

Johns Hopkins Medical Laboratories Safety Manual

It is the policy of the Johns Hopkins Medical Laboratories to provide the employee a workplace as protected as possible from exposure to human blood and body fluids and other biohazards. To provide fire prevention training, and guidance in development and maintenance of safe work practices. These policies are designed for the protection of all employees, and will be enforced at all times.

Brooks Jackson, MD
(Signature on file)

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Director

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Within the Johns Hopkins Medical Laboratories (JHML) there are three levels of containment. The purpose of containment is to reduce exposure of laboratory workers, other persons, and the outside environment to potentially hazardous agents.

The three elements of containment include laboratory practices and techniques, safety equipment, and facility design.

The three levels of containment used in the Department are:

LEVEL I GENERAL SAFETY PRECAUTIONS

This level of containment is basic for all laboratories in the Department. See Section I.

LEVEL II STANDARD PRECAUTIONS

This level of containment is added to the General Safety Precautions when the task being performed exposes the worker to the risks of blood and body fluids. See Section II.

LEVEL III BIOSAFETY LEVEL 3

Laboratory personnel will assure that only persons who have been advised of the potential biohazard, and who comply with all entry and exit procedures may enter. See Section V.

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SAFETY MANUAL
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CLINICAL ENGINEERING	5-5639
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DISASTER COMMAND CENTER	5-3333
DISASTER INFORMATION	5-4594
ENVIRONMENTAL SERVICES	2-5326
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JHH East Baltimore	5-5770
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INFECTION CONTROL	5-8384
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OCCUPATIONAL HEALTH SERVICES	5-6211
OCCUPATIONAL INJURY CLINIC	5-6433
OFFICE OF SAFETY & ENVIRONMENTAL HEALTH	5-5918
RADIATION SAFETY OFFICER	5-3712
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JHM Weather Emergency	410-516-7781 Outside1-800-548-9004

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General Safety Requirements

Safety in the laboratory requires every employee's participation and cooperation. Noncompliance with safety precautions not only endangers the individual, but also compromises the health and safety of fellow workers.

I. Employee Responsibilities-

Each employee's responsibilities include:

- Complying with all safety policies and procedures;
- Maintaining awareness of the risks associated with assigned duties;
- Taking all necessary and appropriate safety precautions relevant to performance of duties;
- Becoming familiar with emergency procedures prior to accidental spills, overt personal exposures, fire, etc.;
- Reporting unsafe conditions or practices to the supervisor or HSE;
- Reporting all incidents resulting in injury or exposure to hazardous agents to the supervisor or HSE.

The following rules and procedures apply to all JH laboratories:

A. Personal

1. Hand washing- is the most important single precaution to prevent the spread of infections. Hands should be washed with soap and water, if visibility soiled, or waterless hand cleaner after:
 - completing a task
 - removing gloves
 - immediately upon accidental contact with contaminated materials

Protective hand cream may be applied in the laboratory in the designated handwashing area.

B. Dress Code

1. The use of a long sleeved laboratory coat (buttoned closed) or a back closed gown is required when working with patient specimens.
 - a. Clothing worn by laboratory workers should be clean, neat and in good repair.
 - b. Clothing worn by laboratory workers should provide protection to the skin in the event of a chemical splash or spill. OSHA laboratory standards (29CFR1910.1450 App. A) state that "Personnel should not wear loose (e.g. saris, dangling neckties, and over large or ragged laboratory coats), skimpy (e.g. shorts, strapless, cropped or halter tops) or torn clothing..." Short trousers or mini skirts are inappropriate laboratory attire because laboratory coats open in

- the front when a person sits thereby exposing the legs above the knees to potential spills.
2. Personal Protective Equipment (PPE) such as fluid resistant gowns, gloves, goggles, face masks, face shields should be available and are required when there is significant probability that potentially hazardous substances may be splashed on the worker. Standard precautions for laboratory workers shall be followed as indicated in the Infection Control: Interdisciplinary Clinical Practice Manual (ICPM).
 3. Shoes should be fluid impermeable material, leather or synthetic, and should cover the entire foot. Shoes with open toes are not unacceptable. Because cloth shoes will absorb chemicals or infectious fluids, they are not recommended.
- C. Specific precautions when working in the laboratory:
1. Employees must use the hospital laundry or purchased laundry services for cleaning soiled lab coats. Lab coats are not to be laundered at home.
 2. Food and beverages must not be stored in refrigerators, freezers, or other areas where biological materials are present. Each laboratory area will designate those places where food and beverages may be stored, and identify them with appropriate signs
 3. Eating, drinking, or chewing gum are not permitted in laboratories where biological materials are handled and work is performed. Each laboratory shall designate areas where eating, and drinking are permitted.
 4. Application of cosmetics and handling of contact lens will follow the guidelines for eating and drinking.
 5. Long hair must be tied back when working near open flames or mechanical equipment, where there is a possibility of entanglement, and when working with patients and patient specimens.
 6. Always use protective equipment that is provided for working with hazardous materials. Be familiar with the location and operation of eye washers, the location of fire extinguishers and other safety equipment.
 7. No mouth pipetting. Mouth pipetting is prohibited. Mechanical pipetting devices are provided.
 8. Biosafety Level 3 Laboratories. Laboratory personnel, maintenance personnel and all other visitors must comply with all entry and exit procedures.
 9. Laboratory personnel will assure that only visitors or maintenance personnel who have been advised of the potential biohazards and have been warned to avoid touching any working surfaces will be allowed through the laboratory.
 10. Smoking. The JHMI is smoke-free. There are no designated smoking areas within the hospital.
 11. Laboratory personnel are to be offered appropriate immunizations or test for agents handled in laboratory (ex. TB skin test annually, Hepatitis B vaccine).

D. Disposal of biological materials and expendable supplies

1. Unless there is evidence of contamination with blood, urine may be disposed through the sewage system. Use caution to prevent splatter. The empty container must be disposed in red bag lined trash containers or may be autoclaved.
2. Those specimens contaminated with blood should be disposed of in red biohazard bags or placed in buckets lined with autoclavable biohazard bags for autoclaving prior to disposal.
3. Other body fluid, solid, and semi-solid waste including laboratory supplies (e.g. microbiological cultures) and urine should be placed in containers or buckets lined with autoclavable biohazard bags, and sent to your designated area to be autoclaved prior to disposal. The fill level must be below the rim of the container.
4. All specimens received in the designated area must be autoclaved prior to disposal.
5. Specimen transport bags bearing the biohazard sign and gloves should be discarded in red bag trash.
6. Trash and paper, in the laboratory is also to be placed in biohazard bags.
7. Only Red biohazard and autoclave bags are to be used in the laboratory areas.

E. Safe handling of Needles

Most needle sticks can be prevented by "safety awareness" on the part of the user. The Johns Hopkins Medical Institutions have established a uniform system for sharps disposal. Needle sticks can be prevented if the approved containers are used properly and with caution.

1. Recommendations for safe handling of needles and other sharps
 - a. Needles containing safety devices, when available, are always to be applied after use when (ex. butterfly, protective needles and syringes).
 - b. Needles and other sharps are never to be discarded directly into the trash.
 - c. Needles and other sharps must not be unattended (i.e. on furniture, trays, equipment or in beds and linen).
 - d. Needles are not to be clipped or bent. Destructlips and similar devices are not to be used.
 - e. Needles are never to be recapped by hand.
 - f. Employees must never reach into any container used for disposal of contaminated sharps. If it is necessary to open a container, call Health Safety and Environment (HSE) at 955-5918.

F. Sharps Disposal

Items considered sharps are: needles, syringes, slides, glass pipettes, glass capillary tubes, scalpels and knives.

The institution uses Biosystems Containers approved for sharps disposal are supplied by Environmental Services at 955-5714.

Whenever possible plastic ware should be substituted for glassware.

1. Sharps containers

Small, needles only container (JHH ESI# 20400- Sage) for disposal of needles and blood lancets.

Five quart (JHH ESI# 3269- Post, JHU Cat#504991)

Metal Stand for Post container JHU # 504501

Sharp 5 Quart ESI#24386 – Post

Sharp star 3 gal. ESI# 24387 - Sage

Biohazard box (ESI # 6090)

- a. The plastic sharps containers are used for discarding needles attached to syringes or cartridges, individual needles, blades, broken glass and other sharps at the point of use.
- b. The lid on the container is to be left open until the container is ready for disposal.
- c. When discarded sharps reach the fill level designated on the container (at the constriction or line), close the lid opening and clip it into place. Secure the lid in the closed position with tape.
- d. The Post containers must be discarded into a red bag or the red bag-lined biohazard box for pickup by Environmental Services.
- e. In Microbiology sharps may be placed in stainless steel sharps discard buckets for autoclaving. After autoclaving, the sharps are dumped into a autoclave bag lined box and taped closed with "Autoclaved Waste" tape. The smaller box is then placed into a large red bag lined biohazard box for pickup by Environmental Services.

2. The Biohazard Box

- a. The cardboard biohazard box (ESI# 6090) with the red plastic bag liner is for the disposal of sharps containers, pipettes, autoclaved waste material, blood tubes, or other material soiled with potentially infectious agents, blood, tissue, or body fluids, and any materials which may be perceived to be "special medical waste" such as calibrated plastic centrifuge tubes, conical tubes and pipettes.
- b. Every biohazard box must contain a red bag liner at least 3 mil. thick.
- c. The biohazard box must not be reused.
- d. When the biohazard box is 2/3 full, the red bag liner must be carefully closed and sealed with tape. Then the box top must be closed, locked with the tabs and sealed with tape prior to pickup by Environmental Services.

3. Disposal of Glass

- a. All glass items that are contaminated by known infectious agents, blood or body fluids requiring Standard Precautions shall be disposed of in an approved sharps container or the approved Biohazard Box.
- b. All laboratory glassware with a potential to be perceived as medical

waste (e.g. items with graduated markings) is to be discarded in the approved sharps container or the approved Biohazard Box whether “clean” or contaminated.

- c. All glass containers not containing a hazardous chemical and not contaminated by blood, body fluids or infectious agents may be drained and discarded in appropriately marked “Glass Only” refuse containers.

4. Requests for approval of alternate containers should be made through the HSE (5-5918) for review and approval by the JHH Safety Committee.

G. Transfer of Biological Materials within the Laboratory

1. All pipetting shall be done with mechanical assistance (e.g. bulbs, semi-automated pipette) to avoid dangers from liquids or aerosols. Never pipette by mouth.
2. Care shall be taken when opening specimen containers to reduce aerosol formation. Barrier protection is to be used when opening of evacuated blood collection tubes after centrifugation as it may result in a spray of fine droplets of serum or plasma. Vacuum tube containers should be opened by twisting the rubber stopper while pulling it.
3. If splashing is possible, the task is to be performed within a Biological Safety Cabinet.

H. Sterilization of reusable items

1. All reusable items of metal, glass, or heat-resistant plastic will be sterilized by steam heat in autoclave.
2. Non-heat-resistant items can be decontaminated by soaking in an iodine solution or 1:10 V/V dilution of bleach when possible viral agents are suspected, for a minimum of six hours.

I. Disinfecting work surfaces

1. There is no one disinfectant that can be used in the laboratory at a single concentration to cover all possible contingencies. The bioload (concentration of the agent spilled) and the amount of organic material (blood, body fluids and other proteinaceous matter) can interfere with disinfectant activity. The time allowed for contact with the disinfectant will also vary according to the material in question. For the above reasons, specific policies are defined for each laboratory.
2. All work surfaces in daily use such as bench tops, sinks, and mobile carts, etc. must be disinfected at the end of each work shift. Use 1:10 v/v solution of Household Bleach or other Hospital approved cleaner: If specimens of blood, blood products or body fluids have been manipulated. For other biohazard spills, use any product such as Lysol or Amphyl, which has been approved by the Infection Control department.

- J. Decontamination of body fluid spills and grossly contaminated surfaces shall occur as soon as possible using the following procedures:
1. Notify all personnel in the immediate work area.
 2. Put on gloves and any other necessary personal protective equipment.
 3. Cover the spill with paper towels or other absorbent material.
 4. Saturate the contaminated area with a 1:10 v/v solution of sodium hypochlorite (household bleach) or 70% ethyl or isopropyl alcohol.
 5. Allow the disinfectant to penetrate for a minimum of 10 minutes making certain the area is well-marked.
 6. If broken glass or other sharp material is present, it must never be picked by up hand. Forceps, tongs, disposable bio scoop or dustpan and broom must be used.
 7. Discard the contaminated materials in an appropriate medical waste container (sharps container, biohazard box or autoclave bucket) depending on the nature of the biohazardous material.
 8. Perform a final wipe with the disinfectant and let dry.
- K. Centrifugation The following precautions serve to minimize the danger from aerosolization of infective material.
1. All specimens will be centrifuged in a closed system.
 2. Centrifuges, with safety-interlock features which prevent opening the unit when it is in motion is recommended.
 3. Centrifuges used for processing potentially infective biological materials shall be disinfected weekly with 1:10 V/V dilution of sodium hypochlorite (household bleach).

SAFE HANDLING Use, and Storage of:

- A. Use and storage of flammable or combustible liquids
1. In a laboratory, quantities of flammable or combustible liquids used or stored outside of an approved storage cabinet shall not exceed the needs of two working days.
 2. All flammable or combustible liquid containers, 1 gallon or larger, shall be stored in approved flammable or combustible liquid storage cabinets or in approved storage rooms.
 3. The total capacity of all approved flammable or combustible liquid storage cabinets in any one laboratory, up to 5000 square feet, shall not exceed 60 gallons (227.1 L).
 4. The storage of any quantity of flammable or combustible liquid in a domestic refrigerator is prohibited. Only a refrigerator specifically designated as approved Flammable Materials Storage Refrigerator or domestic refrigerators modified to remove all sparking devices from the storage compartment, are approved for storage of flammable or combustible liquids.

For further information see Section IV of the JH Safety Manual.

B. Use and storage of compressed gas cylinders

1. All compressed gas cylinders, either in use or in storage, shall be secured in an upright position by means of a strap, chain or non-tip base. Stored gas cylinders shall be secured one strap per tank.
2. All cylinders, lines and equipment used with flammable compressed gases shall be grounded and stored separate from oxidizing gases such as oxygen.
3. Suitable hand trucks will be utilized when transporting gas cylinders.

For further information, See Section II, Johns Hopkins Safety Manual.

C. Safe handling of *in vitro* radioisotopes

1. All laboratory sections using *in vitro* radioisotopes shall have the "Johns Hopkins Safety Manual" of the Johns Hopkins Medical Institutions (JHMI) readily accessible in each area in which these materials are used.
2. JHMI policies in these areas are developed by the JHMI Radiation Control Committee (RCC) and implemented by the JHMI Radiation Safety Officer (RSO).
3. Each laboratory area using radioisotopes needs prior authorization for the isotope by the RCC.
4. Each laboratory has the following responsibilities when using *in vitro* radioisotopes:
 - a. Maintain a logbook of all isotopes received, used and disposed of in the area..
 - b. Instruct laboratory employees in techniques for safe handling of isotopes and handling of emergencies.
 - c. Notify the Radiation Control Unit (RCU) with changes in personnel, assuring instruction in procedures and precautions to minimize exposure.
 - d. Conduct periodic monitoring of laboratory work areas for isotopic contamination. A log record shall be maintained of these surveys including results that are negative.
 - e. A quarterly inventory of radioactive materials is done and sent to RCU.
 - f. Post a "CAUTION RADIOACTIVE MATERIALS" sign on the doors of work areas where radioactive materials are being used or stored. Include the name and home phone numbers of the individual responsible for the posted area on the sign to contact in case of emergency
 - g. Properly label all reagents and equipment contaminated with radioactive material to identify the presence of radioisotopes.
5. Each authorized user (other than those where H-3 is used exclusively or where only exempt quantities of other radionuclides are handled) must be equipped with portable or semi-portable monitoring device suitable to the radioactive materials authorized, for use for personnel and area monitoring.

For further information, see Section IX, of the JH Safety Manual.

D. Carcinogens

1. Specific regulations have been established by OSHA regarding the handling of certain compounds designated as carcinogenic. An inventory of all such materials must be maintained and specific protective measures must be observed.
2. See Section VII of this manual for further information on handling.

III. Reporting Unsafe Conditions the Work Area

Employees must report hazardous conditions to the supervisor or technologist in charge, especially the following:

1. Improperly disposed sharps.
2. Improperly stored containers of flammable liquids.
3. Improperly anchored gas cylinders.
4. Frayed or damaged electrical wiring and damaged plugs.
5. Unused gas cylinders with open valves or empty cylinders without safety caps.
6. Missing emergency equipment of any type.
7. Improperly labeled or unlabelled reagent containers.
8. Obstruction in aisles or fire exits.
9. Fire extinguishers with low charge.
10. Propped open fire doors that are not equipped with automatic fire door closures.
11. Spills involving any hazardous materials.
12. Electrical shocks experienced while working with instruments.

