BIOSAFETY MANUAL

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Purpose and Scope

Calvin College is committed to ensuring the safe handling, storage, and disposal of potentially biohazardous materials used in research and academic activity at the College. The purpose of this manual is to provide the necessary procedures, guidance and information for the safe use of biohazardous or potentially biohazardous agents at Calvin College (Calvin). Biohazardous materials addressed in this manual and of interest to the Institutional Biosafety Committee (IBC) include the following:

1. Risk Group 1, or unknown, or potentially infectious agents (including cell lines)
2. Recombinant DNA
3. Biological agents listed by National Institutes of Health in Risk Group 2, 3 & 4.
4. Human and non-human primate cells, tissue and/or blood
5. Select agents and biological toxins identified by the Centers for Disease Control.

This manual contains procedures for acquiring authorization to use, purchase, and possess biohazardous agents; safety precautions to follow when working with biohazards; emergency procedures for handling accidents involving biohazardous agents; and procedures for the disposal of biohazards. All other appropriate regulations and guidelines (radiation, chemical, occupational safety, etc.) must also be followed.

A. Definitions

Biological Agent: Biological agents include bacteria, viruses, fungi, other microorganisms and their associated toxins. They have the ability to adversely affect human health in a variety of ways, ranging from relatively mild, allergic reactions to serious medical conditions, even death. These organisms are widespread in the natural environment; they are found in water, soil, plants, and animals. Because many microbes reproduce rapidly and require minimal resources for survival, they are a potential danger in a wide variety of settings.

Biohazard: A biological agent that constitutes a hazard to humans or the environment.

Biosafety: Laboratory biosafety includes all containment principles, techniques and practices that are implemented to prevent the unintentional exposure to biological agents and toxins, or other accidental release (WHO).

Infectious Agent: Refers to the specific agent capable of producing an infection or disease, especially a virus or bacterium (i.e.: pathogen).

Recombinant DNA: Recombinant DNA molecules are defined as either:

(i) Molecules that are constructed outside living cells by joining natural or synthetic DNA segments to DNA molecules that can replicate in a living cell; or
(ii) Molecules that result from the replication of those described in (i) above (NIH).

I. Roles and Responsibilities

A. Calvin Institutional Biosafety Committee

The Institutional Biosafety Committee (IBC) is responsible for providing local review and oversight of nearly all forms of research and teaching utilizing recombinant DNA and for providing review and oversight of experimentation that involves hazardous biological materials (e.g., infectious agents) and other potentially hazardous agents (e.g., carcinogens). Furthermore, the Institutional Biosafety Committee shall ensure that all recombinant DNA research conducted at or sponsored by Calvin College is conducted in compliance with the *NIH Guidelines*. The IBC reports to the College President via the Dean for the Natural Sciences and Mathematics.

To accomplish its mandate, the Institutional Biosafety Committee:

1 May invite individuals with competence in special areas to assist in a review of any issues that require expertise beyond that available on the Institutional Biosafety Committee. However, these individuals may not vote on committee matters;

2. File an annual report with the NIH Office of Biotechnology Activities that includes:
   - a roster of IBC members clearly indicating the chair, contact person and, as applicable, the biological safety officer, plant expert, animal expert, and human gene transfer expert or *ad hoc* consultant;
   - biographical sketches (e.g., curricula vitae or résumé) of all IBC members, including community members;

3. Establish procedures that the IBC shall follow in its initial and continuing review and approval of applications, proposals, and activities;

4. Maintain proper records of all IBC meeting minutes and decisions; file approved applications and proposals in the Provost's office.

5. Send a report to the Faculty Senate during each academic year indicating the college's compliance with applicable regulations and law.

