

Laboratory Safety & Compliance

Saint Louis University
 Environmental Health and Safety
 Research Integrity and Safety Group
 Office of the Vice President for Research
 South Campus - Caroline C305

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Other Training Offered

- ▶ Bloodborne Pathogens Awareness Training
- ▶ Infectious Materials Shippers Training
- ▶ Radiation Safety Orientation
- ▶ BSL-3 Facility Awareness Training
- ▶ ABSL-3 Facility Awareness Training
- ▶ Select Agent and High Containment Awareness Training
- ▶ Laser Safety Training

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What are the Regulatory and Training Requirements For Laboratory Employees?

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Occupational Safety and Health Administration

Bloodborne Pathogens Standard (29 CFR 1910.1030)



- ▶ Applies to **all** employees who have a risk of occupational exposure to blood or other potentially infectious materials (OPIM)
- ▶ "Bloodborne Pathogens Awareness" training
 - Required annually
 - Available online
- ▶ Exposure Control Plan (available online)

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Occupational Safety and Health Administration

- ▶ Laboratory Standard (29 CFR 1910.1450)
 Occupational Exposure to Hazardous Chemicals in Laboratories
 - Chemical Hygiene Plan (available online)
- ▶ Hazard Communication Standard (29 CFR 1910.1200)
 - Discloses toxic and hazardous substances in the workplace
 - Includes requirements for training, labels, safety data sheet retention, and exposure monitoring
- ▶ Globally Harmonized System (GHS)
 - Pictograms
 - Signal Words
 - Warning - less severe
 - Danger - more severe
 - Standardized Safety Data Sheets (SDS)

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GHS - Hazard Pictograms and correlated exemplary Hazard Classes



Physical Hazards				
				
Explosives, Self-Reactives, Organic Peroxides	Flammables, Pyrophorics, Self-Heating, Emits Flammable Gas, Self-Reactives, Organic Peroxides	Oxidizers	Compressed Gases	Corrosive to Metals
Health Hazards			Env. Hazards	
				
Acute Toxicity (Fatal or Toxic)	Skin Corrosion/Burns, Irritant (Skin and Eye), Eye Damage	Acute Toxicity (Harmful), Skin Sensitizer, Narcotic Effects, Respiratory Tract Irritant, Hazardous to Ozone Layer	Carcinogen, Mutagenicity, Reproductive Toxicity, Respiratory Sensitizer, Target Organ Toxicity, Aspiration Hazard	Hazardous to the Aquatic Environment

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Personal Protective Equipment

Glove Use


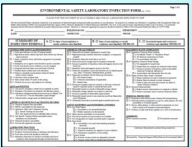
- ▶ Choose proper gloves
- ▶ Inspect gloves before and during use
- ▶ All gloves are porous – **CHANGE REGULARLY**
- ▶ **Do not** re-use disposable gloves
- ▶ **Do not** wear gloves outside the laboratory
- ▶ Wash hands regularly


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Laboratory Inspections

- ▶ Inspection forms are available on the EHS website
 - Review the inspection items regularly
 - Keep compliance records in the lab
 - Training certificates, Safety Data Sheets
 - A fume hood test will be conducted annually

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Laboratory Hazard Signage





- ▶ Contact EHS to update signage
- ▶ Lab Contact can be a lab phone number
- ▶ Emergency Contact should be a cell number reachable 24 hrs.

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Chemical Storage in the Lab

- ▶ Designate storage for food and beverages outside of the lab
- ▶ Keep hazardous chemicals below eye level
- ▶ Store incompatibles in separate containment






- ▶ Use designated storage cabinets for acids and flammables
- ▶ **NEVER** store chemicals on the floor
- ▶ Check on the condition of your chemicals periodically

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Gas Cylinders

- ▶ Ensure contents of cylinders are properly identified
- ▶ Keep cylinders capped until gas is ready to be used
- ▶ Keep gas cylinders upright and secure at all times
- ▶ Use cylinder carts to move cylinders – Do Not “Roll” or “Walk” cylinders
- ▶ Do not force connection fittings or tamper with safety devices in cylinder valves or regulators

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Fume Hood Guidelines



- ▶ All containers must be capped, labeled, and in good condition
- ▶ Do not block the opening at the back of the hood
- ▶ Keep the fume hood organized and clean regularly

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Waste Removal Requests

- ▶ Online Chemical Waste Removal Form
- ▶ chemwaste@slu.edu
 - Chemical waste questions
 - Send additional info (SDS, content info, etc.)



