air vents. This will help secure the lid if the plastic expands and contracts during steam sterilization. Label the container with name of the PI and the room number.

- If leaking is possible, place inside a secondary container. The secondary container must be closable, puncture resistant, and constructed to contain all contents and prevent leakage. This container should either be red in color or labeled with the biohazard symbol.

2) Other Biohazardous Waste

Other biohazard waste that does not pose a threat of skin puncture shall be placed in plastic biohazard bags. Bagged biohazardous waste transported within the same building must be closed, surface decontaminated, and placed inside a secondary containment prior to transport.

- Tie or tape the biohazard bag closed (loosely to allow steam penetration during autoclaving).

- Place the bagged waste inside a rigid, leak-proof secondary container (e.g., autoclave tub, plastic container). Biohazardous waste cannot be transported in biohazard bags alone.

- If the secondary container is closed, it must be identifiable as biohazardous either by being red in color or labeled with the biohazard symbol.
3) Animal Carcasses

Contact the Department of Comparative Medicine prior to transporting animal carcasses. They will provide instruction in packaging and transportation.

b. Between Buildings

Sharps containers with contaminated sharps, transported between buildings, have the same requirements as within the same building (see above). The exception is if transport is by motor vehicle, which must be a UW owned and operated vehicle (e.g., Fleet Services, UCAR).

Bagged biohazardous waste transported between buildings has the same requirements as within the same building (see above), with the exception that the secondary container must have a secured lid.

1) Biohazard bags must be closed, surface decontaminated, and placed inside a leak proof secondary container with a secured lid prior to transport.

2) The secondary container must be identifiable as biohazardous either by being red in color or labeled with the biohazard symbol.

3) If using a motor vehicle for transport between buildings, the vehicle must be a UW owned and operated vehicle (e.g., Fleet Services, UCAR).

5. Autoclave Quality Control

The Seattle/King County Infectious Waste Regulations require all operators of autoclaves to be trained. The training procedure must be written and all users must have access to the written procedures. All users must receive this training prior to actually using the autoclave.

a. A good quality assurance program includes the following:

1) An operation manual is available for each autoclave.

2) Each autoclave is equipped with a recording and/or indicating thermometer or other method for verifying attainment of the minimum decontamination time and temperature (250°F or 121°C). The autoclave's thermometer must be calibrated annually.

3) Each autoclave should bear a sign indicating the maximum permissible pressure and last date of confirmation.

4) Control indicators for autoclaves are indispensable in routine checking against faulty packaging, loading, and sterilizer performances. Physical controls such as pressure gauges and thermometers are widely used but are considered secondary methods of insuring sterilization.

- Autoclave Tape: Heat sensitive tape must be used on each package in the load. The heat sensitive tape will verify that the package has been heated but does not indicate it was heated for the proper time.

- Chemical Integrator: A Thermalog-S chemical integrator must be used with every load of biohazardous waste. Place the integrator in the center of the load to confirm that time and temperature parameters have been met inside the waste package.

- Biological Indicator: The use of appropriate biological indicators at locations throughout the autoclave is considered the best indicator of sterilization. The
The biological indicator most widely used for wet heat sterilization is *Bacillus stearothermophilus* spores.

- At least once a month, a biological indicator (spore strip/ampoule) test must be performed on each unit. (See procedure in the next section)

### b. Biological Indicator Test Procedure

The following procedure establishes the testing required to evaluate the performance of an autoclave.

1) **Equipment**
   - Spore ampoules or strips containing *Bacillus stearothermophilus*.
   - Supporting laboratory equipment (incubator, refrigerator, culture media, miscellaneous glassware).

2) **Procedure**
   - Use spore ampoules or strips with an average population of $10^4$ to $10^6$ organisms adjusted to the following resistance data - survives steam heat at 250°F for five minutes and is killed at 250°F in 13 minutes.
   - The most reliable means for determining whether a sterilizing cycle has been successful is by planting biological indicators throughout the load before the load is subjected to the sterilization process.
   - Operate the autoclave in accordance with the manufacturer's instructions. The cycle (time and temperature) should be the minimum as required by the user's lab procedures.
   - Record chamber temperature as shown by the sterilizer indicator autoclave's thermometer.
   - Upon the completion of the cycle, fast exhaust the chamber and remove test spore strips from the autoclave.
   - Incubate the *Bacillus stearothermophilus* test strips/ampoules at 55°C according to manufacturer's instructions.

3) **Structural Inspection:** Autoclaves must be inspected every two years by a qualified inspector as per [WAC 296-104-100](https://app.leg.wa.gov/content/secure/wac/296-104-100). Contact Facilities Services, Preventive Maintenance Manager at 206-221-2573 for cost estimates and to arrange an inspection.

4) **Recordkeeping:** Operators must maintain and post a user log near the autoclave. An [EH&S Quality Control Checklist](https://www.energy.washington.edu/sites/default/files/EHS-Quality-Control-Checklist.pdf) must be downloaded and completed. It is a good practice to designate a contact person, enter the contact's name on the Quality Control Checklist, and post it near the autoclave.

### 6. Refusal to Collect Waste

Custodial Services personnel have been instructed to refrain from removing any animal carcasses, parts, or other questionable wastes and to report discrepancies to their supervisors. The reports are referred to EH&S ROS, 206-221-7770, for resolution.
G. CONTROL OF recDNA EXPERIMENTATION

1. Responsibility

Procedures for obtaining approval for research involving the use of recDNA techniques at the UW can be found in Section 2.

When working with recDNA materials, effective biological safety programs involve selecting the appropriate biological containment method, including the physical containment facilities.

It is the responsibility of the PI to assess the potential risk associated with the experiment and determine an appropriate host-vector system (biological containment) and physical containment to be used for the proposed experiment. The IBC will review this assessment of risk.

2. Physical Containment

Standard microbiological practices are covered in Section 4.B of this manual.

Special procedures, equipment, and laboratory installations that provide physical barriers that are applied in varying degrees according to the estimated risk are covered in Section 4.C.

3. Biological Containment

Experiments involving recDNA molecules, by their very nature, lend themselves to biological containment. Natural barriers exist which limit either the infectivity of a vector or vehicle (plasmid, bacteriophage, or virus) to specific hosts or its dissemination and survival in the environment.

The vectors that provide the means for replication of the recDNA and/or the host cells in which they replicate can be genetically designed to decrease by many orders of magnitude the probability of dissemination of recDNA molecules outside the laboratory.

In considering biological containment, the vector (plasmid or virus) for the recDNA and the host (bacteria, plant, or animal cell) in which the vector is propagated in the laboratory will be considered together.

Discussion of the various levels of biological containment is beyond the scope of this manual. Additional information can be found in NIH Guidelines. Copies are also available from EH&S ROS at 206-221-7770.
Section 5 – Employee Occupational Health Program

A. OVERVIEW

The UW’s Administrative Occupational Health Policy Statement APS 10.6 specifies that all employees must be provided with a safe and healthful work environment. Health assessments and occupational health recommendations are required for specific work assignments based on the types of hazards including biohazards that are present in the work environment.

The Occupational Health Program aims to accomplish the following:

1. Conform to occupational health standards set by regulatory agencies and granting and accrediting bodies including Washington State’s Department of Safety and Health (DOSH), the Association for the Assessment and Accreditation of Laboratory Animal Care, International (AAALAC), the NIH Guidelines, and the CDC, including the NIH/CDC’s BMBL publication;
2. Assure that employees are physically able to perform their jobs;
3. Prevent and detect disease and illness resulting from exposure to possible health hazards in the work environment;
4. Establish occupational health guidelines for vaccinations, medical surveillance, and exposure response; and
5. Establish baseline health data for future comparison.

B. ROLES AND RESPONSIBILITIES

1. Environmental Health and Safety

EH&S is responsible for assisting the PI with risk assessments, identifying exposure controls, and developing guidance for and assisting with the implementation of medical management protocols. The goal is to prevent occupational disease or illness resulting from exposure to
health hazards in the work environment. The role of EH&S in the process of implementing the occupational health program includes the following:

1. Provide occupational health reviews and make recommendations based on a hazard/risk assessment by the OHN, incorporating reviews from others such as EH&S specialists (biosafety, chemical hygiene, etc.), the IBC, and the UW EHC;

2. Provide follow-up for accident/injury investigation;

3. Review and ensure workplace compliance with the BBP program and all other components of the occupational health program;

4. Collaborate with the UW EHC to develop medical guidance and facilitate clinical services and care; and

5. Collaborate with Human Resources to establish safe and appropriate work assignments in keeping with current legislation.

2. Principal Investigators

PIs whose research involves the use of biohazards are responsible for communicating workplace hazards to laboratory staff and ensuring that occupational health and safety requirements are followed. In addition, PIs must offer appropriate immunizations and/or medical surveillance as specified by EH&S. All of the following actions are necessary to fulfill these responsibilities:

1. Inform both male and female employees about the reproductive and teratogenic risks when there is a potential for exposure to infectious agents in the work area. Also inform staff about the online document EH&S Guidance About Workplace Hazards Impacting Reproduction and Development;

2. Inform employees about immunologic risks when there is a potential for exposure to biohazardous agents in the work area;

3. Inform employees about the possible risks associated with work using viruses that contain oncogenes or that may be oncogenic;

4. Inform staff that if they have questions or concerns about their health in relation to work with biohazardous agents, they are strongly encouraged to contact the UW EHC for a confidential medical consultation;

* Note the two UW EHC locations are at Harboorview: 206-744-3081 and Hall Health for all other UW campus employees: 206-685-1026

5. Instruct employees that they must contact the UW EHC if they develop signs or symptoms consistent with exposure to the biohazardous agents in use. If employees see their personal health care provider (HCP) with symptoms, they should inform the HCP of the agents they are working with or to which they may have been exposed. They must inform the UW EHC after being treated by their HCP;

6. Instruct employees that if they have allergies that may limit the administration of specified immunizations or contraindicate prophylactic measures needed after an exposure incident, they must contact the UW EHC for evaluation. These employees may have an increased risk for infection when working in an environment where biohazards are in use.