Reporting Relationship:

The Institutional Biosafety Committee will report to the Faculty Senate.

i. Membership

The IBC shall consist of three faculty and two members not affiliated with the college, all of whom are knowledgeable in the issues of safety of *Recombinant or Synthetic Nucleic Acid Molecules* and have the ability to identify potential risks to public health and safety, not entirely men or women, one of whom has expertise in plant, plant pathogen or pest containment principles, one of whom has expertise in animal containment principles; the Environmental Health and Safety Officer; the Biology Department Lab Manager. A faculty member will chair the committee. Appointments will be made by the Dean for Natural Sciences and Mathematics per the federal regulations and forwarded to the Committee on Governance for information.

ii. Responsibilities

The responsibilities of the IBC are to maintain quality safety standards in regards to the use of biohazardous agents on Calvin's campus. This includes the authority to suspend or revoke permission to use biohazardous agents if found to be handled improperly.

The Committee shall do the following:

- Review and approve or disapprove applications for the use biohazardous agents.
- Review training of the authorized users to ensure qualified use.
- Review this Biosafety Manual not less than biannually.
- Advise the Biosafety Officer on technical matters and approve proposed changes to the implementation of the biosafety program.
- Maintain written minutes of each meeting.
- Recommend improvements or procedures for safe use of biohazardous agents.
- Review all reports submitted by the Biosafety Officer.
- Notifying the Principal Investigator of the results of the Institutional Biosafety Committee's review and approval.
- Set containment levels for biological agents.
- Periodically review recombinant DNA research conducted at the institution to ensure compliance with the *NIH Guidelines*.
- Adopt emergency plans covering accidental spills and personnel contamination resulting from research with infectious agents.

B. Biosafety Officer

The individual responsible for implementing the Biosafety program is the Biosafety Officer. The Biosafety Officer has authority to stop operations that he or she considers unsafe. He or she must have sufficient time and commitment to fulfill the duties and responsibilities appointed to ensure safe use of biological materials.

Specific duties of the Biosafety Officer include:

- Reviewing all plans for proposed use of biohazardous materials and make recommendations to the Biosafety Committee
- Oversee all activities involving potentially biohazardous materials
- Conduct training programs to ensure proper use from all authorized users
- Supervise and coordinate biohazard waste disposal
- Immediately terminate any unsafe condition thought to be a risk to public health or safety
- Conduct periodic inspections
- Report to the IBC any significant problems, violations of the *NIH Guidelines*, and any significant research-related accidents or illnesses
- Provide advice on laboratory security

C. Principal Investigator

A Principal Investigator is one whose training and experience have been reviewed and approved by the IBC and use or directly supervise the use of biohazardous agents. Their primary responsibility is to ensure that biological materials used in his or her particular lab are used safely and according to regulatory requirements.

These individuals must have adequate and appropriate training to provide reasonable assurance that they will use the material safely, including maintaining security of, and access to, hazardous material, and respond appropriately to events or accidents to prevent the spread of contamination.

Upon approval, the authorized user shall have the following responsibilities:

- Ensure that operations involving biologically hazardous materials are performed only by personnel who have been properly instructed and authorized.
- Ensure that appropriate precautions are taken for workers under their supervision.
- Follow proper procedures for procurement of biological materials.
- Provide correct and current posting and labeling of laboratory areas and biohazard containers.
- Ensure an accurate and current inventory records for all biohazard materials under his or her responsibility.
- Follow established procedures for biohazardous waste.

- Report immediately any potentially hazardous spills, exposures, loss of biological materials, or other incidents having possible biological safety implications.
- Provide adequate use-specific safety training for all workers under their supervision.
- Provide adequate security for biohazardous agents.
- Notify the Biosafety Officer of changes in the use, location or quantities of biohazardous agents.
- Arrange for disposal or transfer of all biohazardous waste promptly upon termination of the authorized use or application.
- Attend meetings, assist with safety audits, and provide documentation as required by the Biosafety Officer.
- Maintain each controlled area in a way that is both considerate of other users and eliminates risks to maintenance, janitorial, and security personnel if they are required to enter an unoccupied space.
- Maintain an inventory of all biohazardous agents.