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Laboratory Waste Disposal

- ▶ All Hazardous Waste Must Be Collected by Environmental Safety for proper disposal
- ▶ Do NOT put hazardous chemicals down sewer drain!
- ▶ Dilution/Evaporation is NOT the solution !!!

CONTACT ENVIRONMENTAL SAFETY FIRST!!!




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Laboratory Waste Disposal


<p>Approved for Regular Trash Disposal</p> <ul style="list-style-type: none"> ▶ Paper / Paper Towels / Plastic ▶ Gloves (not contaminated) ▶ Triple rinsed chemical containers ▶ Non-hazardous solid chemicals ▶ Lab ware, pipette tips, etc. free of visible chemical contamination ▶ Glass Box - Clean glass and clean broken glass (Must be labeled appropriately for housekeeping staff) 	<p>Approved for Drain Disposal</p> <ul style="list-style-type: none"> ▶ Non-hazardous salt solutions ▶ Bleach used as a disinfectant ▶ Buffers (depending on components) ▶ Non-hazardous chemicals ▶ Chemicals released during a laboratory process that deems the collection of the chemical impossible or unsafe
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Electronics Recycling

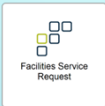



Alkaline Batteries



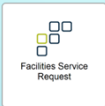


Other Batteries





Equipment



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What Can Go Into Glass Disposal Boxes?





No Mercury Instruments!



No Mercury Containing Lamps!



No Metal Sharpels



Clean Glass (Broken or Unbroken)

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SAINT LOUIS UNIVERSITY Emergency Procedure Guide

 Medical Emergency Report patient condition, locate AED if needed and provide care CALL 977-3000 OR 911	 Gas Leak or Chemical Spill Evacuate and wait for safety guidance from first responders CALL 977-3000	 Biological or Radioactive Materials Do not leave the immediate area CALL 977-3000	 Fire Activate fire pull stations, utilize a fire extinguisher if trained and evacuate the building CALL 977-3000
 Violent Intruder RUN and evacuate or BARRICADE and HIDE or prepare to FIGHT CALL 977-3000 OR 911	 Severe Storms Seek shelter in an interior room or hallway away from windows and report damage CALL 977-3000	 Earthquake DROP to the ground and take COVER under a sturdy table or other piece of furniture and HOLD ON until the shaking stops, then EVACUATE the building CALL 977-3000	 Campus Safety Report Crime, suspicious persons, or safety concerns CALL 977-3000


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Types of Fires


- ▶ Class A – Combustible solids (paper, wood, etc)
- ▶ Class B – Flammable liquids and gases
- ▶ Class C – Electrical (computers, lab equipment, etc)
- ▶ Class D – Metals (not common)



Class B and C (CO₂)



Class A, B, C



Class D

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Fire Safety Reminders

- ▶ Corridors/Stairways
 - Designated safe areas for egress
 - Must not be used for storage
 - Remove combustible materials and chemicals
 - Do not stage equipment in the hallways when being received/moved
- ▶ Know location (before an emergency):
 - Evacuation route
 - Fire extinguishers
 - Pull stations (may not be on every floor)
 - Fire exits / Evacuation routes
- ▶ Plan ahead!
- ▶ Keep fire doors closed







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How to use a Fire Extinguisher

Remember P.A.S.S.


- ▶ **P**ull the pin
- ▶ **A**im the nozzle at the base of the fire
- ▶ **S**queeze the handle
- ▶ **S**weep side to side




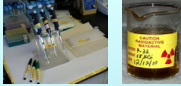

** Fire extinguishers are provided for your protection and voluntary use for actual emergencies ** 'I and Done'

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General Radiation Safety Awareness



- ▶ **Restricted Areas**
 - These signs indicate restricted areas where radioactive materials are used and stored.
 - Do not be afraid to enter these areas; take appropriate precautions and be respectful of the presence of radioactive material.
- ▶ **Radioactive Work Areas and Waste Storage Areas**
 - Radioactive work areas and waste storage areas are labeled for your safety.
 - Do not attempt to handle equipment or labware in radioactive work areas unless you are trained and authorized.
 - Do not lean on countertops in radioactive work areas.
 - Do not attempt to handle radioactive waste or containers unless you are trained and authorized.
 - Do not handle any items marked "RADIOACTIVE" whether handwritten or marked with yellow/magenta trefoil labels unless you are trained and authorized to do so.