7. Maintain records for each employee documenting the requirements to work in the laboratory. These records should be available for review by EH&S. At a minimum these records should address the following for each job classification or position:
1) Specific biohazard and/or exposure risk;
2) Required medical evaluations, including documentation of an assessment with the UW EHC;
3) Recommended surveillance testing;
4) Required or recommended immunizations, documenting the date offered and frequency of administration;
5) Any applicable physical requirements
6) Recommended serum banking and/or monitoring, documenting the frequency and date offered.
7) Instruct employees about procedures to follow in case of exposure to a hazardous agent. Ensure that the UW exposure response procedure information is available to staff and that the procedures are followed.
8) Instruct employees to report exposure incidents and near misses within 24 hours (eight hours if hospitalized or injury is serious) on the UW Online Accident Reporting System (OARS).

3. Employees

Employees engaged in activities involving biohazards are responsible for complying with the occupational health requirements and guidelines as specified by their PIs and EH&S. Employees should be aware of the hazards in their workplace and able to bring concerns or suggestions for improvement to the attention of their supervisors.

- Employees should be aware of how their health status may be impacted by work with biohazardous agents. For example, immunocompromised individuals may be at increased risk of illness or may experience more severe illness should an exposure incident occur when working with certain biohazardous agents.

An immunocompromised status may result from immunosuppressive therapy (chronic steroid use, chemotherapy for cancer, immune modulators, radiation therapy, and others), diabetes mellitus, cancer, malnutrition, pregnancy, acquired immune deficiency syndrome (AIDS), and chronic alcoholism.

- If personal health concerns or questions arise, employees are strongly urged to arrange for a confidential medical consultation by contacting the UW EHC.

- The UW EHC is to be contacted for medical guidance after completing first aid procedures if a possible exposure occurs. UW employees working at non-UW facilities should contact the EHC at their location (for example, Fred Hutchinson Cancer Research Center, Seattle Children’s Hospital, or the Veterans’ Administration Medical Center) or go to the nearest emergency department. The UW EHC should then be notified of the exposure.

4. UW Employee Health Centers

The UW EHC is responsible for providing clinical services, including medical evaluations as needed for specific work, administering immunizations, providing follow-up care after an injury, providing employee counseling, and establishing and maintaining employee medical records. UW Employee Health Centers are located at Hall Health Center, UW Medical Center (UWMC), and Harborview Medical Center (HMC).
C. IMMUNIZATION GUIDELINES

- Depending on the specific work setting, the offering of immunizations may be required or recommended for employees who are potentially exposed to certain biological agents or in contact with certain animals. However, because of the wide range of biological agents or combinations of agents that may be present in a research institution, the specific immunizations or other health related measures that are indicated will be determined based on the risk assessment performed by the EH&S OHN in consultation with the UW EHC and the IBC as appropriate.

- To reduce the risk of occupationally acquired bloodborne disease, employees with a reasonably anticipated potential for exposure to human blood and its components, human bodily fluids, or other human tissues (including cell lines) must participate in the UW’s BBP Program and be offered the hepatitis B vaccine in accordance with the Washington State Department of Safety and Health requirements. After being informed of the risks versus benefits of immunization, a declination form must be signed if an employee declines the hepatitis B vaccine. This form then becomes part of the employee's health record that is maintained by the UW EHC. The BBP program is covered in detail in Appendix A of this manual.

- Immunization for other potentially infectious agents may be required after risk assessment by EH&S, the EHC, the IBC, and the PI. In this instance, a waiver must be signed if the employee declines to be vaccinated after being informed of the risks versus benefits of immunization. This waiver then becomes part of the employee's health record that is maintained by the UW EHC. For information about immunizations that may be required, contact an EH&S OHN at 206-221-7770.

D. ANIMAL USE MEDICAL SCREENING

1) The OHN provides an AUMS to identify medical conditions that could be adversely affected by work in the animal care and use environment. The AUMS is offered to all veterinary and animal husbandry staff, researchers and their staff, the IACUC members, volunteers, visiting scientists, students, and other individuals working in or entering areas with animals, animal tissues, or animal fluids. Employees have the option to decline the screening; if they do so, they must sign and date the form.

2) The AUMS form must be completed at least every three years for research staff and at least annually for husbandry, veterinary, and other research support staff. The OHN will provide phone or in-person consultation as needed for those who have increased risk of hazards associated with animals.

E. RESEARCH PROTOCOL REVIEW

- The EH&S OHN reviews all animal research protocol submissions to evaluate for occupational hazards.

- The EH&S OHN discusses the project with the PI, the UW EHC, other EH&S specialists, the IBC, and others (for example, the IACUC) as needed in order to provide comprehensive recommendations to be used in the laboratory or in the field.
The review includes recommendations for immunizations, medical surveillance, post-exposure evaluation guidelines, training, workplace exposure controls, PPE, and the safe use of hazardous materials.

The OHN sends the occupational health recommendations (OHR) to the PI electronically, with a copy sent to the Office of Animal Welfare, the UW EHC, and other health and safety personnel who may interface with the PI’s laboratory.

The EH&S OHN also reviews non-animal research protocols involving biohazards and provides recommendations for immunizations, medical surveillance, and post-exposure evaluation guidelines. These recommendations are based in part on review by other EH&S staff, such as biosafety officers, and review by the IBC.

F. POST EXPOSURE TREATMENT

a. The UW Exposure Response Poster describes the actions to take in the event of a possible exposure. Should an employee experience an exposure to a hazardous or biologic agent, he or she must immediately perform first aid, and then call the EHC for evaluation. The employee must also call his/her supervisor and fill out the OARS either separately or with the supervisor’s assistance.

b. The Washington State Department of Labor and Industries requires that an exposure determination be made for anyone who is potentially exposed to human blood and its components, human bodily fluids, or other human tissues (including cell lines). This exposure determination is covered in detail in the BBP Program section of this manual. BBP exposures are treated in accordance with the WISHA BBP regulations (WAC 296-823) and the “Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Postexposure Prophylaxis” (June 2001, with updates on HIV in Sept.2005).

G. EMPLOYEE HEALTH AND IMMUNIZATION RECORDS

Employee occupational health records, including immunization records are maintained at one of the three UW EHCs in a secure password-protected database that is owned and maintained by Campus Health Services.

H. SERUM BANKING AND MONITORING

As a standard practice, serum from research personnel will not be banked. However, specific serum collection and/or monitoring programs may be offered in some cases. EH&S, in conjunction with the IBC review and in consultation with the UW EHC and the PI, will assist in making medical monitoring decisions. For more information, contact the EH&S OHN at 206-221-7770.
Section 6 – Emergency Preparedness and Response

Contents

A. BIOHAZARDOUS SPILL CLEAN-UP PROCEDURES ........................................... 6-1
  1. Responsibility .............................................................................. 6-1
  2. Biohazard Spill Kit ....................................................................... 6-1
  3. Spill Advice ................................................................................. 6-2
  4. Biohazardous Spill Inside a BSC .................................................. 6-2
     a. Spill inside a BSC that stays contained on the work surface .......... 6-2
     b. Spill inside a BSC that flows past the work surface through the front or rear grills . 6-2
  5. Biohazardous Spill outside a BSC ................................................ 6-3
     a. Small spills that can be easily absorbed by one standard paper towel .......... 6-3
     b. Large spills that require more than one paper towel to absorb .......... 6-4
  6. Spills Outside the Laboratory in Public Spaces ................................ 6-5
  7. Radioactive Biohazardous Spill ..................................................... 6-5

B. INJURY POLICY AND ACCIDENT REPORTING ........................................... 6-5
  1. Injury Policy ................................................................................ 6-5
  2. Immediate Response .................................................................. 6-5
     a. For an exposure incident, follow these steps immediately: ............ 6-5
     b. Injuries involving animal contact and exposures ................................ 6-6
  3. Accident Reporting ..................................................................... 6-7

A. BIOHAZARDOUS SPILL CLEAN-UP PROCEDURES

This section provides spill clean-up procedures for BSL-1 and BSL-2 laboratories. These procedures apply to biohazardous agents and all recDNA. For BSL-2 laboratories with BSL-3 practices and BSL-3 laboratories, refer to your laboratory specific biosafety manuals for spill clean-up procedures.

1. Responsibility

   Each PI is responsible for developing spill clean-up procedures appropriate for the materials used in the laboratory, as well as assuring that a spill kit is assembled and placed in a strategic location outside of, but near, the area where a spill could occur.

   Furthermore, anyone working with biological materials must receive training in spill clean-up appropriate for the materials routinely used.

2. Biohazard Spill Kit

   The following items should be assembled in a single container that can be easily moved to the spill area. A large bucket is practical for the container as it can double as the secondary container for transporting waste away from the spill. See the EH&S Biohazard Spill Kit page for more information.

   1. An appropriate chemical decontaminant: In most cases a 1:10 dilution of freshly prepared household bleach is appropriate.
2. Materials to absorb liquids after decontamination: This could include paper towels, absorbent lab pads, or special materials designed to absorb large volumes of liquid.

3. Appropriate PPE to wear during clean-up: Nitrile or heavy duty gloves, a long-sleeve laboratory coat or gown, and goggles are always necessary. Facial protection should be considered for large spills as well as protection against splash and splatter of the chemical decontaminant.

4. A mechanical means for handling broken glass: This could include tongs, forceps, small disposable scoops and sponges, autoclavable dust pans, or any other method that prevents direct contact with the broken glass.

5. Biohazard bags, sharps containers, and/or other containers: The containers are used to hold the material for further treatment and disposal.

3. Spill Advice

For biohazardous spill advice contact EH&S ROS at 206-221-7770 during business hours (Monday – Friday; 8:00 a.m. – 5:00 p.m.). Outside of business hours, call UW Police Department at 206-685-UWPD to be redirected to EH&S on-call staff.

4. Biohazardous Spill Inside a BSC

This section provides spill clean-up procedures for biohazardous agents and all recDNA inside a BSC.

a. Spill inside a BSC that stays contained on the work surface

Operate to prevent escape of contaminants from the cabinet. Spill cleanup procedures should be initiated immediately while the cabinet continues to operate.