D. IBC Coordinator

The coordinator prepares documents for committee review and maintains records on behalf of the committee. Duties include:

- Schedule and facilitate IBC meetings
- Maintain records of biosafety applications, IBC meetings, and PI communication
- Shall ensure waste records are kept on file in the EHS department
- Conduct annual inspections with the BSO
- Maintain, and edit as needed, the biosafety manual, application, and biosafety webpage
- File an annual report with NIH/OBA which includes:
  - (i) A roster of all IBC members indicating the Chair, contact person, Biological Safety Officer, plant expert (if applicable), animal expert (if applicable), human gene therapy expertise or *ad hoc* consultant (if applicable).
  - (ii) Biographical sketches of all Institutional Biosafety Committee members (including community members).

II. Biosafety Approval Procedures

All research and coursework at Calvin using biohazardous/potentially biohazardous materials are subject to review and approval by the Institutional Biosafety Committee. Principal Investigators, Department Heads, or any others wishing to use the biological agents covered in this manual must first notify the Biosafety Officer well in advance of the proposed use.

Individuals wishing to work with biological agents must do the following:

1. Read, be familiar with, and follow the procedures outlined in this manual.
2. If the agent fits one of the categories in Section I of this manual, submit a "Calvin Biosafety Application" to the Biosafety Officer prior to procurements of the biological agents.

The IBC will approve proposals only if convincing evidence is provided that the user is competent in performing all applicable phases of the proposed experiments. If, after reviewing the proposal and supporting information, members have questions about the safety of the proposed use, they may require a personal interview with the applicant for specific details of the experiment and/or ask that the user first make trial runs of the experiment using nonhazardous materials. A proposal may be approved for a period of 1 to 3 years as determined by the IBC. Subsequent approvals may be granted for a longer period, but never to exceed 3 years. Approvals will be documented as part of the minutes of the meeting, unless certain conditions or modifications were made as part of the approval, in which case written notification will be provided.

Non-compliance with the provisions of this manual, the conditions of the protocol approval, requests from the IBC, or NIH requirements or any other condition that may result in substantial risk to human health, property damage, reputational harm, or legal liability as determined by the IBC may result in termination of the approval to conduct research with biological materials or removal of access to research space.

A. Biological agents or potentially biologically hazardous material

All work involving biological agents is subject to review by the IBC and is covered by this Manual (see appendix for application). IBC protocol review and approval is required for all biological agents in Risk Group 2 and/or those that may require Biosafety Level 2 (BSL2). Projects requiring Biosafety Level 3 (BSL3) and Biosafety Level 4 (BSL4) are currently prohibited at Calvin.

If the biological materials are identified as <u>not</u> requiring full IBC approval (RG 1/BSL 1) by this manual, use may begin immediately after notifying the Biosafety Officer.
Applications not requiring full IBC review do not expire, but are subject to revocation in the event of substandard safety practices. **Approved users must submit an amendment form when there are changes to the use, location or types of biological materials or other circumstances that may increase the hazards. Users also must maintain a current inventory and any additional data necessary to verify the hazards associated with the agent.**

Guidelines for determination of biosafety levels can be found in the Centers for Disease Control publication *Biosafety in Microbiological and Biomedical Laboratories.* The *NIH Guidelines* established a classification of human infectious agents into four "risk groups" on the basis of hazard. These descriptions generally correlate with, but do not equate to, biosafety levels. A risk assessment will determine an agent's biosafety level. Risk Groups (from *NIH Guidelines*) and Biosafety Levels (from *CDC Biosafety*) are defined below:

Risk Group 1	**Biosafety Level 1**
Agents not associated with disease in healthy adult humans.	Biosafety Level 1 is suitable for work involving well-characterized agents not known to consistently cause disease in immunocompetent adult humans, and present minimal potential hazard to laboratory personnel and the environment. BSL-1 laboratories are not necessarily separated from the general traffic patterns in the building. Work is typically conducted on open bench tops using standard microbiological practices. Special containment equipment or facility design is not required, but may be used as determined by appropriate risk assessment. Laboratory personnel must have specific training in the procedures conducted in the laboratory and must be supervised by a scientist with training in microbiology or a related science.
Risk Group 2	**Biosafety Level 2**
Agents associated with human disease that is rarely serious and for which preventive or therapeutic interventions are often available.	Biosafety Level 2 builds upon BSL-1. BSL-2 is suitable for work involving agents that pose moderate hazards to personnel and the environment. It differs from BSL-1 in that: 1. laboratory personnel have specific training in handling pathogenic agents and are supervised by scientists competent in handling infectious agents and associated procedures; 2. access to the laboratory is restricted when work is being conducted; and 3. all procedures in which infectious aerosols or splashes may be created are conducted in BSCs or other physical containment equipment.
Risk Group 3	**Biosafety Level 3**
Agents associated with serious or lethal human disease for which preventive or therapeutic interventions may be available	Facilities not available at CALVIN
Risk Group 4	**Biosafety Level 4**
Agents likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not usually available	Facilities not available at CALVIN

B. Human and Nonhuman Primate Blood and Tissue

Human blood, tissue, cell lines, and certain other body fluids are considered potentially infectious for bloodborne pathogens such as hepatitis B, hepatitis C, and human immunodeficiency virus. Work with human material is also regulated by OSHA's Bloodborne Pathogens Standard (29 CFR 1910.1030). In addition, non-human primates and their tissues pose risks of disease that may be transmissible to humans.

The following are requirements for the use of human and non-human primate blood and tissue products:

1. Laboratory use must be registered with the Biosafety Officer

2. All research and academic staff as well as any other employees of CALVIN with potential to exposure to human blood must be trained in the hazards of bloodborne pathogens and 'Universal Precautions"
3. Comply with all other applicable provisions of OSHA's Bloodborne Pathogen Standard
4. Students who use human blood or tissues in the course of their academic laboratory must receive training in the applicable portions of the Bloodborne Pathogen Standard

C. Recombinant DNA

Biosafety Committee will use *NIH GUIDELINES FOR RESEARCH INVOLVING RECOMBINANT DNA MOLECULES (NIH Guidelines)* to determine what types of research will need only to be registered and those that will require Committee review and approval. Information below is taken from the NIH guidelines. For more information consult the full text at National Institutes of Health Office of Science Policy, Office of Biotechnology Activities (http://oba.od.nih.gov/rdna/nih_guidelines_oba.html).

i. Covered Recombinant DNA

Prior to conducting work as described below, IBC review and approval is required

1. Experiments Using Risk Group 2, Risk Group 3, Risk Group 4, or Restricted Agents as Host-Vector Systems
2. Experiments in Which DNA From Risk Group 2, Risk Group 3, Risk Group 4, or Restricted Agents is Cloned into Nonpathogenic Prokaryotic or Lower Eukaryotic Host-Vector Systems
3. Experiments Involving the Use of Infectious DNA or RNA Viruses or Defective DNA or RNA Viruses in the Presence of Helper Virus in Tissue Culture Systems
4. Experiments Involving Whole Animals
5. Experiments Involving Whole Plants
6. Experiments Involving More than 10 Liters of Culture
7. Experiments Involving Influenza Viruses
8. Experiments Involving the Formation of Recombinant DNA Molecules Containing No More than Two-Thirds of the Genome of any Eukaryotic Virus
9. Experiments Involving Transgenic Rodents

ii. Exempt Recombinant DNA

The following recombinant DNA molecules are exempt from full approval of the biosafety committee, but require registration.

1. Those that are not in organisms or viruses.
2. Those that consist entirely of DNA segments from a single nonchromosomal or viral DNA source, though one or more of the segments may be a synthetic equivalent.
3. Those that consist entirely of DNA from a prokaryotic host including its indigenous plasmids or viruses when propagated only in that host (or a closely related strain of the same species), or when transferred to another host by well-established physiological means.

