

Radiation Control Unit

Stan Wadsworth,
Radiation Safety Officer

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410-955-3710



Mission



- Facilitate the safe and efficacious use of radiation sources in research, medical diagnosis, therapy, and education while maintaining compliance with regulatory licensing, registration, and accreditation standards.

Radiation Safety Regulations

- NRC (Nuclear Regulatory Commission)
 - MDE (Maryland Department of the Environment)
 - JHU (Radiation Control Committee)
- <http://www.hopkinsmedicine.org/hse/policies/policiessections.html#Sec9>



Laboratory Caution Sign

- Emergency or important event after hours 5-4444



Notice to Employees

Employer's responsibility
Worker responsibility
What is covered by regulations
Reports on radiation exposure history
Inspections



Radioactive Materials Research



- The use of radioactive materials by personnel at Johns Hopkins is authorized by a radioactive materials license.



- Applications for use shall be submitted to the Radiation Control Committee through the Radiation Safety Officer.

Human Research



- Administration of radiation (x-rays or radioisotopes) to human subjects in research projects must be made on RCU form 5
- Completed form should be sent to the JHMI Clinical Investigation Committee

Radiation Safety Training

- See www.hopkinsmedicine.org/hse (under *Access Training*)
- For new users of radioactive material or radiation producing machines

Services

- Training
- Lab and clinic surveys
- Personnel Dosimetry
- Review of application for radioactive material use
- Emergency response
- Radioactive waste disposal

Services

- Instrument calibration
- Radioactive source inventory
- Bioassays
- Brachytherapy/Radiopharmaceutical support
- X-ray shielding analysis
- X-ray machine surveys

Radiation Signs and Labels





Sources of Radiation

- Radioactive Materials: do not touch labeled areas or items, no food or drink in lab, wash hands after working with radioactive material.

Sources of Radiation

- Radiation Producing Machines: no radiation emitted after machine is de-energized

Radiation Badge

- Used to measure dose to individual

Dose Limits

- Max. annual dose for radiation worker, regulatory limit 5,000 millirems
- Avg. annual dose from natural background radiation, external and internal 300 millirems
- Max. annual dose for members of public regulatory limit 100 millirems
- Median annual dose to Hopkins researcher 1 millirems

Contamination

- Radioactive material where it is not desired or where it may cause harm

Injuries or Contamination Incidents Involving Radioactive Material

- Contact supervisor/PI immediately
- If injury is life threatening, first aid
- If injury is not life threatening, rinse/wash area of contamination before getting medical attention
- Call Radiation Control Unit
- (EMERGENCY 5-4444)

Spills of Radioactive Material

- Notify others in room
- Confine spill
- Call Radiation Control Unit
- Decontaminate
- Monitor individuals involved

JOHNS HOPKINS UNIVERSITY Health, Safety, and Environment Graduate Student Orientation August 19, 2010



Industrial Hygiene & Ergonomics

- ▶ Identifies and controls chemical, physical and ergonomic hazards.
- ▶ Monitors and administers hazardous chemical waste disposal program.
- ▶ Conducts environmental sampling monitoring.
- ▶ Responds to chemical spills and accidents.
- ▶ Investigates complaints related to workplace exposures.
- ▶ Conducts training in the use, control, disposal, and shipping of hazardous chemicals.
- ▶ Ensures compliance with EPA regulations.

Safety Management

- ▶ Conducts facility surveys and laboratory safety inspections.
- ▶ Performs incident investigations and record keeping functions.
- ▶ Conducts job hazard analyses.
- ▶ Responds to fire and other emergency situations.
- ▶ Surveys all Hospital/University areas for compliance with regulatory standards and public health practices.
- ▶ Conducts safety training (HazCom, Fire Safety, Bloodborne Pathogens, TB, etc.).

Training Classes

- ▶ Hazard Communication
- ▶ Bloodborne Pathogens
- ▶ Shipping Hazardous Materials (infectious agents, biological specimens, dry ice)
- ▶ Supervisor Safety
- ▶ Laboratory Safety

Management of Hazardous Materials/Chemicals

HSE Policy 701: Hazard Communication

- Also called OSHA's "Employee Right to Know" law.
- States every employee has a right to know every hazard associated with each chemical they work with.
- This is communicated in two ways—Material Safety Data Sheets (MSDSs) and labels.