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General Radiation Safety Awareness



- ▶ **Radioactive Packages**
 - You may not order radioactive materials without authorization.
 - Do not attempt to open a radioactive package unless you are trained and authorized to do so AND it has been processed by Radiation Safety.
- ▶ **Security**
 - Make sure doors are closed and locked when leaving a restricted area.
- ▶ **Food and Drink**
 - Do not consume or store food and drink in restricted areas.
 - This includes applying cosmetics, lip balm, and contact lenses.
- ▶ **Radioactive Spills**
 - If you suspect radioactive materials have been spilled, stay where you are and call for assistance, 314-977-3000.
 - Do not attempt to leave area until cleared to prevent the spread of radioactive contamination.
- ▶ **Questions: Contact Radiation Safety**
 - 314-977-8609 or <https://slu.edu/ehs>

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Minors in Labs

- ▶ Applies to all minors (STARS and Non-STARS) in the laboratory.
- ▶ Must be approved by EHS

Minors in Labs Documents

- Policy on Minors in Laboratories
- Form A - Request for Approval of Research Project Involving Minor Participants in Laboratories
- Form B - Parent/Guardian Consent for a Minor in Laboratories
- Minors in Laboratories - Faculty Step by Step Guide to Approval and Onboarding
- STARS Students at SLU: How to Obtain an ID Badge
- OHP Enrollment Form: Medical History Questionnaire

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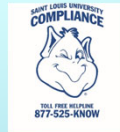
Questions / Comments

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chemwaste@slu.edu ehs@slu.edu



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Biological Safety



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Biosafety training outline

- ▶ Risk groups and biosafety levels
- ▶ Work practices and procedures
- ▶ Regulatory aspects, standards & guidelines

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Risk Groups and Biosafety levels

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Risk Groups (RG) and Biosafety levels (BSL)

Definitions

- ▶ **Biohazard** – An agent of biological origin that has the capacity to produce harmful effects on humans or the environment.
- ▶ **Biosafety** – The application of knowledge, techniques and equipment to prevent personal, laboratory and environmental exposure to potentially infectious agents or biohazards.

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Laboratory Acquired Infections (LAI)

Exposures:

- ▶ Most are acquired via inhalation
- ▶ Other: ingestion, inoculation (sharps), splashes, direct & indirect contact

51% LAIs occur in research laboratories

- ▶ **Viral:**
 - 16% from clinical labs
 - 70% from research labs
 - 32% from animal related activities
- ▶ **Bacterial:**
 - 76% from clinical labs
 - 8% from research labs
- ▶ **Other:**
 - Parasites
 - Molds
 - Fungi
 - Prions



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Risk Groups & Biosafety Levels

- ▶ The Risk Group (RG) of an agent is an important factor to be considered during the biosafety risk assessment process.
- ▶ Biological agents and toxins are assigned to their relevant Risk Groups based on their ability to cause disease in healthy human adults and spread within the community.
- ▶ Biosafety Levels (BSL) are ways to contain the agent
 - facilities, safety equipment, practices, PPE, etc.
- ▶ Once risk is assessed then the appropriate BSL is determined
- ▶ Risk Groups are used in risk assessment
- ▶ BSL are used in risk management

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NIH Risk Groups

- ▶ RG1 – agents not associated with disease in healthy adults
 - RG1 ex. – adeno-associated viruses (AAV), Baculoviruses
- ▶ RG2 – agents associated with human disease which is rarely serious
 - preventive/therapeutic interventions *are often* available
 - RG2 ex. – human origin cells (BBP), influenza, Zika virus
- ▶ RG3 – agents associated with serious or lethal human disease
 - preventive/therapeutic interventions *may be* available
 - RG3 ex. – SARS-CoV-2, *Mycobacterium tuberculosis*, SARS*
- ▶ RG4 – agents cause serious or lethal human disease
 - preventive/therapeutic interventions *not usually* available
 - RG4 ex. – Ebola, Marburg, Lassa

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Safe Work Practices for all Biosafety Levels

- ▶ Wash hands after work; when removing gloves; before leaving lab
- ▶ No eating, drinking, applying cosmetics, handling contact lenses
- ▶ No plants or animals in laboratories that are not part of the research
- ▶ Maintain labs in clean, orderly fashion
- ▶ Limit access to lab when work with organisms is in progress
- ▶ Use good microbiological techniques (No mouth pipetting)
- ▶ Use plastic instead of glass when possible
- ▶ Dispose of sharps properly
- ▶ Plan your work
 - Know in advance what you are working with

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Biosafety Levels (BSL)

LOWEST
Basic Laboratories

BSL-1

- Work is typically done on the open bench
- Standard microbiological practices
- General laboratory safety & hand washing

↓
Containment Laboratories

BSL-2

- Specific agent training for the lab
- Biosafety cabinets (BSC) used
 - Prevention of aerosol/splash exposures
- PPE, primary & secondary containment

↓
HIGHEST

BSL-3

- Specialized training and approval required
- Additional PPE, all work within BSC

BSL-4

- Not at SLU (specialized labs, suits, etc.)