4. Those that consist entirely of DNA from a eukaryotic host including its chloroplasts, mitochondria, or plasmids (but excluding viruses) when propagated only in that host (or a closely related strain of the same species).
5. Those that consist entirely of DNA segments from different species that exchange DNA by known physiological processes, though one or more of the segments may be a synthetic equivalent. A list of such exchangers will is available from National Institutes of Health.
6. Those that do not present a significant risk to health

D. Select Agents

A US Government multi-agency program has established the "National Select Agent Registry". The Registry includes biological agents and toxins have been determined to have the potential to pose a severe threat to both human and animal health, to plant health, or to animal and plant products. The Animal and Plant Health Inspection Service (APHIS) and the Centers for Disease Control and Prevention (CDC) have established regulations for using Select Agents.

All research involving the use of a Select Agent must be approved by the biosafety committee prior to initiating the research. In most cases, Calvin does not have the facilities to accommodate Select Agent use.

III. Training

Before beginning work with biohazardous agents, Authorized Users must receive biosafety training commensurate with their assigned duties (in addition to Lab Safety Training). Students enrolled in classes involving biohazards may do so only if biological safety instruction is provided as part of the coursework, clearly identified in the syllabus and is given by an Authorized User, the Biosafety Officer, or an individual approved by The Committee.

A. Biosafety Training

All researchers using RG 2 agents and/or recombinant DNA must complete general biosafety training. Training will be conducted either through classroom sessions or online modules. The purpose of this training is to familiarize the Principal Investigator and lab personnel with good microbiological practices which include recognizing risk groups for biological materials, appropriate containment levels, and personal protective clothing and equipment. The IBC Coordinator will be responsible for registration and oversight of the biosafety training courses.

B. Bloodborne Pathogen Training

All employees/researchers who have occupational exposure to bloodborne pathogens must receive initial and annual training which is available through Calvin's online training platform, Safe Colleges. Contact Heather Chapman or Jennifer Ambrose to register for a training module. Training includes epidemiology, symptoms, and transmission of bloodborne pathogen diseases. In addition, the training program covers, at a minimum, the following elements:

- an explanation of the OSHA bloodborne pathogen standard
- an explanation of the Exposure Control Plan
- an explanation of methods to recognize tasks and other activities that may involve exposure to blood and other potentially infectious material (OPIM), including what constitutes an exposure incident
- an explanation of the use and limitations of engineering controls, work practices, and PPE
- an explanation of the types, uses, location, removal, handling, decontamination, and disposal of PPE
- an explanation of the basis for PPE selection
- information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration, the benefits of being vaccinated.
- information on the appropriate actions to take and persons to contact in an emergency involving blood or OPIM
- 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
- information on the post-exposure evaluation and follow-up that the employer is required to provide for the employee following an exposure incident
- an explanation of the signs and labels required by the standard

IV. Personal Protection

A. Protective Equipment

Users of biohazardous agents must ensure fume hoods, biological safety cabinets, and other protective equipment are adjusted and functioning properly prior to initiating an activity requiring their use. Each authorized user shall develop written procedures for the use of personal protective equipment and shielding in their area. These should be included in the research protocols reviewed by the Biosafety Committee. The minimum personal protective equipment for handling hazardous material includes lab coat, closed-toed footwear, safety glasses and disposable gloves. Protective equipment must not be worn outside the laboratory unless it has been monitored and found to be free of contamination. Gloves, while providing protection to the user, can spread contamination if worn outside the laboratory. Other personal protection recommendations are as follows:

1. Understand whether general lab ventilation, BSC's or fume hoods are necessary.
2. Protective laboratory coats, gowns, or uniforms are recommended to prevent contamination of personal clothing.
3. Wear protective eyewear when conducting procedures that have the potential to create splashes of microorganisms or other hazardous materials. Persons who wear contact lenses in laboratories should also wear eye protection.
4. Gloves must be worn to protect hands from exposure to hazardous materials. Change gloves when contaminated, glove integrity is compromised, or when otherwise necessary. Remove gloves and wash hands when work with hazardous materials has been completed and before leaving the laboratory. Do not wash or reuse disposable gloves. Dispose of used gloves with other contaminated laboratory waste. Hand washing protocols must be rigorously followed

B. Medical Restrictions

It is recognized that exposure to certain infectious agents may adversely affect a fetus during pregnancy if the mother is infected with the agent. Women that are pregnant or become pregnant are encouraged to inform their supervisors or Principal Investigators. It is also advised to notify your supervisor if your immune system is compromised or suppressed (HIV, immunosuppressant drugs etc.). Your physician should be informed of your work if you are pregnant or immune compromised.

V. Working Safely with Biohazardous Agents

A. Standard Safety Procedures

In addition to procedures outlined in other sections of this manual, the following safety procedures must be followed when working with biohazardous agents:

1. Avoid hand to mouth or hand to eye contact in the laboratory. Never eat, drink, apply cosmetics or lip balm, handle contact lenses or take medication in the laboratory.
2. Wash hands after removing gloves and other personal protective equipment, after handling potentially infectious agents or materials and prior to exiting the laboratory
3. Needles and syringes or other sharp instruments should be restricted in laboratories where infectious agents are handled. Never recap a used needle. Dispose of syringe-needle assemblies in properly labeled, puncture resistant, autoclavable sharps containers.
4. Procedures with infectious agents that have the potential to generate aerosols should be performed in a Biosafety Cabinet (BSC).
5. Store and transport containers of biohazardous liquids in secondary containers that will hold the contents of the primary container in the event of breakage.
6. Store all biohazardous materials securely in clearly labeled, sealed containers. Storage units, incubators, freezers or refrigerators should be labeled with the Universal Biohazard Sign when they house infectious material.
7. Only authorized persons may remove biohazards from storage and only designated cabinets, freezers, and refrigerators may be used for storing these materials.
8. The laboratory should be kept clean and organized so that contaminated items are clearly identified and confined to a local area. A sign clearly identifying the area(s) where biohazardous materials are stored and used must be posted.
9. Never allow contaminated, infectious waste materials to leave the laboratory or to be put in the trash or sanitary sewer without being decontaminated or sterilized. When autoclaving use adequate temperature (121C), pressure (15psi), and time, based on the size of the load. Also use a sterile indicator strip to verify sterilization.
10. After each experiment, clean up the work area with an approved disinfectant and place disposable materials (serological pipets, Pasteur pipettes, Kimwipes, etc.) in the appropriate waste container before removing gloves.
11. Principal Investigators/Lab Managers must maintain an inventory of infectious agents.

B. Warning Signs and Labels

A warning label that includes the universal biohazard symbol, followed by the term "biohazard," must be included on bags/containers of biohazardous waste, on bags/containers of contaminated laundry, on refrigerators and freezers that are used to store blood or biological hazards, and on bags/containers used to store, dispose of, transport, or ship blood or biological hazards (e.g., specimen containers).

The universal biohazard sign must be posted on all lab entrances, laboratory freezers or storage containers with human blood, RG2 or higher and covered recombinant DNA. Access doors should be labelled while experiments are in progress and on all doors leading to biohazard storage areas.

C. Biosafety Cabinets

The Biological Safety Cabinets (BSC's) are used to provide containment of infectious splashes or aerosols generated by many microbiological procedures. BSC's use High Efficiency Particulate Air (HEPA) filters to protect personnel and products inside the BSC from contamination from aerosols and particulates. They also protect the laboratory by isolating and containing the work occurring within the BSC.