IV. Laboratory Risk Assessment

Appropriate measures shall be taken to ensure the safety of personnel working in laboratories.

1. Each laboratory shall post a list of safety precautions based on the types of hazards present therein. This list shall be posted for viewing for all persons frequenting that laboratory.
2. A Risk Assessment shall be performed in laboratories for the safety of environment of all employees. See section XI for more information.

V. Staff Safety Training and Education

1. All new employees will be trained in safety precautions: Standard precautions, fire safety, flammable liquids, compressed gas cylinders, hazardous waste disposal, potential hazards of HBV/HIV, carcinogens, chemical hygiene, and emergency equipment.
2. This program must be documented and updated, as needed or on a yearly basis.
3. The training program shall cover safety issues listed in the New Employee Orientation Checklist.

VI. Documentation of Safety Training and Education.

- A. Documentation of initial safety training will be found in the “New Employee Orientation Checklist”. This checklist must be reviewed and signed within 14 days of employment and maintained in the administrative office.
- B. Applicable procedures from these guidelines will be included in appropriate manuals of each individual laboratory. Each member of the laboratory staff will read the guidelines and document in writing that it has been reviewed.
- C. Initial training for Emergency Equipment is documented on the Emergency Equipment Training Log. (ex. Eyewash)
 - a. A copy is retained in the laboratory and the original is sent to the Health Safety and Environment Office at 2024 E. Monument St.
- D. Annual training –
 - a. Bloodborne Pathogen training is required for any individual that may have possible contact with blood or body fluid.
 - b. Fire Safety training for all staff.
 - c. Infection Control Updates through institutional updates
4. Department of Transportation (DOT)-
 - a. This training is required to be performed every two years if employee’s duties include shipping biological materials. Contact HSE for dates and times.

VII. Chemical Hazards in the Laboratory – **The “Right to Know” Law**

1. All laboratories are required by Occupational Safety and Health Administration (OSHA) to:
 - a. Have Material Data Sheets (MSDS) available for chemicals used in the lab.
 - b. Label containers of chemicals properly; manufacturer’s labels are acceptable.
 - c. Train employees to recognize potential hazards in the workplace and proper procedures for handling hazardous substances.
 - d. List of hazardous chemicals used in laboratory maintained and reviewed annually.
2. Material Safety Data Sheet. An MSDS is a printed sheet (or computer file) listing product identification, precautionary labeling, hazardous components, fire and explosion data, health hazard data, spill and disposal procedures and similar information on individual chemicals or mixtures.
3. Access to Material Safety Data Sheets is listed below.
 - a. Health Safety and Environment Office at 955-5918.
 - b. Or Links for Access to Material Safety Data Sheets (MSDS):
ChemWatch <http://jhu.chemwatchna.com> or <http://siri.org/>

4. The employee's responsibility regarding chemical hazards
 - a. Know the chemical hazards of the reagents you work with. Consult the procedure manuals. Refer to the MSDS files to learn the hazards of any chemical that you use. Note: Not all prepackaged mixtures have MSDS. Look at the MSDS of key components.
 - b. Handle and dispose of chemicals using good laboratory practice and as described in the procedure manuals. Use safety appliances such as gloves, goggles and fume hoods as appropriate. Refer to MSDS file where appropriate. Notify a supervisor if any discrepancy exists.
 - c. Consult your supervisor if you have concerns regarding the hazard of any chemical or procedure.

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SECTION II: STANDARD PRECAUTIONS

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II. STANDARD PRECAUTIONS

Standard Precautions expands the coverage of Universal Precautions by recognizing that any body fluid may contain contagious microorganisms.

A. Nature of the risks

1. **HEPATITIS:** Most cases of laboratory associated hepatitis are caused by one of the following agents: Viral hepatitis, Hepatitis B virus (HBV) and Hepatitis C which accounts for most of the transfusion-associated Hepatitis cases seen in the USA. Laboratory acquired Hepatitis is now recognized as a major occupational hazard to laboratory workers handling biological materials.
2. **AIDS:** The etiology of Acquired Immunodeficiency Syndrome (AIDS) is a retrovirus called Human Immunodeficiency Virus (HIV). Transmission occurs from infected persons through direct intimate contact involving mucosal surfaces, such as sexual contact or through parenteral spread such as shared needles and syringes. Airborne transmission and spread through casual contact has not been documented.

B. General safety requirements

All precautions listed under Section I of this manual will apply to standard precautions.

C. Standard Precautions Principle

Since medical history and examination cannot reliably identify all patients with blood-borne pathogens, all body fluids are treated as if known to be infectious for HIV, HBV, and other blood borne pathogens. Standard Precautions are designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infection in the hospital. Standard precautions apply to blood and body fluids, secretions, excretions and all tissues. Standard precautions do not apply to sweat.

D. Exposure categories

1. Category I: Tasks that involve exposure to blood, body fluids, or tissues. All procedures or other job-related tasks that involve an inherent potential for mucous membrane or skin contact with blood, body fluids, or tissues, or a potential for spills or splashes of them, are Category I tasks. Use of appropriate protective measures should be required for every employee engaged in Category I tasks.
2. Category II: Tasks that involve no exposure to blood, body fluids, or tissues, but employment may require performing unplanned Category I tasks. The normal work routine involves no exposure to blood, body fluids, or tissues, but exposure or potential exposure may be required as a condition of employment. Appropriate protective measures should be

readily available to every employee engaged in Category II tasks.

3. Category III. Tasks that involve no exposure to blood, body fluids, or tissue (and category I tasks are not a condition of employment).
The normal work routine involves no exposure to blood, body fluids, or tissues (although situations can be imagined or hypothesized under which anyone, anywhere, might encounter potential exposure to body fluids).
Persons who perform these duties are not called upon as part of their employment to perform or assist in emergency medical care or first aid or to be potentially exposed in some other way.

E. Laboratory workers with the exception of central administration and data processing are considered Category 3, other laboratory workers can fall into all three categories. For this reason "tasks" will be identified into two categories.

1. Tasks with no exposure to blood, blood products, body fluids, or tissue. The Department's "General Safety Requirements" will be used.
2. Tasks with Category I exposure use Standard precautions.
3. In addition, some tasks may be split in the type of precautions needed to complete the assay e.g. Chloramphenicol HPLC assay, Part A body fluids are mixed with a mephensin solution and extracted with ethyl acetate. (Standard precautions); Part B evaporation and chromatography is performed (General safety requirements.)

F. Standard precautions barrier protection.

Standard precautions include general safety precautions plus:

1. Gloves will be worn when
 - a. Handling blood, tissues, body fluids or items contaminated with blood or body fluids including specimen containers, laboratory instruments, counter tops, etc.
 - b. Performing venipuncture, changing gloves and washing hands between each patient.
 - c. Worker's hands are abraded or active dermatitis is present.
2. Gloves will be replaced as soon as possible when contaminated, before touching non-contaminated items or surfaces.
3. Always wash hands with soap and water, for at least 15 seconds, following the removal of gloves or use an alcohol based hand rub solution.
4. To protect the mucous membranes, masks and eye protection, face shields,

splashguards or safety cabinets must be used if splashing or spraying of blood or body fluid is anticipated.

5. All lab coats, gloves, and other personal protective equipment must be removed prior to leaving the work area.
6. Soiled gloves, masks and other disposable personal protective equipment will be discarded into red bag-lined receptacles or autoclave buckets after use.
7. Plastic aprons
 - a. A plastic apron may be available for further protection over coat/gown if there is potential for splashing or spraying of blood or body fluids.
 - b. Plastic aprons are not to be used as a sole source for protection.

G. Medical Examination

1. Occupational Health Services will determine the immune status of new employees for Hepatitis B, Rubeola, Varicella Zoster, and Rubella and appropriate vaccinations will be offered.
2. Semiannual tuberculin tests are administered to all Microbiology personnel. Annual tuberculin tests are administered to all other departmental personnel. If a tuberculin test becomes positive, a routine chest x-ray is performed.
3. Pregnant women are not known to be at greater risk of contracting bloodborne infections than other laboratory workers. However, if HBV or HIV infection develops during pregnancy or if the mother carries these viruses prior to pregnancy, the infant is at risk of infection by perinatal transmission. Therefore, pregnant laboratory workers carry added responsibility for attention to standard precautions.

H. Hepatitis B Vaccination

All laboratory employees will be offered the Hepatitis B vaccine series by the Occupational Health Services. Employees who decline the vaccine must complete a declination form to be kept on file in Occupational Health Services office. If an employee declines the vaccine, he may still opt to receive the vaccine in the future at no cost.

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III. LABORATORY ACCIDENT PROCEDURES

Occupational Injury Clinic. 955-6344

The Occupational Injury Clinic (OIC) Blalock 139 is equipped and staffed to provide screening and treatment services as defined herein to hospital employees with job-related injuries and illnesses. The OIC will provide treatment to JHMI employees for work related injuries and illnesses from 7:30 AM to 5:00 PM- Monday through Friday, except days observed as Hospital holidays. If the Occupational Injury Clinic is closed the employee should report to Adult Emergency Department Park Basement1. This applies to the employees of the Johns Hopkins Hospital and University .

Laboratory Accident Procedures

A. Personnel Injuries

JHH:

All accidents resulting in personnel injuries, no matter how minor, are to be reported and documented via Employee Report of Incident form (JHH Form 15-142020, 12/97). The report is completed and signed by the Supervisor; the first and second copies are to be taken to the Occupational Injury Clinic, Blalock 139 (or Emergency Department when the clinic is closed). The third pink copy is to be sent to the Department's Administrative Office (Carnegie 417 for Pathology) for their files.

1. All employees with job related injuries will report to OIC (Blalock 139) during time and days specified above. The employee will be taken directly to the Hospital Emergency Department (Park B1) or in cases of serious emergencies call 5-4444. Have a co-worker call ER to inform them that the injured party is on the way.
Examples of serious emergencies are: seizures, loss of consciousness, life threatening injury and/ or change in mental status.
2. When the Compensation Clinic is closed, an employee with a job related injury goes to the Emergency Department for initial emergency treatment of any injury. The employee and/or supervisor are responsible for the completion of the "Report of Incident" form on the next business day.
3. All JHMI employees treated in the Emergency Department will be given the yellow copy of Job Related Injury form and referred within 24 hours to OIC. (48 hours if injury occurs over a weekend.)

JHU:

Injuries are to be reported within 24hrs, and documented via JHI Report of Incident (JHH Form 15-142020, 12/97). The Report of Incident form (three part form) should be completed by the department supervisor or administrator in coordination with information from the employee, witnesses, etc. All copies except the 3rd page (pink copy, which is retained in the department) should be taken to the Occupational Injury Clinic or divisional Occupational Health Services Office by the employee when they seek treatment, or forwarded to the Workers' Compensation Office at 2024 E. Monument Street, if treatment is not necessary. The pink copy should go to JHU Human Resources, JHML Administration /Carnegie 417. Sending a readable duplicated copy of page one of the Incident Report form to Office of Human Resources and Organizational Effectiveness, Houck 428

- a. Students with minor injuries may be referred directly to University Health Service, Carnegie 136, Workdays 8:30AM - 4:00PM, 955-3250.
- b. JHMI University students with serious emergencies will be treated in the Emergency Department.

B. Exposure to Blood - Call 5-STIX (955-7849).

If an employee is exposed to blood or other potentially infectious materials by way of a needlestick, percutaneous injury, mucous membrane contact, or non-intact skin contact, the following procedures should be initiated:

1. Notification

After a suspected exposure occurs, it is the employee's responsibility to contact his/her supervisor, to initiate an "Employee Report of Incident" (JHH 15-142020) (JHU 12/97), and to immediately call the Needlestick Hotline 5-STIX (955-7849).

a. Weekdays

If the exposure occurs during the hours of operation of the Worker's Occupational Injury Clinic (OIC) (7:30 AM to 5:00 PM Monday - Friday), the employee is to contact the OIC as soon as possible after the exposure. (955-6433)

b. Nights and Weekends

If the exposure occurs when the OIC is closed, the employee is to contact the Infectious Diseases Fellow on call for the Infectious Disease

Physician through the paging operator (5-5020) as soon as possible after the exposure.

2. Evaluation
Evaluation of the exposure will be managed in the Occupational Injury Clinic, located in Blalock 139. The employee will receive free medical counseling about the risk of infection and treatment options. Follow-up treatment, if needed, will be at no cost to the employee and will be private and confidential.
3. Post-exposure Antiviral Therapy for HIV
The Infectious Disease Fellow on-call for the AIDS Service (B team) will provide counseling to the exposed employee regarding the use of antiviral agents for HIV prophylaxis following an exposure.
4. Post-exposure Immunotherapy for HBV
The Infectious Disease Fellow on call will provide counseling to the exposed employee regarding Hepatitis B virus (HBV) post-exposure management. Any immunotherapy indicated will be given to the employee by the Emergency Department triage nurse by telephone order of the Infectious Disease Fellow on call for the AIDS service.

For more info see the Bloodborne Pathogen Control Program in the JHH Safety Manual .

C. Other Injuries

1. Eye Injuries
Effective April 29, 2009 all Wilmer eye emergency services were relocated to the Johns Hopkins Hospital Adult or Pediatric Emergency Departments. Then take completed Employee Report of Incident form from your supervisor and proceed to OIC on next business day for further disposition.
2. Minor injuries such as glassware cuts, small burns from heat or chemical sources, bruises or sprains from falls and etc. are to be immediately reported to the laboratory supervisor. The employee with a completed Employee Report of Incident form reports to Occupational Injury Clinic, (Blalock 139).
3. Personnel suffering a major injury are to be rendered emergency assistance or first aid while a physician is being summoned. Such assistance might involve use of eye wash showers, suppression of bleeding, treatment of shock and etc. If a physician on the laboratory staff cannot be immediately reached call: JHMI emergency (x5-4444) to summon medical assistance. When the injured individual is stabilized to the point that he can be moved,

the employee should be taken to the Emergency Room by stretcher or wheelchair for further treatment.

D. Patient/Blood donor/Visitor Injuries

JHH:

Incident involving patients, blood donors and visitors are to be reported and documented via the JHH Form, Report of Patient/ Visitor Event. The completed original form is to be forwarded to Director/Nurse Manager of the clinical area or department. The last copy is retained in the originating department. The second copy is sent to JHH Performance Improvement/Utilization and Management Office, Carnegie 171.

JHU:

Volunteers and visitors are not protected by Workers Compensation laws through JHU; however, documentation of any incident is encouraged for record keeping purposes.

1. In the case of an outpatient or visitor to the hospital, the appropriate form, Report of Patient/Visitor Event, is to be filled out and the individual sent to the Emergency Room, accompanied by a laboratory staff member. The completed form with the physician's notes is to be brought back to the laboratory by the staff member.
2. In the event an inpatient is involved, the patient, together with a written report of incident, is to be immediately returned to the floor with appropriate treatment initiated by the floor physician.

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IV. FIRE INCIDENT RESPONSIBILITIES

- A. If you discover a fire, remain calm; Do not shout "FIRE!"
1. Remove all individuals in immediate danger.
 2. Close the door.
 3. Report the fire immediately regardless of size.
 - a. Pull the nearest fire alarm box.
 - b. Dial 5-4444 (Centrex). Tell the operator the building involved, the floor, the kind of fire your name and extension number.
- If job duty requires:
4. Clear the area of personnel. Take patients to designated refuge area. Direct others to evacuate the building.
 5. If possible turn off gas, especially oxygen valves.
 6. If possible, return flammable materials to approved storage cabinets.
 7. Leave room or area, CLOSE THE DOOR.
 8. Leave the building by the nearest accessible fire exit. Do not use elevators. Use stairs or exit through a fire door to an adjacent building.
- B. Fire alarm Response (Business Occupancy)
1. Clear area of non-laboratory personnel. Take patients to designated refuge area. Direct others to evacuate the building.
 2. Evacuate the laboratory (leave the building under alarm).
 3. Before evacuation take the following steps if possible:
 - a. Turn off gas cocks
 - b. Close valves on gas cylinders, especially oxygen.
 - c. Return flammables to the approved cabinet.
 - d. Close all window and doors.
- C. Fire Alarm Codes (Non Business Occupancy locations only)
Non- Business Occupancies (those buildings and structures that are normally occupied by those who are non-ambulatory and provide sleeping accommodations).
-If you hear a fire alarm sounding, the alarm was activated in your building.
- D. Operation of the Fire Alarm System. There are three types of fire alarm boxes. The proper procedure for transmitting a fire alarm is as follows:
1. Round fire alarm box with glass door lock (Couch)
 - a. *Break glass strip on the face of the alarm box by striking breaker plate sharply with palm of hand or fist. The door will swing open, allowing access to the operating lever. (This does not send out a signal, it only exposes the operating lever.)*

- b. *Pull the operating lever all the way down and release.* When the operating lever is pulled down, it winds a clock spring mechanism inside the fire alarm box which provides the power to turn a coded wheel. The turning wheel electrically transmits the four digit code sequence four times. The operating lever returns to its original position and the box is automatically reset when the signal is completed.
 2. Rectangular fire alarm - *Pull down lever* (Simplex).
The operating lever is flush mounted on the face of the alarm box and is readily accessible. When the operating lever is pulled down, the clock spring alarm mechanism is wound, and the reset signal is transmitted as in (a) above. The operating lever returns to its original position and the box is automatically reset when the signal is complete.
 3. Rectangular fire alarm box - *glass lock on operating arm* (Couch).
The operating lever, which is flush mounted on the face of this alarm box, is secured by a glass rod. *To activate this alarm box, the operating lever must be pulled down with sufficient force to break the glass rod.* When the operating arm is pulled down, a switch is activated to electrically turn the coded wheel and transmit the alarm signal. The operating arm does not return to its original position, and the box does not reset automatically.
- E. What happens when an alarm is sounded?
 1. All fire alarms sounded in the Hospital are transmitted automatically to the Baltimore City Fire Department. All alarm signals activated in the Hospital automatically activate a master alarm coded specifically for The Johns Hopkins Hospital. This direct connection with the Fire Department is in compliance with local, state and federal regulations and the standards of the Joint Commission on Accreditation of Health Care Organizations (JCAHO). The Hospital is not permitted to use a pre-signaling system. That is, Hospital personnel are not permitted to investigate the emergency area to determine whether or not the assistance of the Fire Department is necessary. All fires, regardless of size, must be reported to the Fire Department. When responding to a Hospital fire alarm, Fire Department and equipment arrive at three staging areas. These are:
 - a. The Rutland Avenue/Monument Street entrance
 - b. The Wolfe Street (Harvey/Nelson) entrance
 - c. The Jefferson Street Entrance
 2. Hospital security personnel meet the Fire Department at these staging areas and direct them to the scene of the fire.
 3. In the Hospital, a telephone operator determines the location of the emergency by identifying the fire alarm code on the master list. The Hospital Fire Brigade, the Officer of HSE and appropriate administrative personnel are notified via a hot-line emergency telephone (RED PHONE), by the individual paging system, and by the Hospital paging system.