HSE 701 – Hazard Communication

MSDS' can now be found on line via Chemwatch

<http://www.hopkinsmedicine.org/hse/msds/index.html>

Related Policies

HSE 703 – Management of Hazardous Chemicals

Covers transport, storage, use, disposal, and spill procedures

http://www.hopkinsmedicine.org/hse/Policies/HSE_Policies/individ_sections/hse703.pdf

HSE 701 – Hazard Communication

Labeling Program

Primary Container Labels:

- Name of Chemical
- Appropriate Hazard Warnings
- Name and Address of Manufacturer

Secondary Container Labels

- Name of Chemical
- Date filled
- Initials of Responsible Person

Labeling is the responsibility of the User

Hazard Communication



A screenshot of the MSDS & LABELS software interface. The main content area displays a "Summary for XYLENE" with the following information: CAS No. 1326-21-7, OSHA: Respirator, HAZCHEM: 201, UN No. 1307, DOT: 3, Packing Group: III, TSCA: Yes, EPC: 3A1, and WPC: 16. A hazard diamond is shown with a blue section containing "2", a red section containing "3", a yellow section containing "0", and a white section containing "0". Below the diamond is a table for "MATCHING HAZARD RATINGS" with columns for "Min" and "Max" and rows for "Flammability 2", "Toxicity 2", "Body Contact", and "Reactivity 2". The interface also includes a sidebar with navigation options like "HOME", "MSDS", "LABELS", and "PROGRAMS", and a top navigation bar with "CLASSIFY", "INVENTORY", and "ASSESS".

Hazard Communication

Hazardous Material Storage

- ▶ All chemicals should be dated when received and again when opened.
- ▶ Flammable materials in containers larger than one gallon shall be stored in approved flammable material storage cabinets.
- ▶ Peroxide forming compounds (e.g. ether, dioxane, THF) shall be disposed of six months after opening or one year after receipt.
- ▶ Acids and bases shall not be stored with flammable materials in flammable cabinets. Acids should be segregated from bases.
- ▶ Incompatible chemicals shall not be stored together.
- ▶ Stored chemicals should be evaluated annually to determine suitability and integrity for continued use.
- ▶ Chemicals that have been stored for 10 years should be sent for disposal via the Johns Hopkins Hazardous Materials Program. Maximum storage of chemicals is 10 years.
- ▶ A sufficient supply of absorbents and neutralizers should be available at all chemical storage location for use in the event of a spill.

Hazard Communication

Used/Unwanted Chemicals

- ▶ All unwanted chemicals must be collected for disposal.
- ▶ Secondary containment required for moving materials between labs.
- ▶ All containers of excess chemicals must contain the following information.
 - a. Specific chemical name (in English). If a mixture, list the components and percentage composition. Non-specific identifiers (i.e mixed solvents, mixed aqueous solutions) will be treated as Unknowns
 - b. Contact name (Principal Investigator or their designee).
 - c. Location of lab (Building/room number)
 - d. Lab phone number
- ▶ Unknown materials must be characterized – Unknowns accepted for disposal only if an M&S is provided.



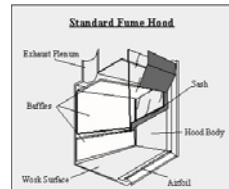
Hazard Communication

Chemical Disposal

- | | |
|---|--|
| ▶ Johns Hopkins Hospital
Blalock B-195
Every Tuesday 1-3pm | ▶ Asthma & Allergy Ctr
Loading Dock
1 st Tuesday 9-10am |
| ▶ Woods Basic Science
Woods 10 th Fl
Every Wednesday 1-2pm | ▶ Homewood Campus
Macaulay Hall Basement
Every Thursday 10:30-11:30am &
1:00-2:00pm |
| ▶ School of Hygiene
Contact HSE for pick-up | ▶ CRB II
G26
Every Wednesday 9-10am |
| | ▶ Traylor G065
Wednesday 2:30-3:30pm |

Chemical Fume Hoods

- ▶ Keep sash as low as possible
- ▶ Work at least 6 inches into the hood
- ▶ Separate and elevate instruments in the hood
- ▶ Avoid opening/closing the sash rapidly and making swift movements in front of hood
- ▶ Don't block the baffles
- ▶ Maintain open lower baffle
- ▶ Don't block the air foil



Response to FIRE/SMOKE



1. Remove anyone in immediate danger
2. Close the door
3. PULL THE ALARM (found along your exit route)
4. Call 5 – 4444 to give location of fire.
5. Do not use fire extinguishers unless you have been formally trained on an annual basis.