All BSC's at Calvin are Class II, defined as: *A ventilated cabinet for personnel, product, and environmental protection having an open front with inward airflow for personnel protection, downward HEPA filtered laminar airflow for product protection, and HEPA filtered exhausted air for environmental protection.*

Properly maintained Biological Safety Cabinets are used whenever:

1. Procedures with a potential for creating infectious aerosols or splashes are conducted. These may include centrifuging, grinding, blending, vigorous shaking or mixing, sonic disruption, opening containers of infectious materials that may be under pressure, inoculating animals intranasally, and harvesting infected tissues from animals or eggs.
2. High concentrations or large volumes of infectious agents

Guidance for safe use of Biological Safety Cabinets:

- Never use chemicals with the potential to generate hazardous vapors. The HEPA filters are intended only to remove particulates and biological agents.
- Never work in or near the hood with the ultraviolet light turned on. UV light can damage eyes and exposed skin very quickly. Calvin does not encourage the use of the UV light for disinfection purposes.
- Work surfaces should be decontaminated with an appropriate disinfectant on a routine basis, after work with infectious materials is finished, and especially after spills, splashes, or other contamination by infectious materials.
- Prior to use, turn the blower on and air purge for at least five minutes to remove airborne contamination.

- Laboratory personnel must receive appropriate training on the proper use of a BSC.
- BSC's must be certified annually or after repairs. BSCs will be posted with the most recent date of certification. Notify the BSO or the Health & Safety department for operation or maintenance concerns.

D. Decontamination

Physical and chemical means of decontamination fall into three main categories: heat, liquid decontaminants, and vapors and gases.

i. Heat

The application of heat, either moist or dry, is recommended as the most effective method of sterilization. Steam at 121°C under pressure in the autoclave is the most convenient method of rapidly achieving sterility under ordinary circumstances.

- Autoclaves present significant safety hazards and must be operated properly to ensure proper sterilization. Each autoclave unit must have standard operating practices posted nearby with procedures for safe use and instructions for proper disinfection.
- Laboratory personnel should be cautioned that steam under pressure could be a source of scalding jets if the equipment is misused. Loads of manageable size should be used.
- Fluids treated by steam under pressure may be superheated if removed from the sterilizer too soon after treatment. This may cause a sudden and violent boiling of contents from the containers that can splash scalding liquids onto personnel handling the containers.

ii. Liquid Decontaminants

In general, the liquid decontaminants are used in surface decontamination and decontamination of liquid wastes for final disposal in sanitary sewer systems.

- Proper consideration should be given to such factors as temperature, contact time, pH, the presence and state of dispersion, penetrability and reactivity of organic material at the site of application. Small variations in the above factors may make large differences in the effectiveness of decontamination. For this reason even when used under highly favorable conditions, complete reliance should not be placed on liquid decontaminants when the end result must be sterility.
- There are many liquid decontaminants available under a wide variety of trade names. In general, these can be categorized as halogens, acids and alkalis, heavy metal salts, quaternary ammonium compounds, phenols, aldehydes, ketones, alcohols, and amines. Unfortunately, the more active the decontaminant the more likely it will possess undesirable characteristics such as corrosivity. None is equally useful or effective under all conditions for all infectious agents.
- Particular care should be observed when handling concentrated stock solutions of disinfectants. Personnel assigned to the task of making up use-concentrations from stock solutions must be informed of the potential hazards and trained in the safe procedures to follow and appropriate personal protective equipment to use as well as the toxicity associated with eye, skin and respiratory exposure.

VI. Biohazard Waste Procedures

Procedures for biohazardous waste disposal must be included in the research protocols for review and approval by the Biosafety Committee. Specific rules, regulations, and guidelines must be followed for the disposal of biohazardous waste. General procedures are provided below:

1. Minimize quantities of waste and segregate non-hazardous from biohazardous waste
2. Waste must be stored in secure restricted access areas and containers must be clearly labeled with the appropriate warning sign (universal biohazard symbol)
3. All off-site disposal of biohazardous material will be coordinated through the Biosafety Officer or the Health & Safety department
4. Biohazard waste should be stored in suitable well-marked containers, and the containers should provide adequate shielding from accidental exposure to the contents