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4. A Fire emergency announcement over the general paging system is preceded by eleven (11) bells, and then the message is given - "Code I, (Building), (Location)."
- F. Extension 5-4444
 1. This Hospital emergency telephone number is a top priority line to Centrex which Hospital telephone operators answer immediately. This extension is to be used only for fire and medical emergencies.
 2. The occupants of a building in which the fire was discovered are not alerted when a fire is reported by telephone only. The operator can not sound an alarm in the Hospital building involved. The operator will instruct the telephone caller to pull the nearest fire alarm. This is the only way to properly alert building occupants.

Note: The proper sequence in sounding an alarm when you discover a fire is to:

 - a. Pull the nearest fire alarm box, THEN
 - b. Dial 5-4444 and provide the details
- G. All clear. When the fire emergency is over, Centrex is informed and announces an All Clear over the Hospital paging system. The message is - Attention Please - Code - All Clear.
- H. Fire incident response evaluation
 1. Whenever a fire occurs in the JHH areas, a report of Fire Incident Response Evaluation form (JHH-21-1211)(FIRE) must be completed as soon as possible after the fire is extinguished - NO MATTER HOW SMALL OR INSIGNIFICANT THE FIRE.
 2. The incident report is the responsibility of the senior supervisor of the area involved, such as, Technician-in-Charge, Nurse-in-Charge, or Office Manager. No harm is done if more than one report is filed, but harm is done if no report is filed.
 3. The Fire Incident Response Evaluation (FIRE) form is an important part of the fire response evaluation procedure. It is a self evaluation checklist which indicates the proper fire emergency responses. It provides a permanent record of fire drills and actual fires. The information requested also alerts the Office of Health, Safety and Environmental to any malfunctions in the fire emergency signaling system. The form is provided to all nursing stations. To replenish supplies of the FIRE forms, call the Office of Health, Safety and Environmental at 955-5918.
 4. All laboratory staff is to participate in at least one fire drill evacuation annually. Their participation in such drill shall be documented maintained in the lab area.
- I. Evacuation plan
 1. Wholesale or mass evacuation is to be undertaken only as a last resort and only on orders from competent authority, i.e. Fire Department, the Office of Health, Safety and Environmental, or Security Shift Supervisor.

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2. Limited evacuation, generally horizontally, to another building or another wing of the same building may be undertaken at any time as conditions dictate.
3. Generally, elevators are not to be used in evacuation. Power failure may trap occupants between floors. Opening elevator doors will create added drafts, gently accelerating the spread of smoke and/or fire.
4. Elevators remote from the fire in other buildings may be used if specifically directed.
5. Should evacuation be necessary, remove patients and staff from danger area:
 - a. Non-ambulatory patients - Roll beds out to a designated area or remove patients by the various emergency carries.
 - b. Wheelchair patients - Wrap patients in blankets and move to a designated area. Carry patients down steps if necessary.
 - c. Ambulatory patients - Wrap patients in blankets or bathrobes and assist them to a designated area or down steps if necessary.

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V. PRINCIPLES OF BIOSAFETY

- A. The term "containment" is used in describing methods for managing infectious agents in the laboratory environment where they are being handled or maintained. The purpose of containment is to reduce exposure of laboratory workers, other persons, and the outside environment to potentially hazardous agents. The three elements of containment include laboratory practices and techniques, safety equipment, and facility design.
- a. Primary containment, the protection of personnel and the immediate laboratory environment from exposure to infectious agents, is provided by good technique and the use of appropriate safety equipment.
 - b. Secondary containment, the protection of external laboratory environment from exposure to infectious materials, is provided by a combination of facility design and operational practices.
- B. **Laboratory Practice and Technique.** The most important element of containment is strict adherence of standard biohazard practices and techniques. Persons working with infectious agents or infected materials must be aware of potential hazards and be trained and proficient in the practices and techniques required for handling such material safely. The supervisor is responsible for providing or arranging for appropriate training of personnel.
- C. Additional measures may be necessary when standard laboratory practices are not sufficient to control the hazard associated with a particular agent or laboratory procedure. The selection of additional safety practices is the responsibility of the laboratory supervisor and must be commensurate with the inherent risk associated with the agent or procedure.
1. To reduce the risk of injury due to breakage of glass capillary tubes, laboratories should adopt blood collection devices that are less prone to accidental breakage, including
 1. Capillary tubes not made of glass
 2. Glass capillary tubes wrapped in puncture-resistant film
 3. Products that use a method of sealing that does not require manually pushing one end of the tube into putty to form a plug
 4. Products that allow the hematocrit to be measured without centrifugation
- D. Each laboratory must develop or adopt a safety or operational manual which identifies the hazards that will or may be encountered and which specify practices and procedures designed to minimize or eliminate identified risks. Personnel should be advised of special hazards and should be required to read and to follow the required practices and procedures. In the Microbiology Laboratory activities must be supervised by a microbiologist who is trained and knowledgeable in appropriate laboratory techniques, safety procedures, and associated risks.
- F. Laboratory personnel safety practices and techniques must be supplemented by

appropriate facility design and engineering features, safety equipment, and management practices.

- G. **Biosafety Levels.** These guidelines specify four Biosafety levels (BSLS) which consist of combinations of laboratory practices and techniques, safety equipment, and laboratory facilities which are commensurate with the operations performed and with the potential hazard posed by the infectious agents for which the laboratory is responsible.(See Section IX for specific BSLS)
- H. The object of these guidelines is to inform the laboratory staff of the Johns Hopkins Institution of safe practices when handling potentially hazardous organisms and biological materials.
- I. Each laboratory worker is responsible for:
1. The safety of his/her fellow worker
 2. His/her own safety
 3. Training in the safety methods used in the laboratory

It should be remembered that the most expensive equipment is not a substitute for careful technique.

- J. **Medical Examination**
Medical evaluations with special attention to factors appropriate to the origin most involved are given by Occupational Health Services.
1. Occupational Health Services will determine the immune status of new employees for Hepatitis B, Rubeola, Varicella Zoster, and Rubella and appropriate vaccinations will be offered.
 2. Semi-annual tuberculin tests are administered to all Microbiology personnel. Annual tuberculin tests are administered to all other departmental personnel. If a tuberculin test becomes newly positive, a chest x-ray is performed.
 3. Pregnant women are not known to be at greater risk of contracting bloodborne infections than other laboratory workers. However, if HBV or HIV infection develops during pregnancy or if the mother carries these viruses prior to pregnancy, the infant is at risk of infection by perinatal transmission. Therefore, pregnant laboratory workers carry added responsibility for attention to safety precaution

- K. The laboratory function is based on the quantities of organisms or activities involving infected animals. The laboratory function for the Microbiology Laboratories of this Hospital would routinely only involve the "A Function".
1. Function A: Activities involve the use or manipulation of small quantities or low concentrations of cultures or other materials known or suspected of containing the agent.
 2. Function B: Activities involve the use or manipulation of large quantities or high concentrations of cultures or other materials known or suspected of containing the agent.
 3. Function C: Activities involve the use or manipulation of vertebrate animals with natural or induced infection with the agent.
 4. Function D: The importation, possession, and use of variola major, variola minor, and whitepox viruses which is restricted to the designated World Health Organization Collaborating Center for Poxviruses.
- L. Tables containing Bacteria, Mycoplasma, Fungal, Parasitic and Viral agents, are found on pages 5-11.
1. Classification of biological agents is based according to risk. This section lists viral, bacterial, fungal and parasitic agents based on their potential hazard. The classification is based on guidelines published by the Center for Disease Control (CDC), office of Biosafety. The numbers as well as the agents are underlined when Biosafety Level 3 is to be used for Function "A" organisms.
 2. BECAUSE LABORATORIES DEAL WITH UNKNOWN, ALL SPECIMENS FOR CULTURES OF MYCOBACTERIA WILL BE TREATED AS BIOSAFETY LEVEL 3 CONTAINMENT.

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RECOMMENDED CONTAINMENT LEVELS FOR INFECTIOUS AGENTS\
BACTERIAL AND MYCOPLASMA AGENTS

AGENT	LABORATORY FUNCTION				LABORATORY FUNCTION		
	A	B	C		A	B	C
<u>Bacillus anthracis</u> (v)	2	3	2	<u>Mycobacterium chelonae</u>	2	3	2
<u>Bordetella pertussis</u>	2	3	2	<u>Mycobacterium fortuitum</u>	2	3	2
<u>Brucella abortus</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>Mycobacterium kansasii</u>	2	3	2
<u>Brucella canis</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>Mycobacterium leprae</u> (g)	2	3	3
<u>Brucella melitensis</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>Mycobacterium marinum</u>	2	3	3
<u>Brucella suis</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>Mycobacterium malmoeense</u>	2	3	2
<u>Burkholderia pseudomallei</u>	2	3	2	<u>Mycobacterium scrofulaceum</u>	2	3	2
<u>Campylobacter fetus</u>							
subspecies <u>fetus</u>	2	3	2	<u>Mycobacterium simiae</u>	2	3	2
subspecies <u>je jeni</u>	2	3	2	<u>Mycobacterium szulgai</u>	2	3	2
subspecies <u>intestinalis</u>	2	3	2	<u>Mycobacterium tuberculosis</u>	<u>3</u>	<u>3</u>	<u>3</u>
<u>Chlamydia psittaci</u>	2	3	2	<u>Mycobacterium ulcerans</u> (G)	2	3	3
<u>Chlamydia pneumonia</u>	2	3	2	<u>Mycobacterium xenopi</u>	2	3	2
<u>Chlamydia trachomatis</u>	2	3	2	<u>Neisseria gonorrhoeae</u>	2	3	2
<u>Clostridium botulinum</u>	2	3	2	<u>Neisseria meningitidis</u>	2	3	2
<u>Clostridium tetani</u> (v)	2	3	2	<u>Salmonella choleraesuis</u>	2	3	2
<u>Corynebacterium diphtheriae</u>	2	3	2	<u>Salmonella enteritidis</u>			
<u>Corynebacterium pyogenes</u>	2	3	2	all serotypes	2	3	2
<u>Escherichia coli</u>	2	2	2	<u>Salmonella typhi</u> (v)	2	3	2
<u>Escherichia coli</u> , (VTEC/SLT)	1	1	1	<u>Shigella boydii</u>	2	3	2
<u>Francisella tularensis</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>Shigella dysenteriae</u>	2	3	2
<u>Helicobacter pylori</u>	2	2	2	<u>Shigella flexneri</u>	2	3	2
<u>Legionella pneumophila</u>	2	3	2	<u>Shigella sonnei</u>	2	3	2
<u>Leptospira interrogans</u>							
all serovars	2	3	2	<u>Treponema pallidum</u>	2	3	2
<u>Listeria monocytogenes</u>	2	2	2	<u>Vibrio cholerae</u> (v)	2	3	2
<u>Mycobacterium avium</u>							
intracellulars	2	3	2	<u>Vibrio parahaemolyticus</u>	2	2	2
<u>Mycobacterium bovis</u>	<u>3</u>	<u>3</u>	<u>3</u>	<u>Yersinia pestis</u> (v)	3	3	2

Note:

v = vaccination recommended

x = possession or use restricted by USDA

G = personnel must wear gloves when handling infectious tissue or animals.

Reference:

CDC Biosafety in Microbiological and Biomedical Laboratories 4th Edition. April 1999. Sec VII. pp. 88-113

RECOMMENDED BIOSAFETY LEVELS FOR INFECTIOUS AGENTS

FUNGAL AGENTS

AGENT	LABORATORY FUNCTION			AGENT	LABORATORY FUNCTION		
	A	B	C		A	B	C
<u>Blastomyces dermatitidis</u>	2	3	2	<u>Exophiala dermatitidis</u>	2	2	2
<u>Cladosporium trichoides</u>	2	2	2	<u>Fonsecaea pedrosoi</u>	2	2	2
<u>Cladosporium bantianum</u>	2	2	2	<u>Histoplasma capsulatum</u>	3	3	3
<u>Coccidioides immitis</u>	3	3	3	<u>Microsporum spp.</u>	2	2	2
<u>Cryptococcus neoformans</u>	2	3	2	<u>Penicillium marnettii</u>	2	2	2
<u>Dactulana gallopava</u>	2	2	2	<u>Sporothrix schenckii</u>	2	2	2
<u>Epidermophyton spp.</u>	2	2	2	<u>Trichophyton spp.</u>	2	2	2

Note:

x = possession or use restricted by USDA

Reference:

CDC Biosafety in Microbiological and Biomedical Laboratories
4th Edition. April 1999. Sec VII. pp. 119-124.

PARASITIC AGENTS

AGENT	LABORATORY FUNCTION			AGENT	LABORATORY FUNCTION		
	A	B	C		A	B	C
<u>Ascaris spp.</u>	2	2	2	<u>Hymenolepis spp.</u>	2	2	2
<u>Babesia spp.</u>	2	2	2	<u>Leishmania spp.(G)</u>	2	2	2
<u>Coccidia spp.</u>	2	2	2	<u>Naegleria fowleri</u>	2	2	2
<u>Cryptosporidia spp.</u>	2	2	2	<u>Plasmodium spp.</u>	2	2	2
<u>Cysticercus spp.</u>	2	2	2	<u>Pneumocystis carinii</u>	2	2	2
<u>Echinococcus spp.</u>	2	2	2	<u>Sarcocystic spp.</u>	2	2	2
<u>Entamoeba histolytica</u>	2	2	2	<u>Schistosoma spp. (G)</u>	2	2	2
<u>Enterobius spp.</u>	2	2	2	<u>Strongyloides spp.</u>	2	2	2
<u>Fasciola spp.</u>	2	2	2	<u>Taenia spp.</u>	2	2	2
<u>Giardia spp.</u>	2	2	2	<u>Toxoplasma spp.</u>	2	2	2
<u>Hookworm</u>	2	2	2	<u>Trypanosoma spp. (G)</u>	2	2	2

Note:

G = Personnel must wear gloves when handling infectious tissue or animals.

Reference:

CDC Biosafety in Microbiological and Biomedical Laboratories
4th Edition. April 1999. Sec VII. pp. 128-133.