1. Remove any sharp, contaminated objects from the spill area using mechanical means (like tongs or forceps) and never with hands. Discard contaminated sharps in a sturdy, leak-proof, biohazard labeled sharps container.

2. Cover the spill with paper towels or other absorbent material. Slowly pour a decontaminant solution appropriate for the agent involved (Section 4.E) around the spill and allow the solution to flow into the spill. Paper towels soaked with the decontaminant may also be used to cover the area. An example of an appropriate decontaminant for use in BSCs is freshly prepared 1:10 dilution of household bleach, 0.5% sodium hypochlorite (left on for an appropriate contact time), followed by a final rinse with water to avoid any corrosion caused by bleach on stainless steel work surfaces.

3. At least 30 minutes is generally considered an appropriate contact time for decontamination but this varies with the decontaminant and the microbiological agent. Manufacturer's directions should be followed.

4. Wipe up the spill, work surfaces, walls, and any equipment in the cabinet with paper towels dampened with decontaminant. Do not place your head in the cabinet to clean the spill; keep your face behind the sash.

5. Place contaminated paper towels and other spill clean-up materials in biohazard bags or autoclavable pans with lids for autoclaving.

6. Decontaminate the spill area again. Place all used spill materials into a biohazard bag.

7. Remove any contaminated PPE in a manner to avoid cross-contamination; dispose of per standard lab practices.

8. Wash hands thoroughly after removing gloves.
b. Spill inside a BSC that flows past the work surface through the front or rear grills

A large spill inside a BSC that flows past the work surface through the front or rear grilles requires more extensive decontamination. To prevent escape of contaminants from the cabinet, spill clean-up procedures should be initiated at once while the cabinet continues to operate.

1. Ensure the drain valve under the BSC is closed.
2. Remove any sharp, contaminated objects from the spill area using mechanical means (like tongs or forceps) and never with hands. Discard contaminated sharps in a sturdy, leak-proof, biohazard labeled sharps container.
3. Flood the top work surface tray and, if a Class II BSC, the drain pans and catch basins below the work surface with a decontaminating solution that is appropriate for the agent involved (Section 4.E). An example of an appropriate decontaminant for use in BSCs is a freshly prepared 1:10 dilution of household bleach, 0.5% sodium hypochlorite (left on for an appropriate contact time), followed by a final rinse with water to avoid any corrosion caused by bleach on stainless steel work surfaces.
4. At least 30 minutes is generally considered an appropriate contact time for decontamination but this varies with the disinfectant and the microbiological agent. Manufacturer's directions should be followed.
5. Remove excess decontaminant from the work surface tray by wiping with a sponge or cloth. For Class II BSCs, drain the tray into the catch basin below the work surface, lift the tray and take out the removable front intake grille. Wipe the top and bottom (underside) surfaces of the grille with a sponge or cloth soaked in the decontaminant. Then place the tray in position, drain the decontaminant from the cabinet base into an appropriate container, and dispose of the decontaminant in the sewer.
6. Place spill clean-up materials (e.g., contaminated gloves, cloth and/or sponge) in autoclavable pans with lids for autoclaving.
7. Decontaminate the spill area again. Place all used spill materials into a biohazard bag.
8. Remove any contaminated PPE in a manner to avoid cross-contamination and dispose of per standard lab practices.
9. Wash hands thoroughly after removing gloves.

5. Biohazardous Spill outside a BSC

This section provides spill clean-up procedures for biohazardous agents and all recDNA outside a BSC.

a. Small spills that can be easily absorbed by one standard paper towel

Agents transmitted by inhalation (e.g., adenovirus, influenza)

1. Hold your breath and leave the room immediately. Ask other lab occupants to also leave the room and close the door. One good way to identify the spill area is to drop your laboratory coat on the area on your way out.
2. Warn others not to enter the contaminated area and post a sign on the door.
3. Remove contaminated garments and put into a container for autoclaving. Thoroughly wash any exposed areas of the body.
4. Wait 30 minutes to allow dissipation of aerosols created by the spill.
5. Follow the decontamination steps below.
Agents not transmitted by inhalation

1. Assemble spill clean-up materials.
2. Put on appropriate PPE (e.g., long-sleeve lab coat, goggles, and nitrile gloves).
3. Remove any sharp, contaminated objects from the spill area using mechanical means (e.g., tongs or forceps). Discard contaminated sharps in a sturdy, leak-proof, biohazard labeled sharps container.
4. Pour a decontaminant solution (e.g., freshly prepared 1:10 dilution of household bleach) around the spill and allow to flow into the spill. Paper towels soaked with the decontaminant may also be used to cover the area. To avoid aerosolization, never pour decontaminant solution directly onto the spill.
5. Let stand for 30 minutes to allow an adequate contact time and place all used spill materials in a biohazard bag.
6. Decontaminate the spill area again. Place all used spill materials into a biohazard bag.
7. Remove any contaminated PPE in a manner to avoid cross contamination and dispose of per standard lab practices.
8. Wash hands thoroughly after removing gloves.

b. Large spills that require more than one paper towel to absorb

1. Hold your breath and leave the room immediately. Also ask other lab occupants to leave the room and close the door. One good way to identify the spill area is to drop your laboratory coat on the area on your way out.
2. Warn others not to enter the contaminated area and post a sign on the door.
3. Remove contaminated garments and put into a container for autoclaving. Thoroughly wash any exposed areas of the body.
4. Wait 30 minutes to allow dissipation of aerosols created by the spill.
5. Assemble spill clean-up materials.
6. Put on appropriate PPE (e.g., long-sleeve gown, goggles, and nitrile or heavy duty gloves) before re-entering the room.
7. Remove any sharp, contaminated objects from the spill area using mechanical means (e.g., tongs or forceps). Discard contaminated sharps in a sturdy, leak-proof, biohazard labeled sharps container.
8. Pour a decontaminant solution (i.e., a freshly prepared 1:10 dilution of household bleach) around the spill and allow to flow into the spill. Paper towels soaked with the decontaminant may be used to cover the area. To avoid aerosolization, never pour decontaminant solution directly onto the spill.
9. At least 30 minutes is generally considered an appropriate contact time for decontamination, but this varies with the disinfectant and the microbiological agent. Manufacturer’s directions should be followed.
10. Using an autoclavable dust pan and squeegee, transfer all contaminated materials (paper towels, glass, liquid, gloves, etc.) into a deep autoclave pan.
11. Decontaminate the spill area again. Place all used spill materials into autoclave pan.
12. Separate reusable items from non-autoclavable plastic as the plastic will melt, becoming impossible to remove from other items in contact with it. Cover the pan with a lid and autoclave according to standard directions.
13. Remove any contaminated PPE in a manner to avoid cross-contamination and dispose of per standard lab practices.
14. Wash hands thoroughly after removing gloves.

6. Spills Outside the Laboratory in Public Spaces
   Samples must be transported in secondary, leak-proof containers to minimize the potential for spills. However, if a spill does occur in a common hallway or public space and cannot be immediately decontaminated, cordon off the area, restrict access, and contact EH&S ROS at 206-221-7770 for consultation.

7. Radioactive Biohazardous Spill
   Anyone working with both radioactive and biohazardous materials should develop a spill clean-up plan appropriate for all materials used. Some general principles should apply: a) contain the spill, b) prevent spreading the contamination, and c) choose methods for decontamination that do not create "mixed waste". Decontamination procedures involving the use of bleach may be incompatible with some radioactive materials, especially those containing radioiodine. Contact EH&S Radiation Safety at 206-543-0463 for additional information concerning these materials.

B. INJURY POLICY AND ACCIDENT REPORTING

1. Injury Policy
   An exposure incident is defined as a specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with biohazardous agents, which includes all recDNA. Examples of exposure incidents include needlesticks, splash/splatter to the mucous membranes of the face, and any other incident that involves contact between blood or OPIM and non-intact skin (cuts, scratches, chapped skin, etc.).

   If the injury/accident involves a potential exposure to a biohazardous agent, including all recDNA, the steps in Section 4.B.2 below must be initiated immediately. If the accident/incident is of a nature that emergency assistance is required, call 911.

   The UW Administrative Policy Statement 10.8 requires that any accident, injury, work-related illness, or on-the-job incident which could have caused an injury/illness must be reported to EH&S via the OARS Report. The procedures for reporting are also outlined in the following section.

   If an injury exposure involves significant personal exposure to recDNA, EH&S may need to notify the NIH OBA.

   This policy applies to all students, faculty, and staff of the UW.

2. Immediate Response
   a. For an exposure incident, follow these steps immediately:
      1) Provide First Aid Immediately
         Sharps injury (needlestick and subcutaneous biological exposure): Scrub exposed area thoroughly for 15 minutes using warm water and sudsing soap.
         Skin exposure: Use the safety shower or drench hose for 15 minutes. Stay under the shower and remove clothing. Use a clean lab coat or spare clothing for cover-up.
2) **Eye exposure**: Use the eye wash for 15 minutes while holding eyelids open.

**Inhalation**: Move out of contaminated area. Get medical help.

**2) Get Help**

Be ready to share the details of the exposure (agent, dose, route, time since exposure, MSDS).

**For medical emergencies involving chemical exposures** call 911 or go to the emergency room.

**For sharps injuries and biological and radiological exposures** do the following:

- During business hours:
  - Call the UW Employee Health Center at 206-685-1026. At Harborview sites, call 206-744-3081.
  - Radiological exposures call EH&S Radiation Safety at 206-543-0463.

- Outside of business hours or if Employee Health Center is closed:
  - Chemical and radiological exposures: call 911 or go to the nearest emergency room.
  - Biological exposures: go to the nearest emergency room or call 911.

**Notify your supervisor** as soon as possible for assistance.

**Secure area before leaving.**

3) **Report Incident to Environmental Health & Safety**

If serious accident, hospitalization, or fatality, after providing first aid and/or getting help, notify EH&S immediately.

