ANIMAL RESEARCH BIOSAFETY MANUAL

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USC University of Southern California

Office of Environmental Health and Safety

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1.0 Purpose and Scope

The Office of Environmental Health and Safety (EH&S) in collaboration with the Department of Animal Resources (DAR) has created this Animal Research Biosafety program to ensure that laboratory animals are handled safely and that risks associated with biological, chemical, and radiological hazards are minimized.

Regulatory requirements will be clearly highlighted throughout this manual by phrases such as "must" or "required''. This manual will be used by relevant departments and individual research laboratories.

The purpose of this manual is to:

- Provide valuable information to USC animal researchers.
- Serve as a useful resource to USC faculty, staff, and students who are interested in animal research.
- Assist users in conducting safe and proper animal handling procedures with regard to biological, chemical, and radiological hazards.

The primary objectives of this document are to provide techniques for identifying hazards related with the (a) care, use, and handling of laboratory animals, (b) assessing the risk(s) associated with those hazards, and (c) eliminating or controlling those risks.

All research and DAR staff must participate actively in the development, implementation, and maintenance of this Animal Research Biosafety program.

The Animal Research Biosafety Manual pertains to all researchers, students, and any individuals who have direct contact with laboratory animals, non-sanitized animal cages, non-sterilized animal tissues, fluids, or biological/chemical wastes.

Additionally, it outlines best practices and guidance for:

- Proper signage and cage labeling
- Safe administering of biological agents and hazardous chemical substances to laboratory animals
- Safe handling of animals treated with the following:
  - Hazardous chemical substances
  - Replication-incompetent biological hazards
  - Replication-competent biological hazards
- Proper biological/chemical waste disposal
- Emergency response to incidents and accidents
- USC EH&S Occupational Health Program

2.0 Regulatory Requirements

Federal

NIH

- Office of Laboratory Animal Welfare (OLAW): Public Health Service Policy on Humane Care and Use of Laboratory Animals, 2015
- Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules (NIH Guidelines), 2019

NRC

- The Guide for the Care and Use of the Laboratory Animals 8th edition, 2011
- Occupational Health and Safety in the Care and Use of Research Animals, 2003

United States Department of Agriculture (USDA)

Drug Enforcement Administration (DEA)

Centers for Disease Control & Prevention (CDC)- Federal Select Agent Program

State

CCR Title 8 General Industry Safety Orders

- §5194. Hazard Communication
- §5193. Bloodborne Pathogens
- §5191. Occupational Exposure to Hazardous Chemicals in Laboratories
- §5199. Aerosol Transmissible Diseases
- §5097. Hearing Conservation Program

USC

Biosafety Manual

DAR General Animal Care and Use Policies

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3.0 Roles and Responsibilities

Institutional Animal Care and Use Committee (IACUC)

The Institutional Animal Care and Use Committee (IACUC) is responsible for the following:

- Review and approve submitted IACUC protocols.
- Identify potential hazardous risks, animal housing facility designs, and biological/chemical hazards.
- Assess the potential benefits of every study in light of the potential harm to its animal subjects; there must be a clear and apparent value inherent in the experimental design to justify the use of animals.
- Provide recommendations for appropriate training sessions for investigators and their staff.
- Maintain database files with documentation of personnel training for proper animal usage and care.

Institutional Biosafety Committee (IBC)

The Institutional Biosafety Committee (IBC) is responsible for the following:

- Formulate and implement policies related to the safe use of biological materials and chemicals commonly used in biomedical research.
    - Review and approve research involving the use of biological or chemical hazards in biomedical research.
    - Approve or disapprove such projects based on their potential hazard and proposed containment procedures.
    - Establish, approve, and monitor proper laboratory conditions and procedures required for such projects.
    - Review the qualifications and training of investigators and laboratory personnel engaged in such research to ensure appropriate laboratory safety techniques are used.
- Ensure adoption of proper disposal and decontamination procedures.
- Adopt emergency plans that cover accidental spills and personnel contamination resulting from research.
- Ensure the investigation and reporting of any significant problems with or violations of proper biosafety procedures.