VIRAL AGENTS

AGENT	LABORATORY FUNCTION			AGENT	LABORATORY FUNCTION		
	A	B	C		A	B	C
<u>Arenaviruses</u>							
<u>Lymphocytic choriomeningitis</u>	2	3	2	Yanapox virus	2	3	2
<u>Herpesvirus Group</u>				<u>Spongiform Encephalopathy Viruses</u>			
<u>Herpesvirus hominis</u>	2	3	2	Creutzfeld-Jacob agent(G)	2	3	3
Cytomegalovirus	2	3	2	Kuru agent (G)	2	3	3
Epstein-Barr virus	2	3	2	<u>Rickettsial Agents</u>			
<u>Herpesvirus simiae</u>	<u>3/4</u>	<u>4</u>	<u>4</u>	<u>Coxiella burnett</u> (v)	<u>3</u>	<u>3</u>	<u>3</u>
Varicella virus	2	3	2	<u>Rickettsia akari</u>	<u>3</u>	<u>3</u>	<u>3</u>
<u>Myxo-Paramyoviruses</u>				<u>Rickettsia australiar</u>	<u>3</u>	<u>3</u>	<u>3</u>
Influenza viruses	2	3	2	<u>Rickettsia canada</u>	<u>3</u>	<u>3</u>	<u>3</u>
<u>Parainfluenza viruses</u>				<u>Rickettsia conorii</u>	<u>3</u>	<u>3</u>	<u>3</u>
(human isolates)	2	3	2	<u>Rickettsia mooseri</u> (typhi)	<u>3</u>	<u>3</u>	<u>3</u>
Respiratorysyncitial virus	2	3	2	<u>Rickettsia prowazeki</u> (v)	<u>3</u>	<u>3</u>	<u>3</u>
<u>Picornaviruses</u>				<u>Rickettsia rickettsii</u> (v)	<u>3</u>	<u>3</u>	<u>3</u>
Poliomyelitis virus (wild)	2	3	2	<u>Retroviruses</u>			
Poliomyelitis virus				HIV	2	3	2
(attenuated)	2	2	2	SIV	2	3	2
<u>Poxviruses</u>				<u>Rhabdovirus</u>			
Vaccinia virus (v)	2	3	2	Rabies virus (v)	2	2	2
Variola major virus	RESTRICTED#			Rabies virus/carnovores	2	3	2
Variola minor virus	RESTRICTED#			<u>Ungrouped Agents</u>			
				Hepatitis			

Note:

V = vaccination recommended

G = personnel must wear gloves when handling infectious tissue or animals. (Prions)

X = Possession or use restricted by USDA

* = Provided not more than one passage from vaccine strain.

Reference:

CDC Biosafety in Microbiological and Biomedical Laboratories
4th Edition. April 1999. Sec VII. pp. 136-139.

ARBOVIRUSES ASSIGNED TO BIOSAFETY LEVEL 2

Acado	Bussuguara	Great Island	Kowanyama
Acara	Buttonwillow	Guajara	Kunjin
Aquacate	Bwamba	Guama	Kununurra
Alfuy	Cacao	Guaroa	Kwatta
Almpiwar	Cache Valley	Gumbo Limbo	La Crosse
Amapari	Caimito	Hart Park	La Joya
Ananindeua	California	Hazara	Lagos Bat
Anhanga	Encephalitis	Huacho	Landjia
Anhembi	Calovo	Hughes	Langat
Anopheles A	Candiru	Icoaraci	Lanjan
Anopheles B	Cape Wrath	Ieri	Las Mabyas
Apeu	Capim	Ilesha	Latino
Apoi	Caraparu	Ilheus	Le Dantec
Aride	Carey Island	Ingwavuma	Lebombo
Arkonam	Catu	Inkoo	Lednice
Aroa	Chaco	Ippy	Lipovnik
Aruac	Chagres	Irituia	Lokem
Arumowot	Chandipura	Isfahan	Lone Star
Aura	Changuinola	Itaporanga	Lukuni
Avalon	Charleville	Itaqui	M'Poko
Abras	Chenuda	Jamestown Canyon	Madrid
Abu Hammad	Chilibre	Japanaut	Maguari
Aabahoya	Chobar Gorge	Jerry Slough	Mahogany Hammock
Bagaza	Clo Mor	Johnston Atoll	Main Drain
Bahig	Colorado Tick	Joinjakaka	Malakal
Bakau	Fever	Juan Diaz	Manawa
Baku	Corriparta	Jugra	Manzanilla
Bangoran	Cotia	Jurona	Mapputta
Bangui	Cowbone Ridge	Jutiapa	Maprik
Banzi	Csiro Village	Kadam	Marco
Barmah Forest	Cuiaba	Kaeng Khoi	Marituba
Barur	D'Aguilar	Kaikalur	Marrakai
Batai	Dakar Bat	Kaisodi	Matariya
Batama	Dengue-1	Kamese	Matruh
Bauline	Dengue-2	Kammayan pettai	Matucare
Bebaru	Dengue-3	Kannaman galea	Melao
Belmont	Dengue-4	Kao Shuan	Mermet
Benevides	Dera Ghazi Khan	Karimabad	Minatitlan
Benfica	East Equine enc(v)	Karshi	Minnal

<u>ARBOVIRUSES ASSIGNED TO BIOSAFETY LEVEL 2</u>
--

Bertioga	Edge Hill	Kasba	Mirim
Bimiti	Entebbe Bat	Kemerova	Mitchell River
Birao	Ep. Hem. Dis.	Kern Canyon	Modoc
Bluetongue	Erve	Ketapang	Moju
Boraceia	Eubenangee	Keterah	Mono Lake
Botambi	Flanders	Keuraliba	Mont. Myotis Leuk.
Boteke	Fort Morgan	Keystone	Moriche
Bouboui	Frijoles	Kismayo	Mosqueiro
Bujaru	Gamboa	Klamath	Mossuril
Bunuip	Gan Gan	Kokobera	Mount Elgon Bat
Bunyawera	Gomoka	Kolongo	Murutucu
Burg le Arab	Gossas	Koongol	Mukines
Bushbush	Grand Arbaud	Kotonkan	Navarro

ARBOVIRUSES ASSIGNED TO BIOSAFETY LEVEL 2

Nepuyo	Restan	Sunday Canyon	Vellore
Ngaingan	Rio Bravo	Tacaiuma	Venkatapuram
Nique	Rio Grande	Tacaribe	VS - Indiana
Nkolbisson	Ross River	Taggert	VS - New Jersey
Nola	Royal Farm	Tahyna	Wad Medani
Ntaya	Sabo	Tamiami	Wallal
Nugget	Saboya	Tanga	Wanowrite
Nyamanini	Saint-Floris	Tanjong Rabok	Warrego
Nyando	Sakhalin	Tataguine	West equire enc(v)
O'Nyong Nyong	Salehabad	Tehran	Whataroa
Okhotskiy	San Angelo	Tembe	Witwatersrand
Okola	Sandfly	Tembusu	Wonga
Olifantsvlei	(Naples)	Tensaw	Wongorr
Oriboca	Sandfly	Tete	Wyeomyia
Ossa	(Sicilian)	Tettnang	Yaquina Head
Pacora	Sandjimba	Thimiri	Yata
Pacui	Sango	Thottapalayam	Yogue
Pahayokee	Sathuperi	Tibrogargan	Zaliv Terpeniya
Parana	Sawgrass	Timbo	Zegla
Pata	Sebokele	Timboteua	Zika
Pathum Thani	Seletar	Toscana	Zingilamo
Patois	Sembalam	Toure	Zirga
Phnom-Penh Bat	Serra doNavio	Tribec	
Pichinde	Shamonda	Trivittatus	
Pixuna	Shark River	Trubanaman	
Point	Shuni	Tsuruse	
Pongola	Silverwater	Turlock	
Ponteves	Simbu	Tyuleny	
Precarious	Simian Hem. Fev	Uganda S	
Pretoria	Sindbis	Umatilla	
Prospect Hill	Sixgun City	Umbre	
Punchong	Snowshoe hare	Una	
Punta Salinas	Sokoluk	Upolu	
Punta Tora	Soldado	Urucuri	
Qalyub	Sororca	Usutu	
Quanranfil	Startford	Uukuniemi	

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VI. ELECTRICAL AND MECHANICAL SAFETY

A. Electrical Safety

1. Grounding: All instruments must be grounded including household type appliances, coffee pots, etc. The only exceptions to the rule are items entirely encased in plastic (such as microscopes).
2. Report shocks: All shocks must be reported immediately, including small tingles. Small shocks often precede major shocks and a light tingle may indicate potential trouble. Notify supervisory personnel of any shocks.
3. Corrective actions: Shut off the current and/or unplug the instrument. Do not attempt to use an instrument that is causing shocks. Not only is it potentially dangerous, but also any results from the instrument would be suspect.
4. Repairs: DO NOT work on or attempt to repair any instrument while it is plugged in. An exception is the calibration of instruments that require adjustment while plugged in. In this case, be sure hands are dry, remove all jewelry (watches and rings) and proceed with caution.
5. Repairs on the electrical system of the building are prohibited. Any work performed on switches, outlets or circuit boxes (fuses, circuit breaker) must be referred to the building maintenance personnel.
6. Extension cords should be avoided. If used, they must be the 3-way type and properly grounded. Gang plugs are prohibited.
7. New equipment using electrical power should be checked for absence of chassis leaks and other safety hazards by a Biomedical Engineering Technician.
8. Major pieces of equipment may be included in the Clinical Engineering Department's "High-Technology Equipment" program, and will be identified as such by a yellow metal tag. Records concerning initial specifications and safety checks are in their system.
9. For a more explicit procedure and protocol, consult the JHH Safety Manual.

B. Compressed gases

Introduction: Compressed gases constitute several hazards. Any gas cylinder with a broken valve head becomes a missile capable of penetrating walls. Specific gases may be toxic or flammable. In addition, heating of cylinders may result in explosion.

1. General Standards:
 - a. All compressed gas cylinders shall be secured in an upright position by means of a strap, chain or non-tip base. This includes cylinders either in use or in storage (empty or full).

- b. Suitable hand trucks will be utilized when transporting gas cylinders.
 - c. Protective valve caps must be in place when cylinders are not in use.
 - d. All cylinders, lines, and equipment used with flammable compressed gases shall be grounded.
 - e. When in use, all cylinders must be equipped with an appropriate regulating device. All regulators must be marked to identify the gas (or group of compatible gases) with which the regulator is to be used. Regular threads must match cylinder valve outlet threads.
 - f. When a cylinder is in use, a hand wheel, valve handle, spindle key or special tool to activate the cylinder valve shall be attached to the cylinder so that it will immediately be available in the event of an emergency.
 - g. Cylinders containing compressed gases shall be used only in well-ventilated areas.
 - h. Cylinders containing toxic or flammable gases must be stored in an approved storage area. The use of the smallest possible cylinder of toxic or flammable gases is recommended.
 - i. Cylinders containing oxidizing gases, such as oxygen and nitrous oxide, shall be stored separately from flammable gases or liquids.
 - j. Empty cylinders shall be so identified and stored separately from full or partially full cylinders.
 - k. Compressed gas cylinders shall be used only for their intended purposes.
 - l. Cylinders must not be stored with or near flammable materials.
 - m. Do not use oil, grease or lubricants on valves, regulators or fittings.
 - n. Do not attempt to repair damaged cylinders or to force frozen cylinder valves.
3. Flammable gasses: Special care must be used when gases are used in confined spaces.
- a. No more than two cylinders should be manifolded together; however, several instruments or outlets are permitted for a single cylinder.
 - b. No more than one cylinder of highly flammable gas shall be in one room without specific review by the Director (or Safety Officer).
 - c. Standby cylinders (full or empty) must not be stored in the lab
 - d. Cylinder size is limited to 200 cubic feet.
Valves on all flammable gas cylinders shall be shut off when the laboratory is unattended.

4. Pressure regulators and needle valves: Needle valves and regulators are designed specifically for different families of gases. Use only the properly designated fittings.
 - a. Threads and surfaces must be clean and tightly fitted. Do not lubricate.
 - b. Tighten regulators and valves firmly with the proper sized wrench. (Do not use adjustable wrenches or pliers. They damage the nuts.) Do not force tight fits.
 - c. Open valves slowly. Do not stand directly in front of gauges (the gauge face may blow out). Do not force valves that "stick".
 - d. Check for leaks at connections. Leaks are usually due to damaged faces at connections or improper fittings. Do not attempt to force an improper fit. (It may only damage a previously undamaged connection and compound the problem.)
 - e. Valve handles must be left attached to the cylinders.
 - f. The maximum rate of flow should be set by the high pressure valve on the cylinder. Fine tuning of flow should be regulated by the needle valve.
 - g. Shut off cylinders when not in use.
5. Leak testing: Cylinders and connections should be tested by "snoop" or a soap solution. First, test the cylinders before regulators are attached, and then test again after the regulators or gauges are attached.
6. Empty cylinders:
 - a. Must be marked empty, and remain secured in an upright position with safety cap in place.

C. Mechanical safety

Caution should be observed in the operation and maintenance of laboratory equipment and furnishings, with attention to the following general hazards:

1. "Pinch" points (e.g. hinges, pliers, machine detentes)
2. "Catch" points (which may catch either a person or his clothing)
3. "Shear" points (doors, cabinet drawers)
4. "Squeeze" points (between moving parts)
5. "Run in" points (rotating parts moving toward each other, e.g. meshing gears)
6. Flying objects (metal or glass from breakage or explosion)
7. Falling objects (Use caution when storing or removing heavy items from cabinets and overhead shelving.)
8. Sharp or pointed objects (Do not handle syringes or other collecting systems with needles still attached.)

D. Ultraviolet Lights

ULTRAVIOLET LIGHT DECONTAMINATION *

Under certain conditions of radiation intensity, exposure time, humidity, and temperature, ultraviolet radiation at approximately 254 nanometers will cause eventual death of microorganisms. The radiation at this wavelength causes formation of thymine-thymine dimers and other effects on DNA and RNA. Nucleic acid containing thymine dimers does not replicate properly and lethal mutations are often produced. Ultraviolet light's greatest effectiveness is against actively growing bacteria. Low pressure mercury vapor lamps usually supplied with biological safety cabinets emit germicidal radiation at a wavelength of 254 nanometers for about nine months. After this time, the lamp may not produce enough germicidal radiation to effectively kill bacteria, even though it appears to be functioning properly.

In general, ultraviolet radiation is used to reduce exogenous contaminants and/or pathogenic microorganisms on exposed surfaces and in the air.

A. UV LAMP OPERATION

1. All UV installations used for disinfecting should be checked semi-annually. Periodic examination is necessary because UV bulbs may continue to burn without emitting effective radiation. UV lamps should be replaced when they emit 70 percent or less of their rated initial output.
2. UV lamps installed in biological safety cabinets must be replaced when the 254 nm UV irradiation intensity on the work tray surface of the cabinet is less than 40 microwatts per square centimeter.
3. UV lamps should be cleaned often if located in an unusually dusty area. Lamps should be turned off and wiped with a soft pad moistened with alcohol. Cleansing is the responsibility of the personnel in charge of the laboratory.
4. All exposed UV installations in lighting fixtures and safety cabinets shall be turned on only when no personnel are in the area. Louvered, wall mounted UV equipment may be left on continuously.
5. Each UV installation should be equipped with an outside switch and an appropriate safety sign. Interlocks should be installed where appropriate to turn off UV lamps when room lights are turned on.

*From the Draft of the JHMI BioSafety Manual 1995

6. Biological safety cabinets listed by the National Sanitation Foundation (NSF) after 1992 may not have UV lamps installed because there is no longer a NSF secondary test standard for UV lamps. Annual testing is required at JHMI, however, for Biological Safety Cabinets containing UV lamps.

B. TRAINING

All personnel should be instructed in the proper use of each UV installation. Such instruction should include emphasis on the following:

1. Do not look directly at UV lamps;
2. Do not loiter in UV airlocks and door barriers;
3. Turn off lamps before cleaning;
4. Wear eye and skin protection if anticipated exposure to UV will be for longer than a few seconds;
5. Protective goggles should transmit less than 4% of 400 nm wavelength light;
6. Particular care needs to be exercised around UV gel transilluminators, as they produce considerable radiation.

E. Emergency Equipment: Eye Wash and Emergency Showers

1. Any employee or student coming in contact with any hazardous material shall have a local orientation to the actual chemicals and emergency equipment in use at their site and in halls adjacent to laboratories.
2. Training for Emergency Equipment:
 - a. This training is the responsibility of the person in charge of the laboratory.
 - b. The training is to be documented on the Emergency Equipment Training Log. See the attached document page 8, from Health Safety and Environment (HSE) Office Policy HSE037.
 - c. The original training record goes to the HSE. A copy is retained in the work area.
3. Eye Wash stations are verified weekly for operation by checking that:

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- a. The device stays on without using hands (unless under grandfather clause)
 - b. Eye wash nozzles are covered. Caps are intact and clean.
 - c. The height of the stream of water is to be 3 – 6 inches. To assure correct pressure.
 - d. Water temperatures are to be tepid (unless under grandfather clause).
 - e. Access is within 10 seconds from hazard, and not obstructed.
 - f. Document the actions on the Emergency Equipment Maintenance Log. See page 9
4. If the problem is not able to be corrected, place a work order with facilities.