- During business hours, call 206-543-7262.
- Outside of business hours, call 206-685-UWPD (8973) to be routed to the EH&S staff on call.

**For all accidents and near misses**, complete the [OARS Report](#) within 24 hours.

**For incidents involving recDNA**, notify EH&S Research and Occupational Safety as soon as possible at 206-221-7770.

b. **Injuries involving animal contact and exposures**

1) For injuries involving animal contact and exposures, immediately stop work and begin cleansing steps outlined above. Seek medical care from the UW Employee Health Center at Hall Health/UWMC ER as described above. If working with ABSL-2 animals, take the BUA Appendix A (Hazardous Material Information for Animal Husbandry Staff) with you.

2) For injuries involving contact with non-human primates, after following the cleansing steps outlined in Section 4.B.2 above and/or using the scrub kit provided to you by the WaNPRC, call the UW Employee Health Center at 206-685-1026 and proceed as directed. Contact the WaNPRC at 206-543-8686 for additional information about non-human primate exposure procedures.

**For exposures from animal that previously received recDNA**, notify EH&S Research and Occupational Safety as soon as possible at 206-221-7770.
3. Accident Reporting

The UW Administrative Policy Statement 10.8 requires that any accident, injury, work-related illness, or on-the-job incident that could have caused an injury/illness must be reported to EH&S.

The exposed worker or the PI/lab manager must complete the on-line accident/incident report within 24 hours of the occurrence by using the OARS. If the accident/incident involves recDNA, this must be noted in the description of the incident.

In the case of a serious or fatal accident or hospitalization, notify EH&S immediately (within 8 hours) at 206-543-7262; after hours, contact the UW Police Department at 206-685-UWPD.

Both the Washington State Department of Labor and Industries and OSHA require employers to record work related injuries and illnesses. Both of these regulations and the Health Insurance Portability and Accountability Act (HIPAA) rules expressly permit disclosure of this protected information (45 CFR 164.512). UW employees having access to this report must treat it as private and should not disclose it to others unless authorized by statute. An employee may not be discriminated against for reporting a work-related fatality, injury, or illness.
Appendix A – Bloodborne Pathogens Exposure Control Plan

Contents

A. INTRODUCTION .................................................................................................................................. A-2
B. ROLES AND RESPONSIBILITIES ....................................................................................................... A-2
   1. Principal Investigator/Supervisor ............................................................................................... A-2
   2. Employee ....................................................................................................................................... A-3
   3. Employee Health Center ............................................................................................................. A-3
   4. Environmental Health and Safety Department ............................................................................ A-3
C. EXPOSURE DETERMINATION .......................................................................................................... A-3
D. UNIVERSAL PRECAUTIONS ............................................................................................................ A-4
E. ENGINEERING/WORK PRACTICE CONTROLS ............................................................................. A-4
   1. Engineering Controls ................................................................................................................ A-4
   2. Hand Hygiene ........................................................................................................................... A-4
   3. Sharps ........................................................................................................................................ A-4
   5. Mouth Pipetting/Suctioning is Prohibited ................................................................................ A-5
   6. Aerosols ...................................................................................................................................... A-5
   7. Centrifuging ............................................................................................................................. A-5
   8. Transporting and Shipping Biohazardous Materials ..................................................................... A-6
   9. Equipment Servicing and Maintenance ..................................................................................... A-6
F. PERSONAL PROTECTIVE EQUIPMENT ............................................................................................. A-6
   1. Requirements ........................................................................................................................... A-6
   2. Gloves ........................................................................................................................................ A-7
   3. Face Protection ........................................................................................................................ A-7
   4. Use and Removal ....................................................................................................................... A-7
   5. Cleaning, Laundering or Disposal ............................................................................................. A-7
G. WORKSITE CONDITIONS .................................................................................................................. A-7
   1. Responsibility ........................................................................................................................... A-7
   2. Spill Clean-up............................................................................................................................ A-8
   3. Cleaning Schedule .................................................................................................................... A-8
   4. Protective Coverings ................................................................................................................ A-8
   5. Biohazardous Waste ................................................................................................................ A-8
H. BIOHAZARD SIGNS AND LABELS ................................................................................................. A-9
I. HEPATITIS B IMMUNIZATION .......................................................................................................... A-9
   1. Offering Hepatitis B Vaccine ....................................................................................................... A-9
   2. Administering Hepatitis B Vaccine .......................................................................................... A-10
J. POST-EXPOSURE REQUIREMENTS .................................................................................................. A-10
   1. Exposure Incident .................................................................................................................... A-10
   2. Immediate Response ................................................................................................................ A-10
   3. Principal Investigator/Supervisor Responsibility ....................................................................... A-11
   4. Evaluation Post Exposure ......................................................................................................... A-11
K. TRAINING PROGRAM ....................................................................................................................... A-12
   1. Responsibility ........................................................................................................................... A-12
   2. Training Requirements ............................................................................................................ A-12
A. INTRODUCTION

This section serves as the UW Core Bloodborne Pathogens Exposure Control Plan (ECP) and describes the requirements of the UW BBP Program. The purpose of the Program is to help ensure occupational health and safety and meet compliance with the Washington State BBP Rule, WAC 296-823. This rule applies to all occupational exposure to human blood or other potentially infectious materials. It requires employers to identify potential for occupational exposures and implement methods to mitigate these exposures through a variety of methods.

This core ECP was developed with research and clinical laboratories in mind. More specific information for patient care is available from Infection Control at University of Washington Medical Center, Harborview Medical Center and the Dental School.

B. ROLES AND RESPONSIBILITIES

1. Principal Investigator/Supervisor

The PI is responsible for identifying employees who need to be in the BBP program and has ultimate responsibility for ensuring that safety rules and requirements of the BBP Program are followed.

The PI or supervisor (as the PI designates) must develop and implement a Site-Specific BBP ECP and the EH&S template Site-Specific BBP ECP Form can be used for this purpose. It must include information about who is in the BBP program, personal protective equipment required for tasks, decontamination procedures, and first aid and medical response in case of exposure. The Site-Specific BBP ECP must be reviewed annually and updated as necessary. It should be used in conjunction with this core ECP.
2. **Employee**

   The employee is responsible for following the Site-Specific BBP ECP. All practices must be adhered to, including wearing required PPE. The employee is responsible to ask questions if needed and to make suggestions to the PI/supervisor for safer work practices and procedures.

3. **Employee Health Center**

   The Employee Health Center provides clinical services and administers the hepatitis B vaccine. The EHC also provides post-exposure counseling and medical follow-up.

4. **Environmental Health and Safety Department**

   EH&S administers the UW BBP Program. This includes maintaining the UW Core BBP Exposure Control Plan, assisting employees in obtaining the hepatitis B vaccine, providing BBP training, maintaining the injury log, providing consultation, and developing compliance tools to assist PIs/supervisors.

C. **EXPOSURE DETERMINATION**

   BBP are pathogenic microorganisms that are present in human blood and OPIM that can cause disease. All UW employees with reasonably anticipated potential for exposure to human blood and its components, human tissue, all human cell lines, human source materials, as well as medications derived from blood (e.g., immunoglobulins, albumin), and OPIM are required to comply with the University's BBP Program. OPIM includes all of the following:

   - Human cells (including all primary and established human cell lines), human tissue, or human organ cultures
   - Culture supernatant
   - Cerebrospinal fluid
   - Pericardial fluid
   - Synovial fluid
   - Pleural fluid
   - Any solutions containing HIV/HBV/HCV, other BBP
   - Any body fluid visibly contaminated with blood or OPIM
   - Saliva during dental procedures
   - Peritoneal fluid
   - Vaginal secretions
   - Amniotic fluid
   - Semen
   - Any unfixed tissue or organ (other than intact skin) from a human (living or dead)
   - Blood, organs, or tissues from animals infected with HIV/HCV/HBV or other BBP
   - Any fluid where it is difficult to identify the presence or absence of blood

   Urine, feces, vomit, sweat, tears, and saliva are not regulated under the BBP rule because they are not considered to present a risk for BBP transmission unless there is visible blood in them. However, they should still be approached with caution; personnel should use latex or nitrile gloves and/or other PPE as needed when handling.

   PIs/supervisors are responsible for assessing activities in the workplace, determining if employees have a potential for occupational exposure, and documenting the risk in the Site-Specific BBP ECP.

   Individual exposure determinations must be made for existing workers on an on-going basis and prior to assigning or reassigning workers to job classifications with potential for exposure. The exposure determination must be made without regard to the use of PPE. Listed below are examples of tasks that involve potential exposure to blood or OPIM.
• Cleaning up a blood/body fluid spill or handling contaminated waste or laundry;
• Culturing and/or propagating human cells, viruses, including all human and primate retroviruses in laboratory culture and experimental animals.
• Removing, preparing, and/or storing any unfixed tissue or organ from a human;
• Providing patient care in a clinical or research setting;
• Providing emergency services or functions in public safety where delivery of trauma care is likely, i.e., lifeguards, police officers, fire fighters, etc.

D. UNIVERSAL PRECAUTIONS

Universal Precautions is an approach to protecting humans through infection prevention activities. This approach requires that all human blood, body fluids, and OPIM be treated as if they are known to be infectious for BBP. Engineering controls, work practices, and PPE shall be used to prevent contact with human blood and OPIM. Under circumstances in which differentiation between body fluid types is difficult or impossible, all human body fluids should be considered OPIM.

E. ENGINEERING/WORK PRACTICE CONTROLS

1. Engineering Controls

   Engineering controls serve to reduce worker exposure either by removing the hazard or by isolating the worker from exposure.

   Examples are:
   • Protective splash/splatter shields
   • Needles with safety features (e.g., self-sheathing needles, retractable needles)
   • Capture ventilation
   • Biological safety cabinets
   • Air filters
   • Ventilated equipment
   • Sharps disposal containers
   • Enclosures

2. Hand Hygiene

   Hand hygiene facilities must be available. If a sink with warm running water is not immediately available, a 60-95% alcohol-based gel hand sanitizer should be used until the employee can wash hands in a sink.