How do you respond to a fire alarm in your area?

- ◆ **Healthcare Occupancy:**
 - Defend in place. Close doors, clear hallways, and place all patients and visitors in their rooms.
- ◆ **Business Occupancy:**
 - Evacuate patients, visitors, and employees to a connecting building.

If You Are Injured

- ▶ Report all injuries promptly to your supervisor
- ▶ If you are an employee, your supervisor must complete a Report of Incident form
- ▶ Injured students report to:
 - University Health Clinic (401 N. Caroline St)
 - Student Health Clinic (Homewood) (AMR II, Terrace Level)
- ▶ Injured employees report to:
 - OIC (Blalock 139)
 - OHS (3100 Wyman Park, Room 670)
- ▶ After hours, go to nearest ED

Health, Safety, and Environment

Questions?

Ask your supervisor or Call:

Health Safety & Environment
East Baltimore Campus
Phone 5-5918 East Baltimore



Homewood Campus
Phone (410) 516-8798

Johns Hopkins Biosafety



Stephen C. Dahl, Ph.D., RBP
Director of Biological Safety
Johns Hopkins Institutions
sdahl@jhu.edu
www.hopkinsmedicine.org/hse/biosafety.htm

Welcome To Johns Hopkins!



If you are overwhelmed by today's barrage of safety information try to at least remember the following two points:

1. Being safe may look geeky...



2. But being unsafe looks much worse



Luckily, the majority of laboratory safety is simply using common sense

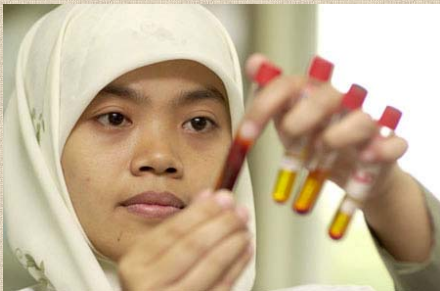
Take avian flu for example...



Its Best to Err on the Safe Side



What's wrong with this picture?



How about this one?



How about this?



As you see, lapses in biosafety can be easy to spot in others.

Get in the habit of doing the same analysis on your own work practices.

What is a Biohazard?

An agent of biological origin that has the capacity to produce deleterious effects on humans, other organisms, and/or their environment.

Or, to be more blunt...

An organism or its by-product that can make you sick, die, or start your very own personal clinical trial if exposed.

What Is Biosafety?

Biosafety is the application of

- laboratory practice and procedure
- safety equipment
- laboratory facilities

to reduce or eliminate exposure of laboratory workers, other persons, and/or the outside environment to potentially hazardous biological agents.

Biosafety **Minimizes** Exposure to Biohazards

Biosafety practices do not eliminate the source.

The Biohazard Is Always There.

So keep your mind on your work AND your safety because you are often only one mistake away from a spill or exposure

Please remember...

This is the big leagues.

Work safely and be aware...

You can get hurt if you are careless.

Diligence, safety compliance, and common sense are very important here.

Biohazards You May Encounter

- Infectious agents and pathogens:
 - Bacteria, virus, parasites, fungi
 - Human-derived tissues, cells, body fluids
 - Non-human primate tissues, cells, body fluids
 - Animals – wild trapped or lab stock
- Biological toxins:
 - Botulinum, tetrodotoxin, ricin, etc.
- Recombinant DNA, RNAi:
 - Plasmids, linear naked DNA, synthesized oligos, etc.
- Viral vectors:
 - Adenovirus, MuLV, lentivirus, etc.
 - All are designed to express transgenes. Many insert in the genome. Modifications like VSV G can increase your risk.