EMERGENCY EQUIPMENT TRAINING LOG

Location of Emergency Equipment: _____

Please check Type(s) of Equipment – at this site – covered in training:

- ☐ Eye Wash Station ☐ Drench Hose ☐ Eye/Face Station ☐ Emergency Shower ☐ Combination Eye Wash/Shower

• SUMMARY OF TRAINING—THIS IS SITE SPECIFIC TRAINING			
• Demonstration by supervisor on activation of Emergency Equipment in use in this site and return demonstration by person(s) being trained to activate Emergency Equipment			
• Training on how to clean eye wash caps and return demonstration:		<input type="checkbox"/> Done	<input type="checkbox"/> N/A
• Training on how to judge whether emergency equipment is operating correctly: 1. Comes on within one second of activation? 2. Water feels tepid on your hand? 3. Water Pressure appears to be adequate based on pressure on hand and visual inspection? 4. Eye wash caps are present and in working condition? 5. Reason for running emergency equipment for at least three (3) minutes and until the water is sediment free.			
• List any chemicals – in use in this site – whose chemical reaction would be accelerated by flushing temperatures of the water from the emergency equipment.			
• CHEMICAL NAME		• LIST SPECIFIC ACTION NEEDED WHEN EXPOSURE OCCURS TO THIS CHEMICAL. This requirement can be met by reviewing this information on the MSDS sheet for this chemical and giving the trainees their own copy. If you use the MSDS sheet, write "MSDS" in this column	
<input type="checkbox"/> "N/A" = Not applicable to this site because it does not routinely use any chemical where the chemical reaction is accelerated by flushing temperatures			
• 1.		•	
• 2.		•	
• Taught to complete Emergency Equipment Maintenance Log and how to submit work order if emergency equipment is not working correctly			
Date of Training	Signature of person being trained		
	Signature of Supervisor doing the training		
Signature of Supervisor providing the training:			

Revised/reviewed 9/2009

Revised: 08/20/04

A copy of this training record is kept for two (2) years.

☐ Eye Wash Station ☐ Drench Hose ☐ Eye/Face Station ☐ Emergency Shower ☐ Combination Eye Wash/Shower

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VII. GENERAL PRINCIPLES FOR SAFE HANDLING OF CHEMICAL HAZARDS

- A. Introduction: The Laboratory's Chemical Hygiene Plan is a supplement to the Johns Hopkins Safety Manual, Chemical Hygiene Plan, HSE 706. A number of routine procedures in a clinical laboratory involve the use of highly caustic, poisonous, or flammable reagents. These should be appropriately labeled to indicate the hazards. Read labels and observe precautions. Failure to follow safe practices is cause for disciplinary action.

OSHA LABORATORY STANDARD

The OSHA Laboratory Standard can be found in the appendix or through the link:

http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106.

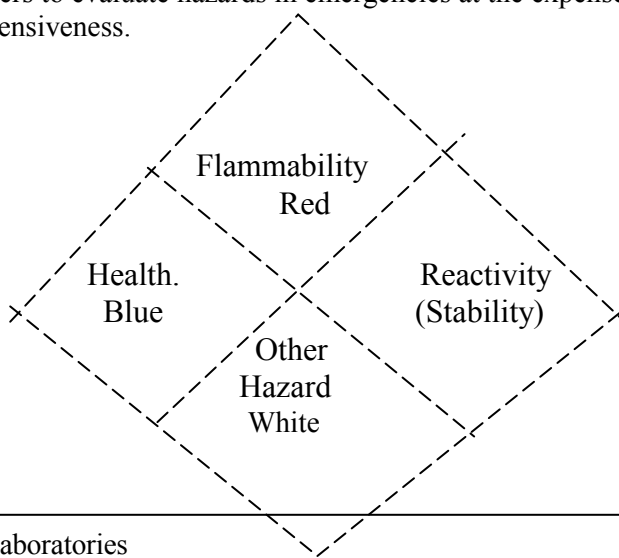
- B. Chemical hazards in the laboratory: OSHA'S "Right to Know" law
1. The Occupational Safety and Health Administration (OSHA) has issued regulations regarding education of employees regarding hazardous chemicals present in the workplace. All laboratories, including clinical laboratories, will be required to:
 - a. Have Material Safety Data Sheets (MSDS) accessible to employees for chemicals used in the laboratory.
 - b. Label containers of chemicals properly; manufacturer's labels are acceptable.
 - c. Train employees to recognize potential hazards in the workplace and proper procedures for handling hazardous substances.
 - d. Prepare a list of hazardous chemicals used in lab for inventory.
The list of hazardous chemicals used in the laboratory is to be updated and reviewed annually.
 2. Material Safety Data Sheets (MSDS). An MSDS is a printed sheet (or computer file) listing product identification, precautionary labeling, hazardous components, fire and explosion data, health hazard data, spill and disposal procedures and similar information on individual chemicals or mixtures.
Access to MSDS is as follows:
 - a. Request for MSDS can be made by contacting the Health Safety and Environment Office at 955-5918.
 - b. Current MSDS are available online on the Health Safety and Environment site under ChemWatch
 - c. Individual MSDS are available from manufacturers of kit reagents. These are generally mixtures of chemicals provided prepackaged. (They are to be filed in an appropriately designated area defined by the laboratory available to staff.)

3. The employee's responsibility regarding chemical hazards.
 - a. Know the chemical hazards of the reagents you work with. Consult the procedure manuals and refer to the MSDS files to learn the hazards of any chemical that you use before you start a job.
Note Not all prepackaged mixtures have MSDS. Look at the MSDS of key components.
 - b. Handle and dispose of chemicals using good laboratory practice and as described in the procedure manuals. Use safety appliances such as gloves, goggles and fume hoods as appropriate. Refer to MSDS file where appropriate. Notify a supervisor if any discrepancy exists.
 - c. Consult your supervisor if you have concerns regarding the hazard of any chemical or procedure.
 - d. **Personal Protective equipment**
When working with a hazardous material the minimum personal protective equipment shall be:
 1. Lab coat or other protective clothing
 2. Safety glasses or splash goggles
 3. Gloves
4. The Employee's Rights regarding Chemical Hazards Training.
 - a. See the Chemical Information List and MSDS for hazardous substances in your workplace within one day of your request.
 - b. Be provided with one copy of the list of substances you use and the corresponding MSDS (or the means to make a copy at no cost) within five days of a request.
 - c. Be trained on the hazards of the chemicals in your workplace, on the appropriate equipment and methods necessary to protect you from the hazards, and on associated emergency procedures.
 - d. Refuse to work with a hazardous chemical if denied access to information about that chemical.
- C. **Classification:** Dangerous chemicals may be grouped into the following:
 1. **Caustic or corrosive:** Acids and alkalis may cause burns of skin, mouth, or eyes and may also cause damage to equipment and storage areas.
 2. **Poisons:** Almost any substance in quantity can be poisonous. For these purposes, a poison will be classified as a substance which may cause death or serious effects if relatively small amounts are inhaled, ingested, or contact the skin (such as concentrated phenols). Poisons may be gas, liquid, or solid
 3. **Carcinogens:** Substances designated by OSHA as carcinogenic (cancer causing) require special handling.
 4. **Flammables:** Such materials that easily ignite/burn and serve as fuel for a fire.
 5. **Explosive:** Materials which may explode under special circumstances.

- D. Labeling: Appropriate hazard warnings are required for manufacturers; however, regular periodic inventories may reveal containers purchased before manufacturers were required to use adequate and precautionary labeling. Laboratories also are required to ensure that containers of hazardous chemicals in use or in storage are labeled with the identity or contents of the container. Existing labels on containers carrying hazardous chemicals should not be removed or defaced unless the container is immediately marked with the required re-labeling information.
- a. Any secondary container into which hazardous chemicals are transferred from originally labeled containers must also be labeled with:
 - i. The chemical identity of the contents
 - ii. Precautionary handling hazards.
 - iii. Date of receipt
 - iv. Date of preparation and/or date placed in service,
 - v. Dilution ratio if applicable
 - vi. Hazardous characteristics, i.e., caustic, corrosive, poisonous, carcinogenic,
 - vii. Date of expiration.
 - viii. Labels or other forms of warning must be legible, in English, and prominently displayed on the container.
 - b. The only permissible exceptions to this requirement are containers intended for immediate use only by the person who does the transfer, and only within the work shift in which the transfer was made. Unlabeled containers of chemicals should not be used; such materials should be disposed of promptly.

Certain manufacturers use the National Fire Protection Association System of identification. The National Fire Protection Association (NFPA 704) "Identification of the Hazards of Materials" is a symbol system. The diamond identifies the health, flammability, and reactivity hazards as well as the severity using a 0-4 gradient, with 4 as the highest hazard. This system was designed to be easily understood and adequate for fire fighters to evaluate hazards in emergencies at the expense of some specificity and comprehensiveness.

NFPA 704:



The five degrees of hazard have these meanings to fire fighters:

- 4 - Too dangerous to approach with standard fire-fighting equipment and procedures. Withdraw and obtain expert advice on how to handle.
- 3 - Fire can be fought using methods intended for extremely hazardous situations, such as unmanned monitors or personal protective equipment which prevents all bodily contact.
- 2 - Can be fought with standard procedures, but hazards are present which require certain equipment or procedures to handle safely.
- 1 - Nuisance hazards present which require some care, but standard firefighting procedures can be used.
- 0 - No special hazards, therefore, no special measures.

Health Hazards

- 4 - Materials too dangerous to health to expose fire fighters. A few whiffs of the vapor could cause death. Protective clothing and breathing apparatus available to the average fire department will not provide adequate protection against inhalation or skin contact with these materials.
- 3 - Materials extremely hazardous to health but areas may be entered with extreme care.
- 2 - Materials hazardous to health but areas may be entered freely with self-contained breathing apparatus.
- 1 - Materials only slightly hazardous to health.
- 0 - Materials which on exposure under fire conditions, should offer no

health hazard beyond that of ordinary combustible material.

Flammability Hazards

- 4 - Very flammable gases or very volatile flammable liquids.
- 3 - Materials that can be ignited under almost all normal temperature conditions. Water may be ineffective because of the low flash point in the materials.
- 2 - Materials that must be moderately heated before ignition will occur. Water spray may be used to extinguish the fire because the material can be cooled below its flash point.
- 1 - Materials that must be preheated before ignition can occur. Water may cause frothing if it gets below the surface of the liquid and turns to steam. however, water fog gently applied to the surface will cause a frothing which will extinguish the fire.
- 0 - Materials that will not burn.

Reactivity (Stability) Hazards

- 4 - Materials which are readily capable of detonation at normal temperatures and pressures. If they are involved in a massive fire, vacate the area.
- 3 - Materials which, when heated and under confinement, are capable of detonation and that may react violently with water. Fire fighting should be conducted from behind explosion-resistant locations.
- 2 - Materials which will undergo a violent chemical change at elevated temperatures and pressures but do not detonate.
- 1 - Materials which are normally stable but may become unstable in combination with other materials or at elevated temperatures and pressures. Use normal precautions as in approaching any fire.
- 0 - Materials which are normally stable and, therefore, do not produce any reactive hazard to fire fighters.

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The following pages are lists of some hazardous substances which are grouped according to their reactivity or explosive qualities. (The laboratories are reminded to use resources for MSDS files for the chemicals they use.)

Hazardous Highly dangerous-will explode owing to heat, <u>flame,</u> <u>shock</u>	Tetracetylene dicarbonic acid Tetranitromethane Trinitroaniline Trinitroanisole Trinitrobenzene Trinitrochlorobenzene 2,4,6-trinitro-m-cresol Trinitrotoluene 2,4,6-trinitroxylene Zinc peroxide Dichloromethyl chloroformate Diphosgene Fuming nitric acid Grignard's reagents Hybridides (nonvolatile) Hydrogen cyanide (stabilized) Hydrogen fluoride Lithium aluminum hydride Magnesium metal Nitric acid Oleum Phosphenyl chloride Phosphides Phosphorus nitride, oxyhalides, pentahalides & trihalides Radioisotopes, beta emitters Sodium azide	_____
Acetylides Acetyl peroxide Aluminum alkyls Ammonium chlorate Diazoethane Diazomethane Dichloroacetylene N,N'-diethyl carbanilide Ethylene oxide Formyl peroxide Fulminates Glycerol irinitrate Hexane hexanitrate Hydrogen (high pressure) Hydrogen peroxide (<35% water) Iodine azide Lead azide Manganese heptoxide Mannitol hexanitrate Mercury acetylde Mercury azide Methyl isocyanide Nitrocellulose (dry) Ozonides (dry) Parathion Perchloric acid (<10% water) Phenyl diazosulfide Picric acid and Cu, Pb, and Zn salts (dry) Radioisotopes, gamma emitters Silver azide Tetracene		Conventional When heated to decom- position gives off highly toxic fumes or products that may cause explosion hazards when <u>exposed to flame</u> Acetic acid Acetic anhydride Acetoacetanilide Acetone cyanohydrin Acetyl chloride Acrolein Acrylonitrile Alcohols Alkaloids Alkyl aryl acids, alcohols, amines, esters, esters >C ₃ (wet) halides, hydrocarbons, ketones, mercaptans, & sulfides Alkyl dihalides Alkyl nitrates Allyl amine Allyl cyanide Allyl ether Allyl halide Amines

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Aminoacetophenone

p-aminoazobenzene

p-aminophenol

2-amino pyridine

Amino pyrine

2-aminothiazole

Highly dangerous-gives off
highly toxic fumes on heat,
flame, shock

Carbon disulfide

Carbon monoxide

Carbon oxysulfide

Dibromoacetylene

Diethyl ether

Dimethyl ether

Ethyl nitrate

Hyponitrous acid

Mercury

Mercuric perchlorate

Methyl phosphine

Phosgene

Thionyl chloride-fluoride

Thiophosgene

Vinyl chloride

Vinyl ether

Vinylidene chloride

Special

Dangerous-when exposed to
heat or flame may explode or
is spontaneously
flammable in air

Acetyl benzoyl peroxide

Acetylene

Acetylene chloride

Alkyl ethers <C₄

Allyene

Aluminum chlorate

Ammonium chromate

Benzoyl peroxide, dry

Butadiene-1,3

Chlorates

Diakyl phosphines

Diazoacetic ester

Diazoamidobenzol

Diazobenzene chloride

Diethyl carbonate

Diisopropyl & higher-alkyl
ethers

Ferrous perchlorate

Furan

Hydrazine, anhydrous

Hydrazoic acid

Hydrides, volatile

Hydrogen, cyanide
(unstabilized)

Ammonia

Ammonium nitrate

Amyl nitrate

Hydrogen fluoride

Benzene sulfonyl chloride

Benzoyl peroxide (wet)

Bromine & iodine

N-bromoacetamide

Chlorobutanol

Chloroform

2-chloropyridine

Cresols

Cyanates

N,N-dialkylaminoethylamine

Dibutylphosphite

Dicyandiamide

Diethylamino ethanol

Diethyl phosphite

Diethyl sulfate

Diketene

Epichlorohydrin

Esters

Ethylene imine

Hydrazine hydrate

Hydrogen sulfide

Hydroxylamine salts

Inorganic Hg compounds

Iodates

Iodides

Ketones >c₃

Methyl acrylate

methylene chloride

Nitriles

Hydrocarbons

Bromine & iodine

N-bromoacetamide

Chlorobutanol

Chloroform

2-chloropyridine

Cresols

Cyanates

N,N-dialkylaminoethylamine

Dibutylphosphite

Dicyandiamide

Diethylamino ethanol

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Diethyl phosphite

Diethyl sulfate

Diketene

Epichlorohydrin

Esters

Ethylene imine

Hydrazine hydrate

Hydrogen sulfide

Hydroxylamine salts

Hydrogen (low pressure)

Hydrogen peroxide (>35%
water)

Magnesium peroxide

Mercurous azide

Methyl acetylene

Methyl lactate

Nickel hypophosphite

Nitriles ethyl

Nitrogen bromide

Inorganic salts of
alkylnitrates

Nitrosoguanidine

Nitrosomethyl urea (dry)

OzoneOzonides (solution)

Pentaborane

Perbenzoic acid

Perchlorates

Perchloric acid (10% or more
water)

Performic acid

Peroxides (organic)

Phosphorus (white)

Phenylazoimide

Silicon hydride

Silver oxalate

Sodium chlorite

Trinitrobenzaldehyde

Dangerous-will react with
water or steam to produce
hydrogen toxic fumes or
highly flammable gases

Acetone

Alkali cyanides, hydrides,
sodium, & other metalsAluminum borohydride,
carbide, chloride, hydride,
and nitride

Benzoyl chloride

Boron compounds

Carbonyls

Chlorine

Cyanogen bromide

Cyanogen chloride

Dialkyl carbamyl chlorides

Dialkyl cyanamide

Dialkyl aluminum hydrides

Diborane

Dibromoketone

Inorganic Hg compounds

Iodates

Iodides

Ketones >C₃

Methyl acrylate

Methylene chloride

Nitriles

Nitrosomethyl urea (wet)

Petroleum ether

Piperidine

Propargyl bromide

Pyridine

Sodium alkoxide

Sodium azide

Sodium borohydride

Tetrabromoethane

Tetrachlorethane

Moderately stable-
when heated gives off acid
fumes

Alcohol

Alkyl acids >C₂

Alumina

Ammonia

Amyl alcohol

Benzoic anhydride

Benzophenone

Charcoal

Chlorophenyl carbamate

Diethylene glycol

Dimethyl formamide

Formic acid

Nitrosomethyl urea

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Inorganic acids
Methyl diacetoacetate
Phenyl cellosolve
Silica gel
Tetradecane
Tetrahydrophthalic
anhydride