   Employees should immediately wash hands with soap and water upon glove removal and on completion of tasks involving contact with human blood, body fluids, or OPIM.

3. Sharps

   BBP exposures occur readily from needlestick or sharps injury to the skin.

   Preventative sharps safety practices are listed below:
Needles must not be recapped, purposely bent or broken, removed from disposable syringes, or otherwise manipulated. If recapping a syringe is unavoidable, then a safe procedure for doing this must be followed (one-hand scoop method) preferably using a recapping device. Ideally syringe preparation and injection should occur at the same location;

Sharps are not to be placed in the regular trash;

Needles with safety features should be used whenever possible; information and products can be found online at the International Sharps Prevent website or an EH&S OHN can be contacted;

Needles or sharps of any kind shall not be left on the work surface. Instead, a syringe holder or magnetic strip can be used to hold razor blades;

Procedures for proper restraint of animals must be ensured during injections. If necessary more than one person should assist;

After use, disposable syringes and needles, scalpel blades, lancets, and other contaminated sharp items (i.e., broken glass, razor blades, fragile glass items, glass slides and cover slips) must be placed in puncture-resistant sharps containers for disposal;

Dispose of contaminated reusable sharps immediately, or as soon as possible after use, in appropriate sharps containers until properly decontaminated. For additional information on sharps disposal, see the EH&S website.

4. Eating, Drinking, and Smoking

Eating, drinking, smoking, and other activities including applying cosmetics or lip balm, handling contact lenses, placing any article in the mouth, eyes, or nose, or other contact with mucous membranes is prohibited in work areas where there is a likelihood of occupational exposure to blood or OPIM.

Food and drink shall not be kept in refrigerators, freezers, shelves, cabinets, or on countertops or bench tops where blood or OPIM are stored or used.

5. Mouth Pipetting/Suctioning

To prevent accidental ingestion of potentially infectious materials, mouth pipetting or suctioning is strictly prohibited.

6. Aerosols

All procedures involving blood or OPIM shall be performed in such a manner as to minimize splashing, spraying, splattering, or generation of droplets of these substances. Such activity should be conducted in a certified BSC.

7. Centrifuging

Containment devices such as centrifuge safety cups and sealed rotors are recommended to protect the worker from exposure to microbial aerosols and droplets. Safety characteristics of centrifuges are only effective if the equipment is operated properly, thus training in the correct use of the equipment and routine inspections, with regular re-certification of the centrifuge are essential. See Section 4.C.2.
8. **Transporting and Shipping Biohazardous Materials**

Specimen containers used for blood or OPIM must be leak-proof. They also need to be red in color or labeled with the biohazard symbol. Anytime specimens of blood or OPIM are transported within the building or between buildings, the specimen container must be placed inside a secondary container that is also leak-proof, providing a double barrier. Additional information on transporting biohazardous materials is found on the [EH&S Biohazardous Waste page](#).

All specimens of blood or OPIM must be properly packaged for shipment by mail or courier service. Information on packaging and shipping hazardous materials is available on the [EH&S Shipping Hazardous Materials page](#). For questions, contact EH&S Environmental Programs at 206-616-5835.

9. **Equipment Servicing and Maintenance**

Equipment that may be contaminated with blood or OPIM must be decontaminated prior to servicing. Equipment being repaired, surplused, or disposed of must be decontaminated. A Notice of Laboratory Equipment Decontamination must be completed to certify that this has been done. The notice of decontamination form has information on how to decontaminate various types of equipment and who to call for questions.

When a portion of the equipment cannot be decontaminated, the equipment must be labeled with the biohazard label as well as stating which portion of the equipment remains contaminated. This information must be conveyed to all repair workers and servicing representatives and/or the manufacturer as necessary prior to handling, servicing, or shipping so that appropriate precautions will be taken.

F. **PERSONAL PROTECTIVE EQUIPMENT**

1. **Requirements**

The PI/supervisor must ensure that PPE for identified hazards is readily available in appropriate sizes at the worksite or is issued to the worker. The PI/supervisor is responsible for ensuring that a PPE hazard assessment is completed, that required PPE is documented in the Site-Specific BBP Exposure Control Plan, and that it is worn correctly by staff. Required PPE must be provided at no cost to employees. Refer to the [EH&S PPE page](#) and to the PPE information in Section 4.B.4.

PPE includes but is not limited to gloves, gowns, laboratory coats, clinic jackets, aprons, face shields or masks, eye protection (goggles, safety glasses with side shields) mouthpieces, resuscitation bags, and pocket masks or other ventilation devices. Surgical caps or hoods and shoe coverings or boots shall be worn in instances when gross contamination can be anticipated.

In order to be effective, PPE must prevent blood or OPIM from soaking through to the user's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membrane under normal conditions of use and for the duration of time for which the PPE will be used.

PPE must be cleaned, laundered, or disposed of and repaired or replaced as needed to maintain its effectiveness.
2. **Gloves**

   Appropriate gloves (latex or nitrile) must be provided to and worn by workers when handling blood or OPIM. Hypoallergenic gloves, glove liners, powderless gloves, or other similar alternatives are recommended to prevent allergies to latex.

   Double gloves may appropriately be used by persons with dermatitis, skin breaks, or as needed when working directly with biohazardous agents. Replace disposable gloves when contaminated, torn, punctured, or when their ability to function as a barrier is compromised. Do not wash or decontaminate disposable gloves for reuse.

   Wear nitrile or other chemically resistant gloves when working with chemicals. Latex gloves do not provide adequate chemical protection.

3. **Face Protection**

   Moisture resistant surgical face masks in combination with eye protection devices such as goggles, close fitting glasses with solid side shields, or chin-length face shields must be worn whenever splashes, spray, splatter, droplets of blood, or OPIM may be generated and where eye, nose, or mouth contamination can be anticipated. A table-top plexiglas® shield can provide additional protection from splash/splatter when work is performed behind the shield. Respirators are not typically required for work with BBP unless aerosol-generating activities are performed outside of a containment device. If these activities are anticipated, contact EH&S at 206-543-7388 for consultation about the potential need for respirators.

4. **Use and Removal**

   The PI/supervisor must ensure that employees use appropriate PPE when performing tasks with identified hazards. The types of PPE worn will depend upon the sort of work being done and the exposure anticipated. PPE must be removed and discarded carefully to prevent cross contamination. Hands must be washed after removal of PPE and any time they may be contaminated.

5. **Cleaning, Laundering or Disposal**

   The decontamination and disposal of single use PPE shall be in accordance with established University procedures for the treatment and disposal of biohazardous waste as described on the [EH&S Biohazardous Waste page](#). It shall be the responsibility of the PI/supervisor to ensure that laundry service for personal protective clothing is provided. Workers must not launder any personal protective clothing in their homes. Consolidated Laundry provides this service. All laundry shall be handled using Universal Precautions. If the contaminated laundry is wet and presents a reasonable likelihood of leakage, it must be bagged in special bags that are available from Consolidated Laundry.

G. **WORKSITE CONDITIONS**

1. **Responsibility**

   It is the responsibility of the PI/supervisor to ensure that the worksite is maintained in a clean and sanitary condition. Decontamination procedures can be found on the [EH&S Biohazardous Waste page](#).
2. Spill Clean-up

All workers must be familiar with procedures for decontamination and clean-up of spills of blood and potentially infectious materials. It is recommended that the use of glass be avoided whenever possible when working with biohazards since sharp broken glass can add another hazard.

Each laboratory shall have a specific procedure for dealing with spill cleanup based on the type and quantity of blood or OPIM handled, as well as the surfaces to be decontaminated. In addition to the procedure, cleanup supplies must be readily available. At a minimum, these supplies should include suitable disinfectants, gloves, paper towels or other absorbent material, forceps or tongs for broken glass or other sharps, an autoclavable squeegee and dust pan, and autoclave bags or other disposal container. Additional information on spill clean-up is found on the EH&S Biohazardous Spills page.

3. Cleaning Schedule

All floors, laboratory benches, and other surfaces shall be chemically decontaminated as often as deemed necessary by the PI/supervisor. The chemical decontaminant used is at the discretion of the PI/supervisor but must either be an EPA-registered tuberculocidal (List B), sterilant (List A), or a product registered against HIV/HBV (List D).

At a minimum, work surfaces are decontaminated at least daily, immediately after contamination with blood or OPIM, or following a spill.

At a minimum, floors shall be wet mopped on a weekly basis. Spills on the floor are decontaminated and cleaned up promptly.

4. Protective Coverings

When protective coverings such as plastic or aluminum wrap or absorbent pads are used, these coverings should be removed and replaced either when visibly contaminated or at the end of the work shift (if contamination was likely during the shift).

5. Biohazardous Waste

All untreated biohazardous waste must be handled using Universal Precautions. Disposable sharps containers must not be reused and must be autoclaved prior to disposal. Additional information on biohazardous waste treatment and disposal is found on the EH&S Biohazardous Waste page including flowcharts describing where and how to dispose of waste for your location.

Reusable waste receptacles for biohazardous waste shall be decontaminated each time they are emptied. Alternatively, the receptacle can be protected from contamination by a disposable liner (in addition to the biohazard waste bag) that shall be removed at the same time as the removal of the waste. The liner should be handled as biohazardous waste.

Broken contaminated glassware too large to fit into a 5-gallon sharps container shall be transported and treated in an autoclave-resistant plastic bin and then packaged and disposed of as laboratory glass as described on the EH&S Sharps and Laboratory Glass and Plastic Waste page.

Other biohazardous waste that does not pose the threat of skin puncture shall be placed in plastic biohazard bags. A leak-proof second container is required while transporting to the autoclave for treatment. If this container covers the biohazard label on the bag, the outer
container must have the biohazard label. This secondary container shall be autoclaved or otherwise decontaminated prior to reuse.

If biohazardous waste is to be shipped off-site for treatment via a contracted carrier, packaging must be done in accordance with the Department of Transportation (DOT) requirements. Any faculty or staff who will perform the final packaging steps and offer shipments must complete the EH&S training before setting up an account with the waste contractor.