Michigan's Medical Waste Regulatory Act defines the following regulated wastes:

1. Cultures and stocks of infectious agents and associated biologicals (defined as: if a susceptible host is exposed to the pathogen in an adequate concentration and through a portal of entry, the result could be transmission of disease to a human), including laboratory waste, biological production wastes, discarded live and attenuated vaccines, culture dishes, and related devices.
2. Liquid human and animal waste, including blood and blood products and body fluids, but not including urine or materials stained with blood or body fluids.
3. Pathological waste
4. Sharps - needles, syringes, scalpels, and intravenous tubing with needles attached.
5. Contaminated wastes from animals that have been exposed to agents infectious to humans, these being primarily research animals.

Storage, decontamination, and disposal requirements:

1. Cultures and stocks of material contaminated with an infectious agent shall be stored in closed, puncture-resistant containers, decontaminated by autoclaving or incineration, and disposed of in a sanitary landfill.
    a. Solid biohazardous waste that has been decontaminated, may be disposed of in the regular trash. The biohazard warning labels must be removed or the container is clearly labeled as decontaminated biohazardous waste. Decontaminated waste in biohazard bags with an "Autoclaved" bag indicator must be placed inside a non-transparent box or bag prior to disposal.
    b. Liquid biohazardous waste that has been autoclaved or otherwise decontaminated (bleach, BacDown, etc) can be disposed in sanitary sewer, unless other hazardous chemical or radiological constituents are present.

2. Blood and blood products and body fluids shall be disposed of by one or more of the following methods:
    a. Flushing down a sanitary sewer.
    b. Decontaminating by autoclaving or incineration.
    c. Removal by a licensed medical waste hauler.
    d. If not in liquid form, transferring to a sanitary landfill.
3. Pathological waste shall be disposed of by one or more of the following methods:
    a. Incineration or cremation.
    b. Grinding and flushing into a sanitary sewer.
    c. Burial in a cemetery
    d. Grinding until rendered unrecognizable, stored in closed, puncture-resistant, properly labeled containers, and, if not in liquid form, disposed of in a sanitary landfill.
4. Medical waste sharps (needles, scalpels, etc) shall be placed in appropriately labeled, rigid, puncture-resistant containers and disposed by a licensed medical waste hauler.
5. Animal waste contaminated with or organisms infectious to humans shall be disposed of by incineration or by burial in a sanitary landfill in properly labeled, double containers that are leakproof and puncture-resistant and are tightly sealed to prevent escape of fluids or material. Contaminated animal organs disposed of separately shall be rendered unrecognizable.

VII. Emergency Procedures

Standard emergency response procedures are as follows:

- In a medical emergency, call Campus Safety at 526-3333. Provide assistance to individuals and remove them from exposure to further injury if necessary. Responders should render first aid to the extent they are capable.
- Warn others in the area if there is a potential safety hazard
- In case of a fire, pull the fire alarm, evacuate the area, and dial 911. For small fires only try to extinguish if it can be done safely.
- In case of serious accident and/or injury involving biohazards call the Biosafety Officer, and dial 911. Tell the dispatcher your name, the building and location, and the seriousness of injury, if any.
- Stay on the line until all necessary information is furnished to the dispatcher. The dispatcher will notify the appropriate emergency response agencies. If the Biosafety Officer cannot be reached, a member of The Committee must be notified. Other emergency personnel may also be notified. If no serious injury is involved, call the Biosafety Officer.
- For an exposure or injury, wash the affected area with soap and water and treat with first aid or stay with victim until further help arrives.
- In case of a small spill, notify others in the area of the spill, apply gloves, clean spill, disinfect and dispose of waste properly.
- In case of a large spill, notify others in the area and notify the supervisor or Principal Investigator for help. Check shoes and clothing for contamination and place all towels or other disposable materials in the proper waste containers.