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Work Practices and Procedures



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Biosafety Concepts

*Biosafety in Microbiological and Biomedical Laboratories (BMBL)
6th Edition*

Standard Microbiological Practices

- ▶ Awareness of potential hazards
- ▶ Trained & proficient in techniques
- ▶ Supervisors responsible for:
 - Appropriate Laboratory facilities
 - Personnel & Training
- ▶ Special practices & precautions
 - Occupational Health Programs



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Biosafety Issues

The BMBL

Safety Equipment

- ▶ Minimize exposure to hazard
 - Prevent contact/Contain aerosols
- ▶ Primary Containment Barrier
 - Biological Safety Cabinets
- ▶ Engineering controls/equipment
- ▶ Personal Protective Equipment (PPE)
 - Gloves, gowns, respirator, face shield, shoe covers
- ▶ Covered or ventilated animal cage systems



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Sharps Safety

- ▶ Approved sharps containers are puncture & leak-resistant and should be used for the disposal of metal sharps such as scalpels, razor blades and needles.
- ▶ Contaminated glass should also be placed in the sharps container for safe disposal.
- ▶ The sharps container should be near the working area to avoid carrying sharps.
- ▶ Do not recap needles.
- ▶ If metal sharps are found in the regular trash – Housekeeping will not remove trash & will contact EHS
- ▶ Do not leave exposed sharps on the bench.



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Proper Biowaste Handling

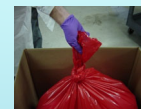
ALL BIOLOGICAL MATERIAL MUST BE DISPOSED OF PROPERLY

- ▶ Solid Waste (two options):
 - Stericycle (biohazard boxes)
 - Autoclave (steam sterilization)
- ▶ Liquid biological waste:
 - 1:9/10% bleach concentration (final concentrations)
 - Hold 24 hours, then pour down the sink with running water

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Stericycle Box Handling

- ▶ Biohazard packaging materials (boxes, bags, manifests and labels) are obtained from EHS
- ▶ DOT requires twisting & tying the red bag in a single knot
 - 5 minutes – upside down – holding water
- ▶ 45 Lbs. (lift with one hand test).
- ▶ Close and tape box as per instructions of box
 - No red bag should show once the box is sealed.
- ▶ Affix Stericycle label on the side of the box in the marked area with date visible
- ▶ Submit biowaste pickup request through EHS "Biological Waste Pickup" form



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Autoclaved solid waste

- ▶ Biohazardous waste should be collected in a red biohazard bag and autoclaved.
- ▶ Autoclaves need to be validated weekly and results documented.
- ▶ Autoclaved waste should be then placed into a black plastic trash bag.
 - Then it can then go into the regular trash.
- ▶ Sharps still need to be placed in a sharps approved container.

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Biohazard Labels

- ▶ OSHA requires biohazard labels to be affixed to containers, refrigerators and freezers containing human BBPs or OPIMs
 - 29 CFR 1910.1030(g)(1)(i)(A)
- ▶ Labels shall be fluorescent orange or orange-red with lettering and symbols in a contrasting color.
- ▶ BSL-2 (agents in use) and BSL-3 laboratories require biohazard labels as noted in the BMBL, 6th ed., 2020.



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Surface Decontamination

- ▶ 10% Bleach, 70% Ethanol
- ▶ Halogens (Sodium and Calcium hypochlorite)
- ▶ Quaternary Ammonium Compounds
- ▶ Aldehydes (Formalin)
- ▶ Hydrogen peroxide
- ▶ **BOTTOM LINE** - Use a disinfectant that is proven to provide kill of the agent with which you're working.