H. BIOHAZARD SIGNS AND LABELS

The Biohazard Warning Sign must be used to restrict laboratory access when work with biohazardous materials is taking place, to communicate agents in use, and to specify entry and exit requirements. The sign includes the universal biohazard symbol which is required to have the fluorescent orange background with the symbol and lettering in a contrasting color.

Biohazard warning labels shall either be an integral part of the container or shall be affixed as close as feasible to the container by string, wire, adhesive, or other method that prevents their loss or unintentional removal.

Warning labels must be affixed to containers of biohazardous waste, refrigerators and freezers containing blood or OPIM, and other containers used to store, transport, mail, or ship blood or OPIM. See the EH&S Posting Biohazard Warning Signs and Labels page.

Biohazard labels do not need to be used on the following:

- Red bags or red containers when the color red is recognized as meaning the same as the warning label, or
- Containers of blood, blood components, or blood products that are labeled as to their contents and have been released for transfusion or other clinical use, or
- Individual containers of blood or OPIM that are placed in a labeled container during storage, transport, shipment, or disposal.

I. HEPATITIS B IMMUNIZATION

1. Offering Hepatitis B Vaccine

The PI/supervisor must assure that all workers with the potential for occupational exposure to BBP are offered the hepatitis B vaccine at no cost to the worker within ten days from the start of the work assignment and after receiving BBP training. For all employees who are in the UW BBP program, the Hepatitis B Vaccine Form is required to be signed in order to ensure this vaccine is offered.

The Hepatitis B Vaccine Form is also offered via the BBP training course which is required prior to the work with a potential for exposure to human blood and OPIM. Information is given on the efficacy, safety, method of administration, and the benefits of the hepatitis B vaccine. The form asks for hepatitis B vaccine dates if the employee has received the vaccination in the past. The completed form is forwarded to the Employee Health Center for review and follow-up.

Employees who decline immunization must sign and date a waiver section on the Hepatitis B Form after reading the waiver statement indicating an understanding of the risks of declining the vaccine. The decision to refuse the vaccination can be reversed at any time.
After receipt of the Hepatitis B Form, the EHC will ask for verification of immunization for workers previously immunized. The EHC will also provide the PI/supervisor and the employee with a written opinion within 15 days of a medical evaluation (if done at EHC) for hepatitis B administration. This written opinion informs the PI/supervisor that the employee completed the evaluation regarding hepatitis B immunization. To protect the worker's privacy, the written opinion will be limited to answering two questions: 1) Is hepatitis B immunization recommended? 2) Was the vaccine administered?

Prescreening of workers (pre-vaccine blood titers) shall not be a condition for beginning the hepatitis B immunization series. However, a post vaccine antibody titer (Anti-HBs) is recommended to assure the efficacy of the immunization.

2. Administering Hepatitis B Vaccine

University staff and faculty are responsible for contacting the EHC and scheduling an appointment to receive the hepatitis B vaccine. Hepatitis B immunization is given as recommended by the U.S. Public Health Service. Booster immunizations are not recommended at this time. If a need for booster immunization is demonstrated in the future, these immunizations will be offered. More information about hepatitis B vaccine can be found.

J. POST-EXPOSURE REQUIREMENTS

1. Exposure Incident

An exposure incident is defined as specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with human blood or OPIM. Examples of exposure incidents include needlesticks, splash/spatter to the mucous membranes of the face, and any other incident that involves contact between blood or OPIM and non-intact skin (cuts, scratches, chapped skin, etc.).

2. Immediate Response

Following an exposure incident, the following steps must be completed. These steps are also provided on the **EH&S Exposure Response Poster** which can be printed and posted in work area for quick reference.

a. Provide first aid immediately.

1) For percutaneous injury or exposure through a wound, rash, or other compromised skin:
   - Scrub exposed area gently but thoroughly for 15 minutes using warm water and sudsing soap.
   - A safety shower may also be used if the affected area is not able to be washed in a sink. Stay under the shower for 15 minutes; remove clothing. Use a clean lab coat, spare clothing, or drop cloth for cover-up.

2) For eye exposure use the eye wash for 15 minutes while holding eyelids open.

3) For inhalation move out of contaminated area and seek medical help

b. Seek help (share details of exposure i.e. agent, dose, route, time since exposure)

1) Contact employee health centers during business hours:

   - Call the UW EHC at 206-685-1026.
• At Harborview sites call 206-744-3081.

2) Outside of business hours or if EHC is closed CALL 911 or go to nearest emergency room.

c. Notify your supervisor as soon as possible for assistance.

d. Secure area before leaving.

e. Report incident to EH&S
   1) For serious accident, hospitalization, or fatality, after providing first aid and/or getting help, notify EH&S immediately.
   2) During business hours call 206-543-7262.
   3) Outside of business hours call 206-685-UWPD (8973).
   4) For all incidents and near misses, complete OARS Report within 24 hours.

3. Principal Investigator/Supervisor Responsibility

The PI/supervisor is responsible for assisting the exposed worker in seeking the necessary and immediate medical evaluation and consultation following an exposure incident. The following table is provided to assist the PI/supervisor in obtaining immediate medical consultation and evaluation for an exposed worker.

<table>
<thead>
<tr>
<th>Worker's Location</th>
<th>Department</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>UW Seattle Campus and Health Sciences, including South Lake Union and Western Facilities</td>
<td>Employee Health Center (EHC) at Hall Health</td>
<td>206.685.1026</td>
</tr>
<tr>
<td>UW Medical Center (MC)</td>
<td>EHC at UWMC</td>
<td>206.598.4848</td>
</tr>
<tr>
<td>Harborview MC</td>
<td>Employee Health Services</td>
<td>206.744.3081</td>
</tr>
</tbody>
</table>

4. Evaluation Post Exposure

The worker who has had a potential BBP exposure will receive a copy of WAC 296-823 describing his/her rights and a post-exposure medical evaluation and follow-up as described in this section below.

a. A medical evaluation will be performed immediately after exposure and will be all of the following:
   1) Confidential,
   2) At no cost to employee,
   3) At a reasonable time and place, and
   4) Administered by a licensed physician or HCP.

b. The examination will include at least these elements:
   1) Documentation of the routes of exposure and the circumstances under which the exposure happened
   2) Identification and documentation of the source (individual or materials) if possible
3) Serial collection and testing of blood to detect the presence of HIV and/or HBV; in the event the worker does not permit serologic testing, a baseline blood sample will be held for at least 90 days
4) Post-exposure treatment when medically indicated and as recommended by the U.S. Public Health Service
5) Counseling about the results of testing and information regarding state laws concerning disclosure of the information
6) Evaluation of reported illnesses subsequent to the exposure
c. The treating HCP is to provide the employee with a copy of the written opinion on the post-exposure evaluation within 15 days of the incident. This written opinion includes whether Hepatitis B vaccination is indicated for the employee and if the employee has received such vaccination. It documents that a medical evaluation took place following the exposure incident, that the employee has been informed of the results of the evaluation, and that the employee has been counseled about potential medical conditions resulting from exposure to blood or OPIM that may need further evaluation or treatment. All other findings are to remain confidential.

It is the responsibility of the PI/supervisor to assist the employee in obtaining a copy of the report if it has not already been provided to the employee. The employee should tell his or her supervisor if a copy of this report has not been received within 15 days.

K. TRAINING PROGRAM

1. Responsibility
   PI/supervisor must ensure that staff complete BBP training. Training must follow standards set forth in WAC 296-823. Training for all employees who have the potential for occupational exposure to human blood or OPIM must be the following:
   • Provided at no cost to the employee
   • Required prior to work with these materials, and within one year of the previous training
   • To take place during compensated work hours

   EH&S offers online BBP training. For research laboratories, verification of current EH&S BBP training is required prior to approval from the Institutional Biosafety Committee.

   Departments/supervisors who choose to provide their own BBP training must first consult with EH&S to ensure the training meets the requirements set forth in the BBP Rule.

   In addition to EH&S BBP training, PIs/supervisors must provide additional documented training to their staff on the Site-Specific BBP Exposure Control Plan prior to work, annually, and when there are changes such as new or modified tasks or procedures that may affect exposure potential.

2. Training Requirements
   The training program must contain the following elements:
   a. An accessible copy of the regulatory text of the bloodborne standard and an explanation of its contents;
   b. A general explanation of the epidemiology and symptoms of bloodborne diseases;
c. An explanation of the modes of transmission of bloodborne pathogens;
d. An explanation of the UW’s ECP and the means by which the worker can obtain a copy of the written plan;
e. An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and OPIM;
f. An explanation of the use and limitations of methods that will prevent or reduce exposure including appropriate engineering controls, work practices, and PPE;
g. An explanation of the basis for selection of PPE, as well as information on the types, proper use, location, removal, handling, decontamination, and disposal of personal protective equipment;
h. Information on the Hepatitis B vaccine, including information on its efficacy, safety, method of administration, benefits of being vaccinated, and that the vaccine and immunization will be offered free of charge;
i. Information on the appropriate actions to take and persons to contact in an emergency involving blood or OPIM;
j. An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident and the medical follow up that will be made available;
k. Information on the post-exposure evaluation and follow up that the PI is required to provide for the worker following an exposure incident;
l. An explanation of the signs and labels and/or color coding as required and used; and
m. An opportunity for interactive questions and answers with the person conducting the training session.

L. RECORDKEEPING

1. Medical Records

The treating facility will establish and maintain accurate and confidential records for each worker with occupational exposure for at least the duration of employment plus thirty years in accordance with WAC 296-823-120.

At a minimum the record shall contain:
a. Worker name
b. A copy of the written opinion sent to the employee following evaluation for Hepatitis B immunization as well as the worker’s Hepatitis B immunization status and any other medical records relative to the worker’s ability to receive the immunization. In lieu of this, the file will have the declination form signed by the worker declining the Hepatitis B immunization
c. The results of examination, medical testing, and follow-up procedures following an exposure incident
d. A copy of the written opinion sent to the PI/supervisor following a post-exposure medical evaluation
e. A copy of the information provided by the PI/supervisor following an exposure incident
2. **Training Records**

EH&S tracks all employee attendance for training conducted by EH&S. These records are kept for at least three years after the date on which the training occurred. PIs/supervisors must also maintain records of site-specific laboratory training conducted by the laboratory and/or department.