SUBSTANCES IN THE LEFT HAND COLUMN SHOULD BE STORED AND HANDLED
SO THEY CANNOT POSSIBLY ACCIDENTALLY CONTACT CORRESPONDING
SUBSTANCES IN THE RIGHT HAND COLUMN

	<u>Incompatible Chemicals</u>
Alkaline and alkaline earth metals, such as sodium, potassium, cesium, lithium, magnesium, calcium, aluminum	Carbon dioxide, carbon tetra-chloride, and other chlorinated hydrocarbons, any free acid or halogen. Do not use water, foam, or dry chemical on fires involving these metals.
Acetic acid	Chromic acid, nitric acid, hydroxyl-containing compounds, ethylene glycol, perchloric acid, peroxide, and permanganates
Acetone	Concentrated nitric and sulfuric acid mixtures
Acetylene	Chlorine, bromine, copper, silver, fluorine, and mercury
Ammonia (anhydrous)	Mercury, chlorine, calcium hypochlorite, iodine, bromine, and hydrogen fluoride
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, finely divided organics or combustibles
Aniline	Nitric acid, hydrogen peroxide
Bromine	Ammonia, acetylene, butadiene, butane and other petroleum gases, sodium carbide, turpentine, benzene, and finely divided metals
Calcium carbide	Water (see also acetylene)
Calcium oxide	Water
Carbon, oxide	Calcium hypochlorite
Copper	Acetylene, hydrogen peroxide
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organics or combustibles

SUBSTANCES IN THE LEFT HAND COLUMN SHOULD BE STORED AND HANDLED
SO THEY CANNOT POSSIBLY ACCIDENTALLY CONTACT CORRESPONDING
SUBSTANCES IN THE RIGHT HAND COLUMN

Incompatible Chemicals

Chromic acid	Acetic acid, naphthalene, camphor, glycerine, turpentine, alcohol, and other flammable liquids, paper, or cellulose
Chlorine	Ammonia, acetylene, butadiene, butane and other petroleum gases, hydrogen, sodium carbide, turpentine, benzene, and finely divided metals
Chlorine dioxide	Ammonia, methane, phosphine, and hydrogen sulfide
Fluorine	Isolate from everything
Hydrocyanic acid	Nitric acid, alkalis
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, any flammable liquid, combustible materials, aniline, nitromethane
Hydrofluoric acid, anhydrous (hydrogen fluoride)	Ammonia, aqueous or anhydrous
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hydrocarbons (benzene, butane, propane, gasoline, turpentine)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Iodine	Acetylene, ammonia (anhydrous or aqueous)
Mercury	Acetylene, fluminic acid ammonia
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, and nitritable substances

SUBSTANCES IN THE LEFT HAND COLUMN SHOULD BE STORED AND HANDLED
SO THEY CANNOT POSSIBLE ACCIDENTALLY CONTACT CORRESPONDING
SUBSTANCES IN THE RIGHT HAND COLUMN

Incompatible Chemicals

Nitroparaffins	Inorganic bases
Oxygen	Oils, grease, hydrogen, flammable liquids, solids, or gases
Oxalic acid	Silver, mercury
Perchloric acid oils, organic amines or antioxidants	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease,
Peroxides, organic	Acids (organic or mineral); avoid friction
Phosphorus (white)	Air, oxygen
Potassium chlorate	Acids (see also chlorate)
Potassium perchlorates	Acids (see also perchloric acid)
Potassium permanganate	Glycerine, ethylene glycol, benzaldehyde, any free acid
Silver compounds	Acetylene, oxalic acid, tartaric acid, fulminic acid, ammonium
Sodium	See alkaline metals (above)
Sodium nitrate	Ammonium nitrate and other ammonium salts

SUBSTANCES IN THE LEFT HAND COLUMN SHOULD BE STORED AND HANDLED
SO THEY CANNOT POSSIBLE ACCIDENTALLY CONTACT CORRESPONDING
SUBSTANCES IN THE RIGHT HAND COLUMN

Incompatible Chemicals

Sodium oxide	Water, any free acid
Sodium peroxide	Any oxidizable substance, such as ethanol, methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerine, ethylene glycol, ethyl acetate, methyl acetate, and furfural
Sulfuric acid	Chlorates, perchlorates, permanganates
Zirconium	Prohibit water, carbon tetrachloride, foam, and dry chemical or zirconium fires

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E. Storage of corrosives:

1. Store caustic and corrosive materials near the floor to minimize danger of bottles falling from shelves.
2. Separate containers to facilitate handling. Organic acids (acetic acid and acetic anhydride) should be stored separately from strong oxidizing agents (sulfuric, nitric, or perchlorate) to prevent interaction of fumes and corrosion of storage cabinets.
3. Acid bottle carriers must be used for containers over 1 quart in size.

F. Storage of flammables

An approved flammable storage cabinet is required. Labs should not store more than 10 gallons of flammable liquid in an individual fire area. Not more than 60 gallons is allowed in a flammable storage cabinet unless approved by Health Safety, Environment.

1. Quantities of one gallon or larger must be stored in approved flammable material storage cabinets. If a reagent must be stored in glass for purity, the glass container may be placed in a bottle to lessen the danger of breakage.
2. Small quantities (working amounts) may be stored on open shelves, but bulk storage (more than 5 gallons) must be in a flammable liquid storage room.
3. Do not store flammables in areas exposed to direct sunlight.
4. Ether is a particular hazard; only small containers (one pint or less) should be used. Once opened, containers must be stored in an explosion-proof enclosure (preferably a vented flammable storage cabinet).
5. Storage of flammables in refrigerators shall be in approved flammable material refrigerators only.
6. Small amounts of residual ether may be disposed of by leaving the open container in an explosion-proof fume hood.

G. Handling caustic materials:

1. If large quantities of acids or alkalis are being used, use a shield or barrier of some kind or work in a sink so breaks or spills can be controlled.
2. Wear aprons, gloves, and eye protection devices when handling highly corrosive materials.
3. Do not pipette by mouth.
4. Do not sniff reagents.
5. Dilution: Use great care and add reagents SLOWLY. Always add acid to water, NEVER water to acid. Allow acid to run down the side of the container and mix slowly by gentle rotation. Avoid overheating.

- H. Breaks and spills Exposures and Monitoring:
1. Skin/eye/mouth contact: wash area immediately.
 2. Clothing spills: take item of clothing off immediately to avoid soaking through to skin. This includes belts and shoes (if affected).
 3. Evaluate Spills for:
 - a. the type of material
 - b. identify all materials by common or chemical name
 - c. estimate how much spilled
 - d. evaluate the degree of danger to others and property
 4. Contain spills to prevent the spread of spilled material using any action designed for this purpose. Evacuate area if irritating odors or dangerous vapors exist.
 5. Clean up spill with sand or absorbent materials if acid, base or flammables Wash area thoroughly after clean up.
Spills of toxic or explosive material shall be handled by HSE.
 6. Spills of flammables beyond the capability to handle shall be handled by Health, Safety and Environment (HSE) at 955-4444.
 7. Miscible liquids should be flushed down the sink with copious amounts of water. Sand or absorbent materials should be placed in a sealed container and marked with the name of the chemical.
 8. Exposure –
If exposure to a hazardous chemical has occurred, the employee shall report promptly to the Occupational Injury Clinic or to the Adult Emergency Room when the clinic is closed. A Report of Incident form is to be completed by the individual's supervisor.
 9. Monitoring
The monitoring of staff for exposure to hazardous chemicals is performed and documented by HSE.
- I. Mercury:
1. For emergency-handling mercury spills in JHH, contact JHH Environmental Services at 955-5714; in JHU contact Health Safety and Environment at 955-5918. See Johns Hopkins Safety Manual policy HSE 022.
 2. Minimize spills of elemental mercury by surrounding contaminated area with wet paper towels. Do not use a broom to pool droplets as this creates dust and smaller particles.
 3. Place mercury contaminated items in a plastic bag in the room for HSE disposal.
 4. Chronic exposure and absorption of mercury may lead to a metallic taste in the mouth, a "lead line" (grey line) around gums, and neurological problems (irritable, hyper-reflexic, comatose).
 5. The Institutions plan is to eliminate any mercury usage within all areas. During Environmental Monitoring Rounds any mercury usage identified is discarded and recommendations made for substitution of products where available.

J. Disposal of Hazardous Materials

A hazardous material or chemical: any chemical, which is a physical hazard or a health hazard.

1. Excess hazardous material must be disposed of in accordance with Federal and State guidelines. Unwanted chemicals must be disposed through the Johns Hopkins Hazardous Material Disposal Program.
2. Materials in any of the following categories must be disposed of as hazardous materials:
 - a. Ignitable - any substance with a flash point below 60 ° C (140 ° F).
 - b. Corrosive - any substance with pH of less than or equal to 2.0 or greater than or equal to 12.5.
 - c. Reactive - any substance which is unstable, reacts violently with water, forms potentially explosive mixtures with water, generates toxic gases, vapors or fumes when mixed with water or exposed to a pH between 2.0 and 12.5, or capable of detonation or explosive decomposition or reaction.
 - d. Toxic - any substance which contains any of the compounds listed by the EPA under the Resource Conservation and Recovery Act at or greater than the listed concentration.
 - e. Specific chemicals - any substance containing an EPA listed compound.

K. Disposal of Unknown Hazardous Materials*

Under the Resource Conservation and Recovery Act (RCRA), all chemicals must be properly identified before proper disposal. "Unknown" materials cannot be disposed until they have been properly characterized with appropriate documentation. The procedure for disposing of "unknowns" is as follows.

1. Bring the unknown material in a sealed container to HSE during hazardous materials receiving hours along with a completed M&S or Requisition Form.
2. HSE will deliver a sample of the material to an independent lab for analysis. HSE will hold the remaining material in an approved chemical accumulation area.
3. Upon receipt of lab results, HSE will inform the Department Administrator of the results and dispose of the material appropriately.

*Note: From the JH Safety Manual Policy, 09/21/07, HSE 703.

For any unusual problems or questions contact the JH Health, Safety and Environment directly at 5-5918.

L. Carcinogens

1. Introduction: Specific regulations have been established by OSHA regarding the handling of certain compounds designated as carcinogenic. There are only a few of these, used in dilute solutions, in routine use in most clinical laboratories. An inventory of all such materials must be maintained and specific protective measures must be observed.
2. Those substances are confirmed by OSHA to be carcinogenic to humans and require special precautions:
 - o 4-Aminodiphenyl, Skin
 - o Vinyl chloride
 - o β -Naphthylamine
 - o Nickel elemental insoluble and soluble compounds, ASNI
 - o 4-Nitrodiphenyl, skin
 - o Chromite ore processing (chromate)
 - o Coal tar pitch volatiles as benzene solubles
 - o Benzidine, Skin
 - o Asbestos (all forms)
 - o bis(Chloromethyl) ether
 - o zinc chromates
 - o insoluble and water-soluble CrVi compounds, NDC
 - o Arsenic, elemental and inorganic compounds (except Arsine)
 - o Benzene - skin
3. Suspected human carcinogens:
 - o Acrylonitrile, Skin
 - o Hydrazine, Skin
 - o Lead chromate as Cr and Pb
 - o Ethylene oxide
 - o 3,3' - Dichlorobenzidine, Skin
 - o Dimethylcarbamoyl chloride
 - o 1,1 - Dimethylhydrazine, Skin
 - o Dimethyl sulfate, Skin
 - o Benzo(a)pyrene
 - o Beryllium and compounds
 - o 1,3 - Butadiene
 - o Chloroform
 - o Vinyl bromide
 - o Vinyl chclohexene dioxide, Skin
 - o N-Phenyl-beta-naphthyl-amine
 - o β -Propiolactone
 - o Hexamethyl phosphoramidate, Skin
 - o Methyl iodide, Skin
 - o 4,4' - Methylene bis (2-chloroaniline)
 - o 4,4' - Methylene dianiline, Skin

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- o Methyl hydrazine, Skin
- o N-Nitrosodimethylamine, Skin
- o Formaldehyde
- o Hexachlorobutadiene, Skin
- o 2-Nitropropane
- o Propylene imine, Skin
- o Chlormethyl methyl ether
- o Propane sultone
- o Phenylhydrazine, Skin
- o Acrylamide - Skin
- o Antimony Trioxide production
- o Benz [a] anthracene
- o Benz [b] fluoranthene
- o Cadmium elemental and compounds, as cd.
- o Calcium chromate
- o Chrysene
- o 1,4 - Dichloro - 2 - butene, skin
- o Dinitrotoluene
- o Ethul achylate
- o Ethul bromide, skin
- o Ethulene dibromide, skin
- o Hexachloroethane, skin
- o Methulene chloride
(Dichloromethane)
- o Phenylenediamine
- o Strontium chromate
- o Tetranitromethane
- o 4 - vinul cyclohexene
- o xylicline (mixed isomers), skin
- o Epichlorohydrin
- o Propyleneimine, Skin
- o O-Tolidine, Skin
- o O-Toluidine, Skin
- o p-Toluidine, Skin
- p-Toluidine, Skin
- Chlormethyl methyl ether
- Zinc chromate
- Propane sultone
- Phenylhydrazine, Skin

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The above list of carcinogens is extracted from the lists provided by Chemical Threshold Limit Values Committee of the American Conference of Governmental Industrial Hygienists. If your laboratory has any of the above substances, please check with "Right To Know" list for specific recommendations on how to deal with any emergencies.

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VIII. RADIOISOTOPES

A. General requirements

1. All laboratory sections using in vitro radioisotopes shall have the Johns Hopkins Safety Manual Section IX readily accessible in each area, in which these materials are used.
2. JHMI policies in these areas are developed by the JHMI Radiation Control Committee (RCC) and implemented by the JHMI Radiation Safety Officer (RSO).
3. Each laboratory using radioisotopes needs prior authorization for the isotope by the RCC.
4. Each laboratory has the following responsibilities when using in vitro radioisotopes:
 - a. Post work areas and label all reagents and equipment to identify the presence of radioisotopes. (See the JH Safety Manual Radiation Section IX).
 - b. Instruct laboratory employees in techniques for safe handling of isotopes and handling of emergencies.
 - c. Maintaining a logbook of all isotopes received, used and disposed of.
 - d. Cover all work areas (bench tops, hood, floors, etc.) as well as storage areas and areas adjacent to permanent set-ups and sinks at all times with stainless steel or plastic trays, uncracked glass plates, or other impervious materials. For some purposes, a plastic-baked absorbent (e.g. Kimpak) will be satisfactory. However, if such paper is used, it should be discarded frequently to prevent active materials from dusting off the surface.
 - e. Conduct weekly surveys of laboratory work areas for isotopic contamination.
5. Each authorized user (other than those where H-3 is used exclusively or where only exempt quantities of other radionuclides are handled) must be equipped with a portable or semi-portable monitoring device suitable to the radioactive materials authorized, for use for personnel and area monitoring.
6. Consult the JH Safety Manual, Section IX Radiation Safety for explicit procedures and protocols.

B. Safe handling of in vitro radioisotopes

1. Receipt and notification. The JHMI Radiation Safety Officer initially receives all shipments of radioisotopes.
 - a. The technologist on duty will: receive the package from Radiation control; inspect package for damage; monitor if necessary; log shipment into inventory log; place shipment in the appropriate refrigerator.
 - b. Inspection of shipment: Note condition of package:
 - 1) if undamaged, note condition in log and place in storage.
 - 2) if the package is crushed, torn, punctured, or wet

(suggesting leakage), it must be checked for radiation.

2. Warning signs and labels:
 - a. Warning signs indicating the presence of radioactive materials shall be placed in the radionuclide storage, work, and waste area.
 - b. Appropriate labels shall be placed on all containers of radionuclides, and waste containers
3. Handling of radionuclides:
 - a. Liquids:

Do not pipet or handle directly. Remove liquid from vials with a syringe and needle or automatic pipetting device. Glove must always be worn. Wash hands thoroughly after each procedure.
 - b. In vitro test kits:

The level of activity is generally very low. Use care in adding labeled materials to test tubes. Cover tubes with the caps provided. Washing: Flush with aspirators and wash into the drain with adequate amounts of water. Avoid splashing rinse water.
 - c. Capsules:

Handle indirectly with forceps or with plastic or paper cups. Do not handle directly.
 - d. Clothing:

Wear a lab coat or apron when handling liquids. Change immediately if coat or apron becomes contaminated. Have coat washed or set aside until contamination decays. Check coat or apron with survey/monitored meter periodically to detect contamination.
 - e. Tissue Handling:

C. Periodic surveys of Radiation Areas.

1. All radioactive materials laboratories shall be surveyed for contamination on weekly basis. The work, storage, specimen receipt, and scanning areas should be monitored weekly as used, and surveys should be recorded.
2. The weekly surveys shall be conducted by the Authorized User (or designee).
3. Additional surveys shall be conducted each time there is reason to suspect a contamination incident. See the JH Safety Manual for permissible contamination levels.
4. Records shall be kept on both positive and negative survey results in chronological sequence in a binder specifically for that laboratory.
5. Survey records must be readily available for review by the Radiation Control Unit.
6. A survey entry must be made for each week for each laboratory, and the entry shall be either the results of the contamination survey or a statement that radioisotopes have not been used since the last survey.