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Aerosol Generating Procedures

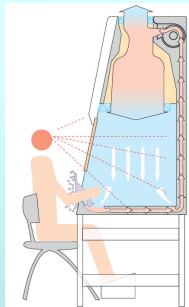
- ▶ Pipetting (vigorous mixing)
- ▶ Mixing & vortexing
- ▶ Centrifugation
- ▶ Inoculating biochemicals or blood culture bottles
- ▶ Pouring of specimens
- ▶ Flaming loops
- ▶ Open bench subculturing
- ▶ Hot loop into broth or media
- ▶ Loading syringes
- ▶ Flow cytometry & sorting
- ▶ Lasers
- ▶ Grinding and homogenizing
- ▶ Opening lyophilized cultures
- ▶ Entering / opening vessels at non-ambient pressures
- ▶ Bone saw at autopsy
- ▶ Sonication



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Biosafety Cabinet Use

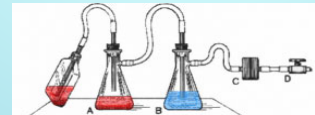
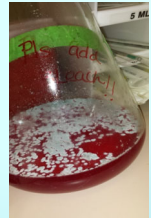
- ▶ BSCs must be tested and certified at the time of installation, any time it is moved, and at least annually.
- ▶ No flammable compressed gas
 - Flames disrupt air flow and may damage HEPA filter
- ▶ Keep vents clear of tools/debris
 - this prevents proper airflow
- ▶ Use appropriate disinfectant
- ▶ Wear PPE (gloves, gown/coat)



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Vacuum use

- ▶ Begin with fresh bleach in the flask
 - final concentration should be 10% bleach
- ▶ Empty frequently to avoid contamination
- ▶ Label the contents
- ▶ HEPA filters should be in-line to protect the house vacuum and a second overflow flask is also useful
- ▶ Use coated glass and/or secondary containment if stored on the floor



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Regulatory aspects, standards & guidelines



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Research & Regulatory Oversight

- ▶ Occupational Safety and Health Administration (OSHA)
 - Bloodborne Pathogens and the Laboratory Standard for working with SA Toxins
- ▶ Department of Health Human Services (DHHS): Select Agent Program
- ▶ Centers for Disease Control and Prevention (CDC)
 - Permit requirements
- ▶ United States Department of Agriculture (USDA): Select Agent Program
 - Animal Plant and Health Inspection Service (APHIS)
 - Permit requirements
- ▶ Department of Transportation (DOT): Ground Shipping
- ▶ International Air Transport Association (IATA): Air Shipping
- ▶ NIH Guidelines for Research Involving Recombinant DNA Molecules

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Registration of Research Protocols

- ▶ Institutional Biosafety Committee (IBC)
 - Biological Agents, recombinant or synthetic nucleic acids (rsNA), biological toxins, prions & select agents
- ▶ Radiation Safety Committee (RSC)
 - Radiological
- ▶ Institutional Animal Care and Use Committee (IACUC)
 - Animals
- ▶ Institutional Review Board (IRB)
 - Humans
- ▶ Conflict of Interest in Research Committee (COIRC)

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IBC and IBC Protocols

- ▶ Research Institutions with NIH funding must register experiments using rsNA molecules with the Institutional Biosafety Committee (IBC).
- ▶ The IBC has responsibility for the oversight, review and approval of all biological research conducted at Saint Louis University and institutional compliance with federal, state and local requirements governing the use of biological materials.
- ▶ IBC protocols are active for five years
 - Annual continuing reviews (per *NIH guidelines*)
 - Ensures personnel, locations, etc. are up-to-date.
- ▶ All personnel listed on an IBC protocol are required to read the protocol as part of their eIBC protocol-specific training.
- ▶ Questions regarding IBC submissions, renewals, or continuing reviews can be emailed to eIBC@slu.edu, or contact Patricia Osmack, IBC Manager

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Shippers Training

- ▶ Training is required for anyone involved in the shipping or transport process
- ▶ Required Shipper's Training Includes:
 - General Awareness
 - Safety
 - Function Specific
 - Security Awareness
 - Dangerous Goods readied for shipment are a security risk and must be secured from unauthorized access prior to shipment.
 - All visitors must be escorted in areas where packaged Dangerous Goods await shipment.
 - Keep laboratory doors and cabinets holding dangerous goods closed and locked.
 - Call DPS 314-977-3000 for any security issues.