Training records must contain:

a. The date(s) and location(s) of the training
b. A summary of the training course content
c. The names and qualifications of the instructors
d. The names of all persons attending the training

3. **Availability**

All records described shall be made available for examination and copying to the Director of the Washington State Department of Labor and Industries.

Medical records will be available for examination and copying to the worker or any person with the worker’s written consent.

Training records will be available for examination and copying to workers or employee representatives.

M. **ACCESSIBILITY OF THE ECP**

Each PI/supervisor is responsible for ensuring that laboratory staff and workers can access and consult the Site-Specific BBP ECP at any time.

A copy of the exposure plan must be available to the Director of the Washington State Department of Labor and Industries upon request for examination and copying.

N. **ANNUAL UPDATE OF THE ECP**

The lab’s Site-Specific BBP ECP will be reviewed and updated when necessary and at least annually.

The PI/supervisor is responsible for reviewing the lab’s Site-Specific BBP ECP annually and whenever necessary to reflect new or modified tasks and procedures that affect the potential for occupational exposure and to reflect new or revised worker positions with the potential for occupational exposure.

O. **ADDITIONAL REQUIREMENTS FOR HIV, HBV, AND HCV RESEARCH LABORATORIES**

1. **Application**

This section applies to a research laboratory engaged in the culture, production, concentration, and manipulation of HIV, HBV, and HCV. It also applies to work with SIV/SHIV non-human primate retroviruses. Such a facility works with high titer concentrations of virus but not with volumes greater than one liter. These requirements apply in addition to the other requirements of the ECP. If greater volumes are used the facility is called an HIV/HBV/HCV Production facility.
This section does not apply to clinical or diagnostic laboratories engaged solely in the analysis of blood, tissues, or organs.

In addition to the above, research involving the culture and/or production of HIV, HBV, or HCV must be reviewed and approved by the IBC before the activities can commence. This review will include a determination as to the appropriate biosafety level and practices, which are typically elevated for research with these agents.

2. **Facility Requirements**

Each laboratory shall contain a facility for hand washing and an eye wash facility that is readily available within the work area. The sink shall be foot, elbow, or automatically operated and located near the exit door.

An autoclave for decontamination of regulated waste shall be available. Refer to the location-specific [Biohazardous Waste Flow Charts](#) for decontamination and disposal of these materials at your location.

Vacuum lines are to be protected with liquid disinfectant traps and HEPA filters or filters of equivalent or superior efficiency. Traps and filters must be checked routinely and maintained or replaced as necessary.

3. **Access Policy**

Access to the work area is to be limited to authorized persons. Written policies and procedures shall be established whereby only persons who have been advised of the potential biohazard, who meet any specific entry requirements, and who comply with all entry and exit procedures before being allowed to enter the work areas and animal rooms.

Laboratory doors are to be kept closed when work involving HIV, HBV, or HCV is in progress. The PI/supervisor must post biohazard signs on all access doors. For more information on biohazard signs, refer to the [EH&S Posting Biohazard Warning Signs and Labels page](#).

4. **Biosafety Manual**

The lab-specific BSL 2 with BSL-3 practices Biosafety Manual (BSL2 w/3 practices BSM) must be available in the laboratory in hard copy form or as an obvious iconshortcut on a laboratory computer that is accessible to lab members. Personnel must be advised of potential hazards and are required to read and implement the instructions on practices and procedures as developed by the laboratory and written in the ECP.

5. **Containment**

No work is to be conducted on the open bench with materials that have the potential for HIV, HBV, or HCV exposure.

A certified BSC must be used when working with materials that have the potential for HIV, HBV, or HCV exposure in the research laboratory. The BSC must be certified when installed, whenever moved, and at least annually.

Use of engineering controls (as noted in part D of this section) and PPE specific for splash and aerosol protection (protective clothing and respiratory protective equipment) are required when working with materials that have the potential for HIV, HBV, or HCV exposure.
6. **Protective Clothing and Practices**

Eye protection and laboratory coats, gowns, smocks, uniforms, or other appropriate protective clothing must be used in the work area and animal rooms. Protective clothing must not be worn outside the work area and, if reusable, must be autoclaved before being laundered.

Avoid skin contact with materials that have the potential for HIV, HBV, or HCV exposure. Gloves must be worn when handling infected animals and when handling these materials. Double gloves are recommended when exposure risk is high, e.g., when working directly with potentially infectious materials. See your lab-specific BSL2 w/3 practices BSM for more information.

7. **Use of Sharps**

Hypodermic needles and syringes should be used only for parenteral injection of laboratory animals and aspiration of fluids from diaphragm bottles. Only needle-locking syringes or disposable syringe-needle units (i.e., the needle is integral to the syringe) should be used for the injection or aspiration of potentially infectious materials. See Appendix A.E.3., for essential work practices using sharps.

8. **Spills**

Contain all spills immediately, and decontaminate as indicated for specific with biohazardous agents.

A spill or accident that results in an exposure incident must be immediately reported to the PI/supervisor or other responsible person. Refer to the EH&S Biohazardous Spills page.

9. **Decontamination of Waste**

Before disposal, all waste from work areas and animal rooms must either be chemically decontaminated by a method that is known to effectively destroy BBP or autoclaved. The method of decontamination needs to be documented in your lab-specific BSL2 w/3 practices BSM.

Contaminated materials that are to be decontaminated at a site away from the work area need to be placed in a durable, leak-proof, labeled or color-coded container that is closed before being removed from the work area. The outside of the container must be decontaminated prior to removal from the lab (i.e., spray or wipe off the container).

10. **Additional Initial Training for Laboratory Staff and Workers in HIV, HBV, and HCV Laboratories**

Laboratory staff and workers in HIV, HBV, or HCV research laboratories must receive the BBP training as outlined in your lab-specific BSL2 w/3 practices BSM. The PI/supervisor must ensure that laboratory staff and workers have experience in the handling of human pathogens or tissue cultures before working with HIV, HBV, or HCV, and must provide a training program to laboratory staff and workers who have no prior experience handling human pathogens. In this case, initial work activities can not include the handling of infectious agents.

A progression of work activities shall be assigned as techniques are learned and proficiency is developed. The PI/supervisor must ensure that laboratory staff participates in work activities involving biohazardous agents only after proficiency has been demonstrated. Practices and operations specific to the facility must be reviewed before allowing work with HIV, HBV, or HCV.
P. HIV, HBV, AND HCV PRODUCTION FACILITY

A HIV, HBV, and HCV production facility is a facility engaged in industrial-scale, large-volume production of high titer concentration of HIV, HBV, and HCV. There currently are no HIV, HBV, or HCV Production facilities at the University of Washington.
Appendix B – Posting Biohazard Signs and Labels

Contents
A. PURPOSE .......................................................................................................................... B-1
B. RESPONSIBILITY ............................................................................................................. B-1
C. BIOHAZARD WARNING SIGN USE .............................................................................. B-1
D. BIOHAZARD WARNING LABELS USE ......................................................................... B-2

A. PURPOSE

Biohazard warning signs are used to restrict access in areas when biohazardous procedures are in progress and to alert support personnel as well as emergency personnel who may enter the area to take precautionary measures.

B. RESPONSIBILITY

It is primarily the responsibility of the PI to identify and restrict access to the laboratory and to notify emergency and support personnel of any hazards in the laboratory.

C. BIOHAZARD WARNING SIGN USE

1) A standardized Biohazard Warning Sign must be used to restrict laboratory access.

2) This sign must be permanently affixed to all entry doors of the following laboratories/rooms: BSL-2 with BSL-3 practices, BSL-3, ABSL-2, ABSL-2 with ABSL-3 practices, ABSL-3.

3) For BSL-2 laboratories, the Biohazard Warning Sign must be affixed to entry doors in a way such that it can be easily removed (e.g., place sign in plastic cover). After work is complete, agents are secured (e.g., inside closed incubator or refrigerator), and surfaces are decontaminated,
the biohazard warning sign may be removed or turned over. If the biohazard warning sign is affixed to a BSL-2 laboratory door, support staff, such as Facilities Services or Custodial Services, will not enter.

4) Refer to the EH&S Posting Biohazard Warning Signs and Labels page for additional information and instructions.

D. BIOHAZARD WARNING LABELS USE

Any storage or transportation container, as well as any waste container that contains untreated biohazardous waste, must be identified with a biohazard warning label. See the EH&S Posting Biohazard Warning Signs and Labels page for additional information about use of these labels and Appendix C for transportation information.

Examples of biohazard warning labels and order information are available from EH&S ROS at 206-221-7770.
Appendix C – Transporting and Shipping
Biohazardous Agents (including Laboratory Specimens)

Contents

A. TRANSPORTING BIOHAZARDOUS AGENTS AND LABORATORY SPECIMENS ........................................... C-1
   1. Within Building ................................................................. C-1
   2. Between Buildings ............................................................ C-1

B. SHIPPING BIOHAZARDOUS MATERIALS ............................................. C-2

A. TRANSPORTING BIOHAZARDOUS AGENTS AND LABORATORY SPECIMENS

This section outlines the proper procedures for transporting biohazardous agents and laboratory specimens within buildings and between buildings. For procedures on transporting biohazardous waste, including recDNA waste, refer to Section 4.F.4 of this manual. Biohazardous agents must be packaged so that PPE is not needed during transport. PPE should not be worn in public corridors.

1. Within Building

When packing biohazardous agents for transportation within the same building but through public areas, the following guidelines apply. UW Medical Center and Harborview Medical Center have specific requirements for transporting materials in their facilities. These requirements are found in each hospital’s infection control manual.

a. Biohazardous agents including specimens of blood or other potentially infectious materials must be placed in a primary container that prevents leakage during transportation. A test tube, for example, is a primary container.

b. The primary container must be closed prior to being transported. The test tube, for example, must have a tight fitting cap or the cap must be taped in place or otherwise secured.

c. Label the container with name of the PI and the room number.

d. The primary container must be placed in a leak-proof secondary container. The test tube, in this example, is placed in a sealable plastic bag.