Main Routes of Transmission

- 1) Direct skin, eye or mucosal membrane exposure to an agent through splash, spill, or touch.
- 2) Self-inoculation by a rogue syringe needle or other contaminated sharp.
- 3) Ingestion of liquid suspension of an infectious agent (mouth pipetting is one way), or by contaminated hand to mouth exposure.
- 4) Inhalation of infectious aerosols.
- 5) Bites or scratches from infected animals or arthropod vectors.

Main Routes of Prevention

- 1) Identify the potential biohazards in your lab.
- 2) Learn from your lab director, lab staff, and/or the Biosafety Office how to handle biological agents safely. **Do not work unaware or untrained.**
- 3) Follow proper containment procedures for handling, storing, and disposing of your biohazards.
- 4) Wear appropriate protective equipment and know how to handle a spill before you begin your work.
- 5) Report all concerning issues and situations to your lab director and/or the Biosafety Office.

You Must Stay Alert and Vigilant!

Every year there are around 300 needlesticks and 100 splash exposures recorded for the Johns Hopkins Hospital and School of Medicine.

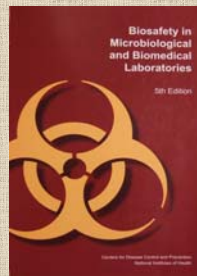
Do Not Let The Routine Or Mundane Dull Your Common Sense

Do not touch or rub your eyes, nose, mouth, and/or open wounds or sores in the laboratory...

Unless you've washed your hands

THOROUGHLY

The BMBL is the Standard



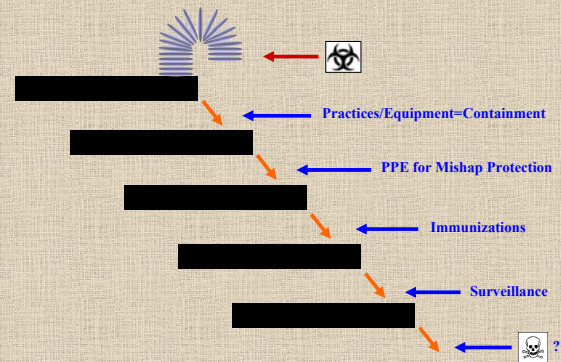
The 5th edition was released on the web in February of 2007. It has been modified a few times since then and is accessible from the JHU Biosafety or the CDC website. The printed edition will be released soon.

<http://www.cdc.gov/od/ohs/biosfty/bmb15/bmb15toc.htm>

The BMBL Specifies

- Biosafety Levels of Containment
 - BSL1, BSL2, BSL3, BSL4
- Laboratory Practice and Techniques
 - Proper handling of biological materials and wastes
- Safety equipment
 - Primary barriers such as biosafety cabinets, pipettors, centrifuge containment cups, PPE such as lab coat, gloves, goggles, etc.
- Facility design and construction
 - Secondary barriers such as doors, directional air flow, cleanable surfaces, etc.

Steve's slinky model of biosafety



Important!

Your personal health status may impact your susceptibility to infection, ability to receive immunizations or prophylactic interventions. If you have health issues, are or may be pregnant or immunocompromised, you are encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

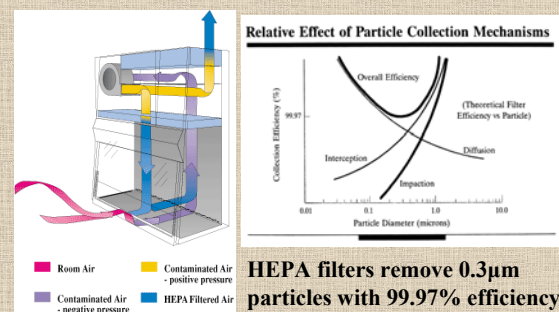
Meet your new friend: The Biosafety Cabinet (BSC)



What does it do??