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Shipping Hazardous Materials

- ▶ Dangerous goods
 - must be shipped in accordance with 49 CFR, Parts 171-180.
- ▶ Biological agents
 - Must be shipped following DOT and/or IATA guidelines.
 - Contact EHS with any questions about specific online training requirements.
- ▶ Shipping Chemicals
 - Please contact EHS prior to shipping ALL CHEMICALS

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Occupational Health Program (OHP) Awareness & Enrollment

- ▶ **What is the OHP?**
 - The OHP is a medical surveillance program for assuring that employees are monitored (for occupational Laboratory and Animal Care Workers only).
- ▶ **How do I enroll?**
 - PI will be provided an OHP Medical Questionnaire for you to complete.
 - For work with animals, the PI will also provide a "Safe Handling of Animals for OHP" form for you to complete.
 - After you complete the form, it must be submitted confidentially (because it contains Personal health information) to the Occupational Health Program Manager.
- ▶ **Can I choose not to participate?**
 - If you choose not to participate in the OHP, you must notify the SLU Occupational Health Program Manager, Dr. Steven Cummings, in writing using the "Informed Consent Declination Documentation" form that is the final page of the OHP Medical Questionnaire.
 - **Opting out of the OHP may prevent you from participating in certain research that is part of your job.** This should be discussed with your supervisor.

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eIBC Protocol-Specific Training

- ▶ All Saint Louis University laboratories are required to have and document **protocol-specific training*** for all faculty, staff, students, and volunteers working in the laboratory.
- ▶ Principal Investigators and Managers in labs that work with any biohazardous agent should:
 - Require all personnel to read eIBC Protocols on which they are listed
 - Explain symptoms of accidental exposures to employees
 - Require self-reporting in the event of illness
 - Require reporting of any spill or release of an agent to the supervisor and to EHS.

***This training should be documented in the Biosafety Training Form**

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Hazardous Exposure or Spill

- ▶ Flush the contaminated area with water for ≥15 minutes
- ▶ Evacuate the immediate area around a spill
 - Avoid leaving and tracking the spill to other areas
- ▶ Call Public Safety at 314-977-3000
- ▶ Provide Important Information:
 - Specific hazard name, exact location, amount spilled, phone #
- ▶ Avoid hazard inhalation, absorption and/or contamination

NEVER leave a message for an emergency !!!


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Sharps Injuries

- ▶ Notify your supervisor immediately, if available.
- ▶ Determine risk of exposure to a biological agent.
- ▶ Immediately report incident to supervisor and seek treatment at Concentra Urgent Care or the emergency room to determine treatment.
- ▶ File an incident report as instructed by the Occupational Health Program (OHP).
- ▶ Follow recommendations for follow-up treatment.

Contact Concentra Urgent Care:
3100 Market Street
St. Louis, MO 63103
Phone: 314-421-2557
Hours: 8AM-5PM

Emergency or After Hours Contact:
SSM Health Saint Louis University
Hospital Emergency Department



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Select Agents and Toxins Awareness



- ▶ Restricted work, unless approved by RO, IBC, and CDC
- ▶ YOU MUST BE APPROVED TO ACCESS AGENT
- ▶ Covers **ALL** who have access to Select Agents and Toxins
- ▶ High-level of federal-level security and scrutiny
 - <https://www.selectagents.gov/>
- ▶ Extensive training to work with agents

RO: Christopher Eickhoff
Caroline Bldg. Rm. 305D – (314) 977-6888

ARO: Tammy Blevins
Caroline Bldg. Rm. 305B – (314) 977-6870

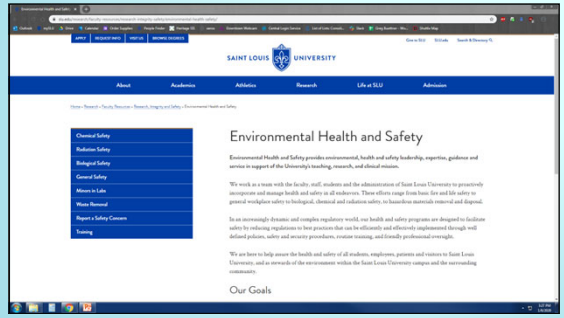
ARO: Patricia Osmack
Caroline Bldg. Rm. 305C – (314) 977-6897

42 CFR Part 73 (CDC): Human & Overlap agents
7 CFR Part 331 (APHIS): Plant
9 CFR Part 121 (APHIS): Animal (& Overlap agents)

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Environmental Health and Safety Website

<http://slu.edu/EHS>



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Contact Us!

- ▶ **Christopher Eickhoff**
 - Biological Safety Officer & Responsible Official (RO)
 - Phone : 977-6888
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- ▶ **Tammy Blevins**
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 - tammy.blevins@health.slu.edu
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