2. Between Buildings

When biohazardous agents are transported between buildings, the following guidelines apply.

a. If using a motor vehicle for transport between buildings, it must be a UW owned and operated vehicle (e.g., Fleet Services, UCAR).

b. Biohazardous agents, including specimens of blood or other potentially infectious materials, must be placed in a primary container that prevents leakage during transportation. A test tube, for example, is a primary container.
c. The primary container must be closed prior to being transported. The test tube, for example, must have a tight fitting cap or the cap must be taped in place or otherwise secured.

d. Label the container with name of the PI and the room number.

e. The primary container is placed within a leak-proof secondary container. The test tube, in this example, is placed in a sealable plastic bag. It is good practice to place absorbent material between the bag and tube to cushion the tube and absorb leakage from improperly sealed tubes. It is mandatory that absorbent material be used for items transported in a motor vehicle (UW owned and operated vehicle such as Fleet Services or UCAR for transport between buildings).

f. The packages are then placed in an outer transport container labeled with the biohazard label. This container can be a cardboard box with a styrofoam liner, a cooler, or other sturdy transport container.

g. If the material is not transported by the original packager (i.e., by courier or UW owned and operated vehicle) the outer transport container must show the following information in addition to the biohazard label:
   1) Identification of the material being transported - for example: human blood, animal blood, cultures, etc.
   2) The name, department, building, box number, and phone number of the receiving party
   3) The name and phone number of the sender
   4) The date sent

B. SHIPPING BIOHAZARDOUS MATERIALS

For shipping biohazardous materials, including infectious substances, contact EH&S Environmental Programs at 206-616-5835. Anyone involved in packaging, shipping or preparing paperwork for the shipment of biohazardous materials, including infectious substances, must have task specific training:

1) Prior to beginning this assignment, and

1) Be re-trained every two years
Appendix D – Current Records Maintained in Biosafety Manual

Contents

A. BIOSAFETY AND BLOODBORNE PATHOGENS TRAINING RECORDS........................................................................................................D-1

B. CDC, U.S. DEPARTMENT OF AGRICULTURE (USDA), ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS) PERMITS..........................D-1

C. SHIPPING PAPERS.................................................................................................................................D-1

D. EXPOSURE INCIDENTS...........................................................................................................................D-1

The Biosafety Manual is augmented with laboratory-specific information that must be accessible to all employees in the laboratory at all times. The laboratory-specific information is typically filed in the front of the Biosafety Manual binder. The current edition of the Biosafety Manual is available electronically on the EH&S website.

Laboratory specific information consisting of information such as standard operating procedures, laboratory floor plans, biohazard spill kit locations, exposure control plan, training records, and emergency procedures filed in this section and should be reviewed and updated by the PI or lab manager at least annually or whenever there are changes.

A. BIOSAFETY AND BLOODBORNE PATHOGENS TRAINING RECORDS

Laboratories must maintain current records of initial and refresher biosafety and BBP trainings.

EH&S maintains records of employee attendance at their classes. Copies of these records are available to departments upon request (call 206-543-7201 or email ehstrain@uw.edu). You can also access your biosafety and BBP training records online.

B. CDC, U.S. DEPARTMENT OF AGRICULTURE, ANIMAL AND PLANT HEALTH INSPECTION SERVICE PERMITS

PI must keep current copies of any required CDC, U.S. Department of Agriculture (USDA), or/and Animal and Plant Health Inspection Service (APHIS) permits.

C. SHIPPING PAPERS

If items containing biohazards are mailed or moved on or off campus and require shipping papers, these papers should be kept for three years.

D. EXPOSURE INCIDENTS

Employee incident/accident report records are maintained at EH&S (206-543-7388). Industrial insurance records are maintained in the UW Office of Risk Management (206-543-0183). The PI should also keep copies of all incident/accident reports filed pertaining to the laboratory or involving laboratory staff.
Appendix E – Website Links

Contents
A. REGULATIONS, GUIDELINES, STANDARDS, AND WEBLINKS ............................................. E-1
B. FORMS AND CHARTS ............................................................................................................. E-4

A. REGULATIONS, GUIDELINES, STANDARDS, AND WEBLINKS

Animal Use Medical Screening (AUMS) Program
http://www.ehs.washington.edu/rbs/resocchealth.shtm

Autoclaves
http://www.ehs.washington.edu/rbsbiosafe/autoclave.shtm

Biohazard Warning Door Sign
http://www.ehs.washington.edu/rbsbiosafe/postbz.shtm

Biohazard Spill Kit
http://www.ehs.washington.edu/rbsbiosafe/spillbiokit.shtm

Biohazardous Waste
http://www.ehs.washington.edu/ohsreslab/biowaste.shtm

Biological Safety Cabinets
http://www.ehs.washington.edu/fsobiocab/bsc.shtm

Biological Use Authorization (BUA Applications)
http://www.ehs.washington.edu/rbsresplan/bua.shtm

Biosafety in Microbiological and Biomedical Laboratories

Bloodborne Pathogens Training
http://www.ehs.washington.edu/rbs/bbp.shtm#training

Bloodborne Pathogens Website
http://www.ehs.washington.edu/rbs/bbp.shtm

Biosafety Training
http://www.ehs.washington.edu/rbsbiosafe/index.shtm#training

CDC Information on Hepatitis B Vaccine

CDC Select Agent List
http://www.selectagents.gov/SelectAgentsandToxinsList.html

CDC Select Agent Program
http://www.cdc.gov/od/sap
Department of Comparative Medicine
http://depts.washington.edu/compmed/index.html

EH&S Exposure Response Poster

EH&S Guidance about Workplace Hazards Impacting Reproduction and Development

Embryonic Stem Cell Research Oversight (ESCRO)
http://www.washington.edu/research/escro/

Employee Health Centers
http://www.ehs.washington.edu/ehs/ehc.shtm

EPA Antimicrobial Chemical/Registration Number Indexes
http://www.epa.gov/oppad001/chemregindex.htm

Flammable Storage
http://www.ehs.washington.edu/fsofire/flamfrig.shtm

IBC’s Roles and Responsibilities

Institutional Animal Care and Use Committee
http://depts.washington.edu/oawhome/

King County Board of Health

Laboratory Safety Design Guide
http://www.ehs.washington.edu/fsodesignrev/labsafdesign.shtm

NIH Guidelines for Research Involving Recombinant DNA Molecules

Online Reporting System (OARS)
http://www.ehs.washington.edu/ohsoars/index.shtm

Online Safety Training Records Look-up
http://www.ehs.washington.edu/psotrain/mytraining.shtm

Public Corridor Storage Policy
http://www.ehs.washington.edu/fsofire/corridor.shtm

Recombinant or Synthetic DNA in Human Research Participants
http://www.ehs.washington.edu/rbsresplan/clinical.shtm

Seattle Municipal Code Infectious Waste Management
http://clerk.ci.seattle.wa.us/~scripts/nph-brs.exe?s1=&s2=infectious+waste&S3=&Sect4=AND&I=20&Sect1=IMAGE&Sect3=PLURON&Sect5=CODE1&d=CODE&p=1&u=~public/code1.htm&r=4&Sect6=HITOFF&f=G

Sharps and Laboratory Glass and Plastic Waste
http://www.ehs.washington.edu/rbsresplan/sharp.shtm
Shipping Hazardous Materials
http://www.ehs.washington.edu/eposhiphazmat/

Shipping Hazardous Materials Training
http://www.ehs.washington.edu/psotrain/corsdesc.shtm#shiphazmat

Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HIV and Recommendations for Postexposure Prophylaxis
http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5409a1.htm

UV (ultraviolet) Light
http://www.ehs.washington.edu/rsononion/uvlight.shtm

UW Administrative Policy Statements
http://www.washington.edu/admin/adminpro/APS/TOC10.html
http://www.washington.edu/admin/rules/policies/APS/10.06.html
http://www.washington.edu/admin/rules/policies/APS/10.08.html
http://www.washington.edu/admin/rules/policies/APS/12.03.html

UW Biosafety Manual
http://www.ehs.washington.edu/rbsbiosafe/bsmanualindex.shtm

UW Consolidated Laundry
http://depts.washington.edu/laundry/

UW Environmental Health & Safety Training
http://www.ehs.washington.edu/psotrain/index.shtm

UW Health & Safety Programs: Policies and Responsibilities
http://www.washington.edu/admin/rules/policies/PO/EO55.html

UW Human Subjects Division (IRB)

UW Laboratory Safety Manual
http://www.ehs.washington.edu/manuals/lsm/

UW Radiation Safety Manual
http://www.ehs.washington.edu/manuals/rsmanual/index.shtm

WAC 296-104-100, Autoclave Structural Inspection

WAC 296-823, Bloodborne Pathogen Standard

Washington Industrial Safety and Health Act, Homepage
http://www.lni.wa.gov/SAFETY/TOPICS/ATOZ/ABOUT/DEFAULT.ASP
B. FORMS AND CHARTS

Autoclave Quality Control Checklist
http://www.ehs.washington.edu/forms/rbs/qcchecklist.doc

EH&S Biological Use Authorization Application
http://www.ehs.washington.edu/rbsresplan/bua.shtm

EH&S Request for Change to Biological Use Authorization
http://www.ehs.washington.edu/rbsresplan/bua.shtm

Exposure Control Plan Template
http://www.ehs.washington.edu/rbs/bbp.shtm#ECP

Hepatitis B Vaccination Form
http://www.ehs.washington.edu/rbs/bbp.shtm#vaccine

Location-Specific Biological Waste Flowcharts
http://www.ehs.washington.edu/ohsreslab/biowaste.shtm#flowcharts

Notice of Laboratory Equipment Decontamination
http://www.ehs.washington.edu/forms/fso/lab_equip.pdf