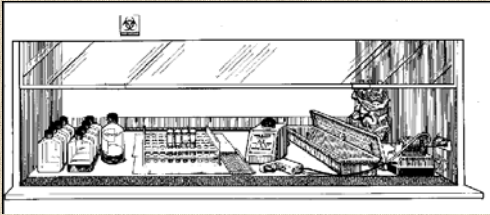
- Provides **user protection** by generating an inward flow of air that contains manipulation-generated aerosols within the cabinet
- Provides **environmental protection** by HEPA-filtering the cabinet exhaust prior to release from the unit.
- Provides **product protection** (if type II cabinet) by generating a HEPA-filtered curtain of air onto the work surface

Airflow in the BSC & HEPA Filtration (High Efficiency Particulate Air)

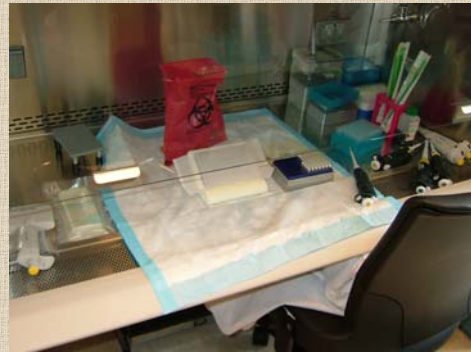


Material arrangement in the BSC is critical to the proper performance of the cabinet. Only put experimentally necessary items inside.

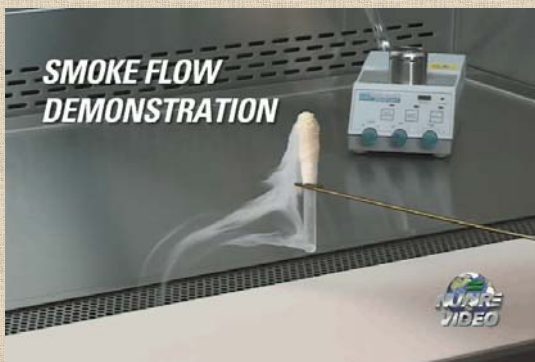
Do not Block Front or Rear Vents.



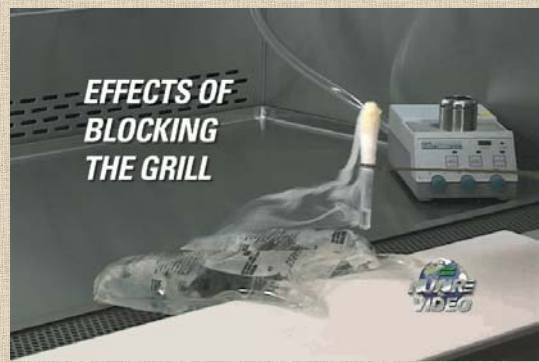
Repeat...Do Not Block The Vents!



**SMOKE FLOW
DEMONSTRATION**



**EFFECTS OF
BLOCKING
THE GRILL**



**ARM MOVEMENT
DISRUPTIONS**



Reduce exposure with good pipette technique

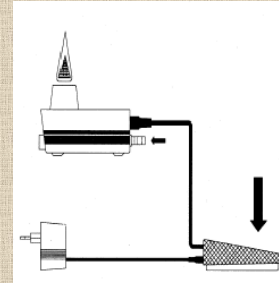


- Expel fluids gently against the walls of tubes or flasks. Blasting them in creates bubbles, droplets and aerosols.
- Place contaminated pipets or tips into disinfectant or a receptacle inside the BSC. Avoid tossing directly from the BSC to the biohaz box or you may establish a contaminated drip line between them.

Recap: Tips for Working in the BSC

- Place only necessary materials in the BSC.
- Use slow and deliberate motion when working in the BSC.
- Work well into the BSC for protection of you and your sample.
- Do not block the front or rear vents.
- Minimize aerosol and droplet production to keep your biohazards inside the BSC.
- Schedule uninterrupted work time. Do not share a BSC even “for a sec.”

Required Equipment for Flame in a BSC (if flame is allowed)



- Flameboy Eco (Integra-Biosciences)
- Flammatic+ (Mostec)
- Gasprofi (WLD-TEC)

Here's why...



Biosafety Containment Levels at JHU

Most labs at JHU are BSL1 or BSL2.

The following slides provide an overview of BSL1 and BSL2 containment. They are provided as reference material in case you wish to revisit an item we discuss.

Please contact the Biosafety Office if you have any questions.