D. Emergency Procedures (Spills)

1. Minor spills Involving No Radiation Hazard To Personnel
 - a. Notify all other persons in the room at once.
 - b. Permit only the minimum number of persons necessary to deal with the spill into the area.
 - c. Confine the spill immediately.
 - i. Liquid Spills
 - Don protective gloves
 - Drop absorbent paper on spill
 - ii. Dry Spills
 - Don protective gloves
 - Dampen thoroughly, taking care not to spread contamination.
 - d. Notify the JHMI Radiation Control Unit (955-3712) as soon as possible. JHMI Radiation Control Unit will perform the following steps
 - e. Decontaminate.
 - f. Monitor all persons involved in the spill and cleaning.
 - g. Permit no person to resume work in the area until a survey is made by the Radiation Control Unit.
 - h. Prepare a complete history of the accident and subsequent activity related thereto for the necessary records.
2. Major Spills Involving Radiation Hazard to Personnel
 - a. Notify all persons not involved in the spill to vacate the room at once.
 - b. Notify the JHMI Radiation Control Unit as soon as possible. The Radiation Safety Officer will be responsible for determining the extent and hazard of contamination (955-3712).
 - c. Take immediate steps to decontaminate personnel involved, as necessary. If the spill is on the skin, wash thoroughly 2-3 minutes. Repeatedly soap and rinse using synthetic detergent if available.
 - d. If the spill is on clothing, discard outer or protective clothing at once.
3. Major Spills: Radiation Contamination of an Area.
 - a. Preparations for decontamination shall be started promptly
 - b. The individual responsible for the contamination will be expected to do most of the cleanup under the supervision of the JHMI Radiation Control Unit.(Personnel involved in decontamination must be adequately protected)

- c. If the spill is liquid, and the hands are protected, right the container.
- d. Monitor all persons involved in the spill and cleaning to determine adequacy of decontamination. The JHMI Radiation Control Unit will assist in this evaluation.
- e. Permit no person to resume work in the area until a survey is made to the area or equipment. It shall be considered contaminated until proved otherwise by the JHMI Radiation Control Unit.

For further procedures and protocols consult the JH Safety Manual, Section IX Radiation Safety.

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BIOSAFETY LEVELS

Biosafety levels. These guidelines specify four Biosafety levels (BSL), for organisms involving infectious microorganisms. The levels consist of a combination of laboratory practices and techniques, degrees of protection provided to personnel, safety equipment, and laboratory facilities which are commensurate with the operations performed and with the potential hazard posed by the infectious agents for which the laboratory is responsible.

Biosafety Level 1. (BSL-1)

Safety equipment and facilities are those appropriate for laboratory personnel having specific training in the procedures conducted in the laboratory and are supervised by a scientist with general training in microbiology or related science. Work in these areas is generally conducted on open bench tops using standard microbiological practices. Special containment equipment or facility design is neither required nor generally used.

1. Standard Microbiological Practices – (For ALL BSL Levels 1-4)
 - a. Access to laboratory is limited or restricted at the discretion of lab director when work or experiments on cultures and specimens are in progress.
 - b. A biohazard sign is to be posted at the entrance to the laboratory. The sign should include the name of the agents in use and the names and phone numbers of the lab contacts.
 - c. Lab coats, gowns or uniforms are worn to prevent contamination or soiling of street clothes and are to remain in the laboratory unless decontaminated.
 - d. Gloves (non- latex) should be worn if broken skin or rash exists on hands.
 - e. Protective eyewear must be worn for procedures in which splashes of microorganisms or other hazardous materials are anticipated.
 - f. Procedures are performed to minimize splashes or aerosols.
 - g. Staff washes their hands after handling viable materials, after removing gloves, and before leaving lab.
 - h. Decontaminate work surfaces at least once a day and after any spill of viable material.
 - i. All cultures, stocks, and other regulated waste are decontaminated before disposal by an approved decontamination method such as autoclaving.
 - j. See “General safety requirements listed in Section I, pgs. 2-9”.

2. Facilities

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- a. Lab should have doors with access control
- b. Each lab must have a sink for hand washing
- c. Lab is easily cleaned. No carpet or rugs in lab area.
- d. Bench tops are impervious to water.
- e. Spaces between benches, cabinets, and equipment are accessible for cleaning.

Many agents not ordinarily associated with disease processes or colonization in humans are opportunistic pathogens and may cause infection for the young, the aged, and for immunosuppressed or immuno-incompetent individuals. A limited listing of other microorganisms meeting these criteria, intended only to provide examples of agents which can be safely handled at Level 1, are included in Section V, Principles of BioSafety.

Biosafety Level 2. (BSL-2)

BSL -2 is suitable for work involving agents of moderate potential hazard to personnel and environment. The differences from BSL-1 labs are:

- 1.) Specific training of personnel is required in handling pathogenic agents and staff are directed by competent scientist,
 - 2.) Access to the lab is limited when work is being conducted,
 - 3.) Extreme precautions are taken with contaminated sharp items and
 - 4.) Certain procedures which infectious aerosols or splashes may be created are conducted in biological safety cabinets or other physical containment equipment.
1. Standard Microbiological Practices-
 - a. The Standard Microbiological Practice requirements listed for BSL-1, and
 - b. A policy for handling sharps is instituted.
 - c. Work surfaces are decontaminated on completion of work or at the end of the day and after any spill or splash of viable material with disinfectants effective against the agent of concern.
 2. Special Practices include:
 - a. Biohazard sign must be posted on entrance to lab when etiologic agents in use. The sign must include names and telephone numbers of lab contacts, personnel protective equipment required in lab, agents or microbes in use and Biosafety level of lab.
 - b. Lab personnel must receive appropriate immunizations or tests for the agents handling. When appropriate a base line serum sample is collected and stored.
 - c. Biosafety procedures are incorporated into standard operating procedures. Personnel are advised of special hazards.
 - d. Lab director ensures the lab personnel receive appropriate training on potential hazards associated with work involved and precautions to prevent exposure and evacuation procedures. Personnel receive annual updates or training as necessary for policy and procedure changes.
 - e. Use a high degree of caution with any contaminated sharp items, including needles and syringes, slides, pipettes, capillary tubes, and scalpels. Plastic should be substituted for glassware whenever possible.
 - f. Cultures, tissues, specimens of body fluid, or potentially infectious wastes are placed in a

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container with a cover that prevents leakage during collection, handling, processing, storage and transport.

3. Safety Equipment, and facilities

Those which are applicable to clinical, diagnostic, technical and other facilities working with the broad spectrum of indigenous moderate-risk agents present in the community and associated with human disease of varying severity. Activities with low aerosol potential with these agents can be conducted on the open bench using good microbiological techniques. The hepatitis agents (hepatitis A, hepatitis B, hepatitis non A-non B), the salmonellae, and *Toxoplasma* spp. are representative of microorganisms assigned to this containment level.

The standard and special practices contained in standard practices along with:

- a. Primary barriers include: Biological safety cabinets, splash shields, face protection, protective lab coats, gowns and gloves.
 - i. Remove all protective clothing before leaving for non- laboratory areas (cafeteria, library, administrative offices)
- b. Secondary barriers include: handwashing and waste decontamination facilities available to reduce potential environmental contamination.

4. Laboratory Facilities

- a. Use safety equipment when centrifuging high concentrations or large volumes of infectious agents. The centrifuge safety cups are to be used.
- b. Eyewash station is readily available.
- c. Furniture is covered with non-fabric material that can be decontaminated.
- d. Lockable doors are provided for restricted agents.

Examples of high-risk steps in the laboratory would include:

- a) Specimen Collection (e.g. needle sticks)
- b) Specimen Processing (e.g. spills in transit, aerosols from improper centrifugation, removal of stoppers, decanting of serum or plasma with external contamination of containers and/or work surfaces)
- c) Specimen Analysis
- d) Disposal of Specimen (e.g. failure to separate specimen containers from non-infectious laboratory waste)

Procedures with high aerosol potential may predictably and significantly increase the risk of exposure of personnel to infectious aerosols and must be conducted in primary containment equipment or devices.

Biosafety Level 3. (BSL-3)

Safety equipment and facilities are applicable to clinical, diagnostic, teaching, research, or production facilities working with indigenous or exotic agents, which may cause serious and potentially lethal infections or disease as a result of exposure by inhalation. *Mycobacterium tuberculosis*, St. Louis encephalitis virus, and *Coxiella burnetii* are representative of microorganisms assigned to this level..

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1. Standard Microbiological Practices

- a. The Standard Microbiological Practice requirements listed for BSL-1, and BSL- 2 apply to all Biosafety Level 3 practices.

2. Special Practices

- a. Laboratory doors are kept closed when work is in progress.
- b. The laboratory director controls access and restrictions to lab.
- c. Biosafety manual specific to laboratory and prepared or adopted by the lab director and biosafety precautions are incorporated in the procedures.
- d. All manipulations involving infectious material are conducted in biological safety cabinets. Clean up is facilitated by using plastic backed paper toweling on non-perforated work surfaces within biological safety cabinets.
- e. Equipment must be decontaminated before removal from the facility for repair or maintenance or packaging for transport.
- f. Report all spills and exposures to laboratory director. Appropriate medical evaluations, evaluation, surveillance, and treatment are provided and records maintained.

3. Safety Equipment

Primary barriers include:

- a. The use of biological safety cabinets (BSC) or other enclosed equipment are used for ALL laboratory manipulations, no culture work is done on open benches.
- b. Protective clothing such as solid front or wrap-around gowns, scrub suits, or overalls are worn by workers in the lab. Along with all barriers listed under BSL-1 and BSL-2

4. Laboratory Facilities (Secondary barriers) include:

1. The lab is separated from areas that are open to unrestricted traffic with controlled access to the laboratory.
2. Laboratory doors are kept closed when cultures are being processed or identified. The doors are also closing and access must be through a set of double doors.
3. A ducted exhaust air ventilation system is provided. and a specialized ventilation system that creates a directional airflow which draws air into the laboratory from clean areas toward contaminated areas. This minimizes the release of infectious aerosols from the laboratory.
4. BSC are required and are located away from doors, from room supply louvers, and from heavily traveled lab areas.
5. All windows are closed and sealed. The interior surfaces of walls, floors, and ceilings of areas where BSL- 3 agents are handled are constructed for easy cleaning

and decontamination. Seams, if present, must be sealed. They must be impermeable to liquids

and resistant to the chemicals and disinfectants normally used in the laboratory.

6. The laboratory supervisor will assure that only persons who have been advised of the potential biohazard, meet any of the specific entry requirements (e.g. immunization and baseline serum), and comply with all entry and exit procedures may enter the laboratory or animal rooms.
7. When infectious materials or infected animals are present in the laboratory or animal rooms, a hazard warning sign, incorporating the universal biohazard symbol, is posted on all laboratory and animal room access doors and on such other items (i.e., equipment, containers, materials) as appropriate to indicate the presence of viable infectious agents. The hazard warning sign should identify the agent, list the name of the laboratory supervisor and another responsible person(s), and indicate any special conditions of entry into the area (immunizations, respirators, etc.).
8. Laboratory clothing that protects street clothing (i.e., solid front or wrap-around gowns, scrub suits, coveralls, etc.) is worn in the laboratory. FRONT-BUTTON LABORATORY COATS ARE UNSUITABLE. Laboratory clothing is not to be worn outside of the laboratory and is decontaminated before laundered.
9. Primary hazards to personnel working with these agents include to auto- inoculation, ingestion, and exposure to infectious aerosols.
Examples of high-risk steps in the laboratory would include:
 - a) Specimen Collection (e.g. needle sticks)
 - b) Specimen Processing (e.g. spills in transit, aerosols from improper centrifugation, removal of stoppers, decanting of serum or plasma with external contamination of containers and/or work surfaces)
 - c) Disposal of Specimen (e.g. failure to separate specimen containers from non-infectious laboratory waste)

Biosafety Level 4. (BSL-4)

Safety equipment and facilities are those, which are applicable to working with dangerous and exotic agents, which pose a high individual risk of life-threatening disease. All manipulations of potentially infectious diagnostic materials, isolates, and naturally or experimentally infected animals pose a high risk of exposure and infection to laboratory personnel. Lassa fever virus is representative of the microorganisms assigned to Level 4. This level is not applicable to the diagnostic laboratories.

BIOSAFETY LEVEL TABLE

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BSL	Agents	Practices	Safety Equipment (Primary Barriers)	Facilities (Secondary Barriers)
1	Not known to consistently cause disease in healthy adults	Standard Microbiological practices	Lab coats, gowns or uniforms Gloves, protective eyewear where potential splashes anticipated	Open bench top sink required
2	Associated with human disease, hazard = percutaneous injury, ingestion, mucous membrane exposure	BSL-1 plus Limited access Biohazard warning signs Sharps precautions Biosafety manual	Primary barriers, biological safety cabinet (BSC) or physical containment devices used for all manipulations of agents that cause splashes or aerosols of infectious materials PPE's: lab coats, gloves, face protection as needed	BSL-1 plus: Autoclave available
3	Indigenous or exotic agents with potential for aerosol transmission; disease may have serious or lethal consequences	BSL-2 practice plus: Controlled access Decontamination of all waste Decontamination of lab clothing before laundering Baseline serum	Primary barriers= BCS or other physical containment devices used for all open manipulations of agents; PPE's: protective lab clothing; gloves; respiratory protection as needed	BSL-2 plus: Physical separation from access corridors Self-closing double door access Exhausted air not recirculated Negative airflow into lab
4	N/A			

PPE= Personal Protective Equipment
BSC= Biological Safety Cabinet
BSL= Biological Safety Level

Reference

CDC-NIH U.S. Department of Health and Human Services Biosafety in Microbiological and Biomedical Laboratories, May 1999, 4th Edition. (HHS Publication No. (CDC) 93-8395).

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BIOLOGICAL SAFETY CABINETS (BSC)

BSCs are designed to provide personnel, environmental and product protection when appropriate practices and procedures are followed. Three kinds of biological safety cabinets, designated as Class I, II and III have been developed to meet varying clinical needs.

EFFECTIVELY USING BSCs

1. BSCs, used for Biosafety Levels 1, 2, 3 and 4 depending on the tasks to be performed, are divided into 3 classes:
 - a. Class I - has negative pressure with minimum face velocity of 75 linear feet per minute (1 fmp) and all of the air from the cabinet is exhausted through a HEPA filter either into the laboratory, or to the outside. Class I BSCs are no longer being manufactured on a regular basis; many have been replaced by Class II BSCs. They may be used for centrifuges, harvesting equipment or blenders.
 - b. Class II – personnel protection is provided with the air flow being drawn around the operator inward with a face velocity of 75 - 100 fpm, HEPA - filtered vertical laminar airflow provide product protection by minimizing cross – contamination along the work surface of the cabinet, and HEPA filter exhaust air for environmental protection. All Class II cabinets are designed for work with microorganisms assigned biosafety levels 1, 2, and 3. They provide a microbe free work environment. They are not to be used with volatile or toxic chemicals.
 - c. Class III - is totally enclosed, ventilated cabinet of gas-tight construction and has the highest degree of personnel and environmental protection from infectious aerosols, as well as protection of research materials from micro biological contamination. Used mostly for work with hazardous agents that requires Biosafety levels 4 containment. All work is done through attached rubber gloves and the cabinet is operated under negative pressure. Supply air is HEPA filtered, and cabinet exhaust air is filtered by two HEPA filters in series. Class III must be connected to double-doored auto clones and chemical dump tanks to sterilize or disinfect all materials exiting the cabinet.
2. General suggestions:
 - a) Effectiveness of the BSC is a function of directional air flow (inward and downward), through a "high efficiency particulate air" (HEPA) filter. Anything such as rapidly moving your arms in and out of the BSC and people walking rapidly behind you, can disrupt the air flow which will reduce the cabinets

effectiveness. For best results, Class I and II BSCs should be located away from traffic patterns and doors, as well as air handling devices.

3. Operational suggestions:
 - a) Do NOT place objects on or over front air intake grille.
 - b) Do NOT block rear exhaust grille.
 - c) Arrange materials to segregate contaminated and clean items.
 - d) Work should be performed at least six (6) inches back from front grille.
 - e) Inside the BSC, always use horizontal pipette discard pans, containing appropriate disinfectant.
 - f) Clean up all spills immediately. Wait 5 minutes before resuming work.
4. An example of the Class II vertical laminar-flow biological cabinet (type A) is an open-fronted, ventilated cabinet with an average inward face velocity at the work opening of at least 75 feet per minute. This cabinet provides a HEPA-filtered, recirculated mass airflow within the work space. The exhaust air from the cabinet is also filtered by HEPA filters. Design, construction, and performance standards for Class II cabinets have been developed by and are available from the National Sanitation Foundation, Ann Arbor, Michigan.