BSL-1 Summary

- Suitable for work involving well-characterized agents not known to consistently cause disease in immunocompetent adult humans, and present minimal potential hazard to laboratory personnel and the environment.
- Work is typically conducted on open bench tops using standard microbiological practices.
- Special containment equipment or facility design is not required, but may be used as determined by appropriate risk assessment.
- Laboratory personnel must have specific training in the procedures conducted in the laboratory and must be supervised by a scientist with training in microbiology or a related science.

BSL-1 Specifics - 8 easy steps

1. Wash your hands after working with potentially hazardous materials and before leaving the lab.
2. No eating, drinking, smoking, handling contact lenses, applying cosmetics, or storing food in lab.
3. No mouth pipetting. Use mechanical devices.
4. Always observe safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware.
5. Perform all procedures to minimize the creation of splashes and/or aerosols.

BSL-1 Specifics continued

6. Decontaminate work surfaces with an appropriate disinfectant after completion of work and after any spill or splash of biologically hazardous material.
7. Decontaminate all cultures, stocks, and other potentially biologically hazardous materials before disposal - autoclave, chemical, biohazard box, etc.
8. The universal biohazard symbol must be posted at the entrance to the laboratory when infectious agents are present.

BSL-1 Specifics continued

NOTE

Your personal health status may impact your susceptibility to infection, ability to receive immunizations or prophylactic interventions. If you have health issues, are or may be pregnant or immunocompromised, you are encouraged to self-identify to the institution's healthcare provider for appropriate counseling and guidance.

BSL-1 Protective Equipment

1. No special containment devices or equipment, such as biosafety cabinets, are generally required.
2. Protective laboratory coats, gowns, or uniforms **are recommended** to prevent contamination of personal clothing.
3. Wear protective eyewear when conducting procedures that have the potential to create splashes of hazardous materials. Persons with contact lenses should wear eye protection in the lab.

BSL-1 Protective Equipment

4. Wear gloves to protect hands from exposure to hazardous materials. Wear double gloves when appropriate
 - a. Change gloves when contaminated, integrity has been compromised, or when otherwise necessary.
 - b. Remove gloves and wash hands when work with hazardous materials has been completed and before leaving the laboratory.
 - c. Do not wash or reuse disposable gloves. Dispose of used gloves with other contaminated laboratory waste. Hand washing protocols must be rigorously followed.

The next set of slides provide an overview of BSL2 containment.

BSL2 containment includes everything listed for BSL1 and then adds additional requirements.

BSL-2 Summary

Biosafety Level 2 builds upon BSL-1. It is suitable for work involving agents that pose moderate hazards to personnel and the environment. It differs from BSL-1 in that:

- 1) laboratory personnel have specific training in handling pathogenic agents and are supervised by scientists competent in handling infectious agents and associated procedures;
- 2) access to the laboratory is restricted when work is being conducted;
- 3) all procedures in which infectious aerosols or splashes may be created are conducted in BSCs or other physical containment equipment.

BSL-2 Specifics

1. All persons entering the laboratory must be advised of the potential hazards and meet specific entry/exit requirements.
2. Laboratory personnel must be provided medical surveillance and offered appropriate immunizations for agents handled or potentially present in the laboratory.
3. A laboratory-specific biosafety manual must be prepared and adopted as policy. The biosafety manual must be available and accessible.

BSL-2 Specifics

4. Lab personnel must be proficient in standard and special microbiological practices before working with BSL-2 agents.
5. Potentially hazardous materials must be placed in durable, leak proof containers during collection, handling, processing, storage, or transport within a facility.
6. Lab equipment is decontaminated routinely, prior to repair or removal from the lab, and after spills or other potential contamination.

BSL-2 Specifics

7. Spills involving infectious materials must be contained, decontaminated, and cleaned up by staff properly trained and equipped to work with infectious material.

Your lab should have a spill protocol to follow. If not, make one. Here is a template:

Small Spills, basic protocol

If only a few milliliters is spilled:

1. Remove contaminated clothing and PPE and place in biohazard box or set aside for decontamination
2. Replace any removed PPE and put on a lab coat, double gloves, and eye protection.
3. Cover spill with absorbent material saturated in fresh decontamination solution (10% bleach). Be sure to cover an area that extends greater than the visible spill area.
4. Allow to sit for 20-30 minutes, then clean up.
5. Dispose of materials in biohazard box
6. Remove lab coat, eye protection, and gloves, and wash hands thoroughly

Large Spills, basic protocol

1. Alert lab members and isolate the area from traffic. If potentially hazardous aerosols have been generated, leave the immediate area and let the aerosols settle and the building exhaust clear the air for 20-30 minutes. Otherwise, without risking exposure, surround the spill with absorbent material to contain spreading of the material.
2. Remove contaminated clothing and PPE and place in biohazard box or set aside for decontamination.
3. If you can clean the spill without help, replace any removed PPE, put on a lab coat, double gloves, and eye protection, and cover the spill with absorbent material saturated in fresh decontamination solution (10% bleach). Be sure to cover an area that extends beyond the visible spill area.
4. Wait 20-30 minutes, then dispose of materials in a biohazard box.
5. Remove lab coat, eye protection, and gloves, and wash hands thoroughly.
6. If you need advice or help to clean the spill call Biosafety at 410-955-5918. After hours call 410-955-5020 and ask them to page Biosafety.

BSL-2 Specifics

8. Incidents that may result in exposure to infectious materials must be immediately evaluated and treated. All such incidents must be reported to the laboratory supervisor. Medical evaluation, surveillance, and treatment should be provided and appropriate records maintained.

Your lab should have an exposure protocol to follow. If not, make one. Here is a template:

Exposures, basic protocol

1. Immediately wash (or rinse if eye exposure) the affected area thoroughly (10-15 minutes).
2. Call 5-STIX (410-955-7849) immediately and report the nature of the exposure, the route of exposure (stick, splash, etc.), the identity and estimated amount/concentration of the agent. After hours listen to the entire message of the 5-STIX hotline. The STIX physician's pager is 410-283-2325.
3. If a monkey bite or exposure, follow the instructions contained in the monkey bite kit.
4. Contact your supervisor and fill out a JHU Report of Incident form (http://www.hopkinsmedicine.org/hse/forms/Report_of_Incident.pdf)
5. Follow the instructions of the 5-STIX professional. You may be asked to report to the emergency room. In either case, a supervisor or co-worker should accompany you.

BSL-2 Protective Equipment

1. Protective laboratory coats, gowns, smocks, or uniforms designated for laboratory use **must** be worn while working with hazardous materials.

(The same goes for gloves as per BSL1)

Remove protective clothing before leaving for non-laboratory areas (e.g., cafeteria, library, administrative offices). Dispose of protective clothing appropriately, or deposit it for laundering by the institution. It is recommended that laboratory clothing not be taken home.

BSL-2 Protective Equipment

2. Eye and face protection (goggles, mask, face shield or other splatter guard) is used for anticipated splashes or sprays of hazardous materials when the agents must be handled outside the BSC or containment device **and as appropriate in rooms housing infected animals**. Dispose of eye and face protection with other contaminated laboratory waste or decontaminate before reuse.

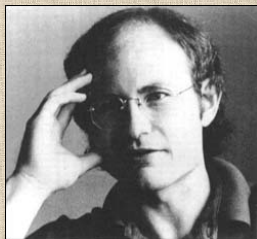
Persons who wear contact lenses in laboratories should also wear eye protection.

BSL-2 Protective Equipment

3. All procedures with potential for creating hazardous aerosols or splashes are performed in the BSC including: pipetting, centrifuging, grinding, blending, shaking, mixing, sonicating, opening containers of hazardous materials, inoculating animals intranasally, and harvesting infected tissues from animals or eggs.

Procedures where high concentrations or large volumes of infectious agents are used may be centrifuged in the open laboratory using sealed rotor heads or centrifuge safety cups that are loaded and unloaded in the BSC

Any Questions??



Biosafety Office Contact Info

- Phone: 410 - 955 - 5918
- FAX 410 - 955 - 5929
- Email: biosafety@jhu.edu
- Web:
www.hopkinsmedicine.org/hse/biosafety.htm
www.hopkinsbiosafety.org
www.jhubiosafety.org