Reference

CDC-NIH U.S. Department of Health and Human Services Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets, Sept 2000, 2nd Edition.

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X. Creutzfeldt-Jakob Disease Safety Precautions

Precautions for Creutzfeldt-Jakob Disease or Samples Suspected for Transmissible Spongiform Encephalopathies

A. General requirements

Creutzfeldt-Jakob Disease (CJD), Gerstmann-Straussler Disease, Kuru, and other diseases such as fatal familial insomnia are caused by infectious agents (prions) which are not inactivated by the usual fixation or disinfection procedures. Since special handling of tissue is required to ensure the safety of the pathologist and technical staff, it is

important that possible CJD cases are identified so that the tissue can be properly treated.

The highest potential risk is from exposure to high infectivity tissues through needle-stick injuries with inoculation. However exposure to either high or low infectivity tissues through direct inoculation (e.g. needle-sticks, puncture wound, sharps or contamination of broken skin) must be avoided. The exact mode of transmission in humans is not known. A previously unrecognized form of CJD, vCJD has been identified in Great Britain and has raised the possibility that this variant form may somehow be related to the increase of bovine spongiform encephalopathy (BSE) in that country.

Tissue Infectivity (Table 1)

- The highest concentration of infectivity is found in the central nervous system (CNS), specifically the brain, spinal cord and eye. (High Infectivity Tissues)
- Infectivity is found less often in CSF and other organs. (Low Infectivity Tissues)
- No infectivity has been detected in a wide variety of other tissues and body fluids/excretions. Very low infectivity has been detected in blood; there are no known transfusion transmissions of CJD. (No Detectable Infectivity Tissues are considered non-infectious)

Table 1. Distribution of Infectivity in the Human Body	
Infectivity Category	Tissues, Secretions, and Excretions
High Infectivity	Brain Spinal cord Eye
Low Infectivity	CSF Kidney Liver Lung Lymph nodes/spleen Placenta

Table 1 (cont.)

Distribution of Infectivity in the Human Body

Infectivity Category	Tissues, Secretions, and Excretions
No Detectable Infectivity	<div>Adipose tissue</div> <div>Adrenal gland</div> <div>Gingival tissue</div> <div>Heart muscle</div> <div>Intestine</div> <div>Peripheral nerve</div> <div>Prostate</div> <div>Skeletal muscle</div> <div>Testis</div> <div>Thyroid gland</div> <div>Blood</div> <div>Tears</div> <div>Nasal mucous</div> <div>Saliva</div> <div>Sweat</div> <div>Serous exudate</div> <div>Milk</div> <div>Semen</div> <div>Urine</div> <div>Feces</div>

B. Laboratory Notification Guidelines (Under Revision 11/2007 by HEIC)

1. Hospital Epidemiology and Infection Control (HEIC) will notify Pathology Customer Services when there is a suspected CJD case within the hospital.
2. Customer Services will notify, by phone, a charge person in each of the following laboratories: Microbiology, Core Lab, Flow Cytometry, Cytology, Anatomic Pathology and Immunology when notification is received from HEIC.
3. If HEIC has not sent notification to the Laboratory and a request for 14-3-3 protein on a Cerebral Spinal Fluid is received on a patient, Customer services will immediately notify the on-call Infection Control nurse at pager # 3-3855.
4. Microbiology Department - Precautions Board lists suspect patient names. The board is to be checked daily at the start of each shift.

C. Safe handling of Samples in Clinical Pathology Laboratories

Use general protective measures and basic precautions as listed in the general laboratory safety Section I. The highest potential risk is from exposure to high infectivity tissues through needle-stick injuries with inoculation; however precautions should be taken when working with high and low infectivity tissues (Table 2).

Table 2. Precautions for working with high and low infectivity tissues for known or suspected CJD TSECJD

1. Whenever possible specimens should be examined in a laboratory accustomed to handling high and low infectivity tissues.
2. Specimens should be labeled 'Biohazard'.
3. Single- use protective clothing as follows is preferred:
 - a. Liquid repellent gowns;
 - b. Gloves (cut resistant preferred for brain cutting);
 - c. Mask;
 - d. Visor or goggles.
4. Use disposable equipment whenever possible.
5. All disposable instruments that have been in contact with high infectivity tissues should be clearly identified and disposed of by incineration.
6. Use disposable non-permeable material to prevent contamination to work surface. Incinerate all coverings.
7. Fixatives and waste fluids must be decontaminated or absorbed onto materials, such as sawdust, and incinerated as a hazardous material.
8. Laboratories handling large numbers of samples are advised to adopt more stringent measures because of the possibility of increased residual contamination, e.g. restricted access to laboratory, use of dedicated microtomes and processing labware, decontamination of all wastes before transport out of facility for incineration.

1. Handling Clinical Samples

- a. Cerebral Spinal Fluid (CSF)
 1. CSF may be infectious and must be handled with care.
 2. It is recommended that analysis not be performed in automated equipment, however, each laboratory area will determine the appropriate testing methodology to accommodate the diagnostic test order and ensure the safety of the laboratory personnel. Manufacturers should be consulted to determine if the decontamination procedures can be tolerated by the instrument.
- b. Central Nervous System (CNS) Tissues and Optic Tissues
 1. CNS tissues should be handled with care.
 2. Tissues should be labeled as coming from a patient with definite or suspected CJD or other prion-related diseases.
 3. Corneal tissues should be handled with special care. (One case of scrapie (sheep prion) has been transmitted via conjunctival tissue after exposure)
- c. Other Body Fluids, Secretions and excretions
 1. These contain no infectivity, and need no special handling beyond standard precautions.

d. Blood or Serum

Blood and its components, although found to contain very low levels of infectivity in experimental models for CJD, have never been identified to be responsible for any case of CJD in humans. Due to the epidemiological evidence, World Health Organization (WHO) strongly recommends that blood specimens from patients with CJD not be considered to be infectious, and no special precautions are needed for its handling in clinical laboratories beyond standard precautions.

2. Specimen Processing is handled according to routine standard precautions.

- a. The WHO recommends minimizing formation of aerosols and droplets when handling CSF samples. Do not cytopsin CSF. Prepare smears by pipetting CSF directly onto slides in the biosafety cabinet.
- b. Handle the waste separately as described below.

3. Bacteriology Culture Work Up is handled according to routine standard precautions.

The plates and broths do not need to go to the AFB lab.

- a. Original CSF incubated with culture must be handled according to the waste instructions below when the culture is completed.
- b. Leftover tissue in the Schaedler's broth or stored in the refrigerator must be handled according to the waste instructions below.

D. Decontamination Procedures in Clinical Laboratories

1. Work Surfaces and Equipment

- a. Use disposable cover sheets whenever possible.
- b. Surfaces or instruments that may be contaminated by high or low infectivity tissues are decontaminated by flooding with 1N NaOH or fresh undiluted household bleach for 1 hour. Rinse with water.
- c. Sodium hydroxide is preferred for steel surfaces because it is less corrosive than bleach.
- d. In cases where complex and expensive automated equipment cannot be decontaminated by NaOH or undiluted bleach, the manufacturer should be consulted. Highest consideration for decontamination must be given to parts of equipment that are subjected to contact with the infected sample and may be exposed to the laboratory worker. Infectious wastes that are released by the instrument must be decontaminated according to the Waste Handling procedure below.
- e. Disposable or single use equipment/supplies are decontaminated as outlined below in the Waste Handling procedure.

2. Waste Handling in Clinical Laboratories (High and Low Infectivity Waste)

Special decontamination procedures are needed for handling the waste from processed brain tissue, spinal cord tissue, eye tissue, and cerebral spinal fluid (CSF) and for leftover CSF and tissue from patients suspected of having Transmissible Spongiform Encephalopathies (TSE) sometimes called “prion” or Creutzfeldt-Jakob Disease (CJD).

- a. Double bag the biohazard bags to hold left over CSF and tissue or all disposable items used during processing including swabs, pipettes, gloves, disposable loops, etc.
- b. Program an autoclave for 1 hour at 132°C cycle
- c. Autoclave this waste separately from other materials.
- d. Allow waste to cool completely.
- e. In a chemical fume hood carefully open biohazard bag and cover contents with 1N NaOH or undiluted Household Bleach. Let sit 1 hour.
- f. Add absorbent spill pillow to solidify contents. Close bag with a rubber band and place in decontamination dumpster.

E. Safe handling in Surgical Pathology Laboratories.

Brain tissue is the most likely tissue from a patient with CJD to be examined by surgical pathology. Other tissues may be sent to the laboratory for examination during the course of neurological illnesses. The tissue category or high infectivity, low infectivity, and no detectable infectivity are listed above in Table 2. It is not recommended that brain biopsies be performed for diagnosis of CJD.

Brain Biopsy Precautions:

1. All biopsies for dementia should be handled as possible CJD cases.
2. Frozen sections
 - a. A portion of every biopsy should be saved in the freezer for possible Western blots.
 - b. No biopsy should be done.
 - c. No frozen sectioning should be done in the cryostat.
3. Electron Microscopy (EM) Examinations
 - a. Electron microscopic examination of tissue sections is not indicated for diagnostic purposes.
 - b. If a case of possible CJD needs to be examined for other diseases, preparation of specimens for EM should be performed the same as for histology.
 - c. Tissue pretreated with formic acid (below) may be handled routinely.
4. Specific Precautions for Tissue Handling in the Histology Laboratory
 - a. Tissue that has not been treated with formic acid must be processed by hand.

- b. Tissue that has been treated with formic acid may be processed routinely, although many histology laboratories prefer to hand process this material also.
- c. Material that is hand processed is treated as potentially infectious.
 - i. Double glove and eye protection are worn at all times
 - ii. All solutions including water washes are collected and treated with equal volumes of fresh undiluted bleach or 1N NaOH for 60 minutes.
 - iii. Disposable supplies, glassware, tools etc. are handled in the laboratory according to the procedures used in the autopsy room (see above).
 - iv. Care should be taken to collect all scraps of paraffin and unused sections on a disposable sheet.
 - v. The microtome itself may be wiped with bleach or sodium hydroxide solution, but it cannot be thoroughly decontaminated. If frequent possible CJD cases are handled laboratories may wish to dedicate an old microtome to this purpose.

5. Handling Slides and Blocks

- a. If the tissue has been treated with formic acid, slides and blocks may be treated routinely. The following precautions are taken with untreated tissue.
- b. No special precautions are needed in handling intact glass slides once they have been cover slipped.
- c. The slides should be labeled as infectious unless the tissue has been treated with formic acid as described above.
- d. Broken slides should be decontaminated and discarded
- e. Paraffin blocks should also be resealed with additional paraffin to cover the cut surface and stored in a properly labeled bag or box.

F. Post Mortem Examinations

1. Autopsy Precautions

- a. No brain autopsy should begin without a copy of the patient's written clinical record or a good oral history from a knowledgeable source. In cases of neurodegenerative disease, the chart should be carefully examined for specific mention of CJD, spongiform encephalopathy, or prion disease. Irrespective of the clinical diagnosis, the chart should also be examine by the pathologist for any of the following:
 - i. Rapidly progressive dementia
 - ii. Dementia less than 3 years total duration
 - iii. Signs or symptoms of cerebellar disease
 - iv. Dementia accompanied by lower motor neuron findings

- v. Dementia accompanied by any focal neurological deficit not explainable on the basis of documented structural disease
 - vi. Or dementia with seizures, especially myoclonic seizures
 - If any of these signs are present, the precautions listed in the next section should be taken. The case should be discussed with the neuropathologist or, if none is available, the case should be discussed with the patients attending neurologist.
 - b. The list above is broad and no one of them alone necessarily indicates the presence of CJD or even the need for CJD precautions. If there is *any suspicion of CJD, the autopsy should be limited to the brain only and the tissue treated as outlined below. Exceptions to this rule should be very few.*
 - c. Ideally, three people should be present during the examination: the pathologist, assisted by one technician and one person to handle and label specimen containers. Observers should be prohibited or kept at a minimum
2. Specific Precautions for Tissue Handling in the Autopsy Room:
During Autopsy:
- a. All persons should wear disposable protective clothing including surgical cap, gown, apron, double gloves; if cut resistant gloves are available, they should be used. Mask and eye shields or face visor should be worn.
 - b. Disposable or dedicated reusable instruments are recommended in order to minimize the risk of environmental contamination. Manual or hand saws are recommended in order to avoid the creation of tissue particulates and aerosols and for ease of decontamination after use. If a Styrker saw is used, there should be some form of shielding to contain small drops of blood and tissue.
 - c. The autopsy should be conducted in such a way that all tissues and fluids are confined to the table. This may be facilitated by placing a plastic sheet over the table. Running water is used sparingly, as it must be confined to the table until it has been decontaminated.
 - d. Care should be taken not to contaminate the outer surfaces of the specimen containers. All containers should be clearly labeled as infectious and placed in secondary containers that are similarly labeled.
 - e. The funeral home should be notified of the infectious nature of the case.
3. Decontamination of Autopsy room
Conclusion of Autopsy
- a. At the conclusion of the autopsy, the area of the incision and any other contaminated skin surfaces are washed with freshly open undiluted bleach (sodium hypochlorite).
 - b. After 10 min, the skin may be washed with water.
 - c. All gowns, gloves, plastic sheets, and other disposable supplies are to be

- placed in a red or orange “Biohazard” bag and incinerated.
- d. Alternatively they may be autoclaved (134 ° F steam) for one hour and then incinerated.
- e. Hard surfaces and surgical instruments are disinfected using fresh undiluted bleach or 1 Normal sodium hydroxide (1N NaOH). These two treatments are equally efficacious. Sodium hydroxide is preferred for steel instruments because it is less corrosive than bleach.
 - i. Sodium hydroxide should remain in contact with the surface for 60 minutes, and then rinse with water.Sodium hypochlorite should remain in contact with the surface for 60 minutes, and then rinse with water.

4. Decontaminating the Tissue

- a. Use formalin fixation followed by formic acid treatment of tissue blocks.
 - i. The intact brain is fixed in formalin for one week prior to cutting
 - ii. Tissue blocks are taken, agitated in a least 250 ml of 95-100% formic acid for 1 hour (volume depends on the number of blocks), and then returned to formalin for 2 days prior to embedding.
- b. Alternatively, take the necessary diagnostic sections from the fresh brain; fix them in formalin for 2-7 days (as one would for a surgical biopsy for dementia). Advantages of this approach are the brain tissue is only handles once, the autopsy room needs to be decontaminated only once and the diagnosis can be provided more promptly to the clinicians and the pathology staff.
- c. Formic acid treatment provides essentially complete disinfection without vacuolization, although some silver stains for the plaques and tangles of Alzheimer’s disease are compromised by this method.
- d. If a diagnosis of CJD is made, the remaining tissue is incinerated. If not CJD, then additional pathologic studies for evaluating other causes of dementia are performed as indicated.

G. Post-exposure management

Contact the Occupational Injury Clinic.

To minimize the theoretical risk of infection following accidents the following actions are recommended:

- Contamination of broken skin with internal body fluids or tissues: wash with detergent and abundant amounts of warm water (avoid scrubbing), rinse and dry. Brief exposure (1 min to 1:10 dilution of Bleach) can be considered for maximum safety
- Needle sticks: gently encourage bleeding; wash (avoid scrubbing) with warm soapy water, rinse, dry and cover with dressing. Report the injury to 5-STIX and the occupational injury clinic.

- Splashes to eye or mouth: irrigate with tap water (mouth) or saline (eye); report according to normal laboratory accident procedures.

H. Hazardous materials precautions

In all cases, hazardous materials guidelines must be consulted.

1. Personnel Cautions-

NaOH is caustic but relatively slow acting at room temperature, and can be removed from skin or clothing by thorough rinsing with water. Hot NaOH is aggressively caustic, and should not be handled until cool. The hazard posed by hot NaOH explains the need to limit boiling to 10 minutes, the shortest time known to be effective.

Hypochlorite solutions continuously evolve chlorine and so must be kept tightly sealed and away from light. The amount of chlorine released during inactivation may be sufficient to create a potential respiratory hazard unless the process is carried out in a well-ventilated or isolated location.

2. Material

In principle, NaOH does not corrode stainless steel, but in practice some formulations of stainless steel can be damaged (including some used for surgical instruments). It is advisable to test a sample or consult with the manufacturer before dedicating a large number of instruments to decontamination procedures. NaOH is known to be corrosive to glass and aluminum. Hypochlorite does not corrode glass or aluminum and has also been shown to be an effective sterilizing agent; it is, however, corrosive both to stainless steel and to autoclaves and (unlike NaOH) cannot be used as an instrument bath in the autoclave. If hypochlorite is used to clean or soak an instrument, it must be completely rinsed from the surfaces before autoclaving. Other decontamination methods may need testing, or consultation with the manufacturer to verify their effect on the instrument.

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