Radiation Safety Committee (RSC)

The Radiation Safety Committee (RSC) is responsible for following:

- Formulate general policy governing the use of radiation-producing devices and radioactive materials.
- Review and approve all requests for the use of radiation-producing devices and radioactive materials.

- Determine that all individuals authorized to use radiation-producing devices and radioactive materials have sufficient training and experience to enable them to perform their duties safely.
- Establish a program to ensure that all individuals whose duties may require them to work in the vicinity of radioactive material or radiation-producing devices are properly instructed about all appropriate health and safety matters.
- Conduct an annual review of the Radiation Safety Program to determine that all activities are being conducted safely and in accordance with California Radiation Control Regulations and the university's radioactive materials license.

Department of Animal Resources (DAR)

The Department of Animal Resources (DAR) is responsible for the following:

- Procure laboratory animals.
- Import, export, and transfer laboratory animals.
- Maintain appropriate environment for housing and care of laboratory animals.
- Provide:
  - Appropriate husbandry and veterinary care.
  - Expert scientific support for teaching and research projects.
  - Veterinary membership to the Institutional Animal Care and Use Committee (IACUC), which is responsible for program and facility review and approval of animal research and teaching protocols, renewals, and amendments.
- Maintain veterinary and regulatory records.
- Manage animal pathogen outbreaks.
- Train investigators and labs in animal research techniques, surgery, and procedures.
- Order (non-controlled) animal research drugs and supplies.

Office of Environmental Health and Safety (EH&S)

The Office of Environmental Health and Safety (EH&S) is responsible for the following:

- Provide safe and healthy working conditions for the prevention of work-related injuries and illnesses by providing resources necessary to the research community.
- Reduce or eliminate injury, incidents, and exposures to the research community related to hazards and exposures in animal research areas.
- Provide training of animal husbandry to research staff upon introduction of a new biohazard to the animal research program.

- Review animal use protocols involving administration of hazardous substances to the animal, to determine occupational health risks, evaluate and recommend proper protective measures, identify any need for special medical monitoring, and assign appropriate housing facilities based on risk assessment.
- Assist in developing standard operating procedures (SOPs) for safe and compliant handling of animals, materials, and equipment.
- Provide respiratory protection evaluation and fit testing for individuals assigned to work in areas where the risk evaluation determines the need.
- Provide timely periodic inspections of areas where animal handling occurs to evaluate risks and determine the need for protective equipment or systems.
- Provide training and technical assistance to supervisors and employees upon request and maintain records of EH&S provided training.
- Manage the Medical Surveillance Program in coordination with IACUC. Enrollment into the program and notification emails are sent to each individual including follow up with any medical clearance including vaccination(s) or need for any medical surveillance, as deemed necessary.
- Work with IACUC on the semiannual report regarding the status of the Occupational Safety and Health Program as it relates to the Animal Care and Use Program, and the status of health and safety inspections of areas where animals are used.

Principal Investigator (PI)

- Ensure a safe working environment.
- Provide instructions and training on safe and proper biosafety practices to all persons working within their research area.
- Provide emergency procedures for laboratory personnel. These procedures must include the names and telephone numbers of key lab personnel (e.g., Lab Manager, Safety Officer, other) to be contacted in case of emergency. These procedures will be prominently posted in work areas where biohazardous materials are used.
- Maintain adequate control of the biohazardous materials.
- Provide necessary personal protective equipment (PPE) for safe work with hazardous materials.
- Properly label all areas where biohazards are stored or handled.
- Notify the Biosafety Officer (BSO) or Biosafety Specialists of any accident or abnormal incident involving or suspected of involving biohazardous material.
- Inform the IBC/IACUC of:
    - Changes in personnel and any significant changes in lab design or procedures by updating the BUA
    - Plans to relocate the lab or leave the university via the BSO or Biosafety Specialists
- Ensure that researchers complete initial and annual refresher biosafety training.

- Provide easy access to Safety Data Sheets (SDSs).
- Prepare Standard Operating Procedures (SOPs) including safe work practices for all routine processes involving biohazardous materials conducted in the facility.
- Hold regular safety meetings.
- Determine and document the personal protective equipment (PPE) needed for each procedure.

Research Staff

The research staff members are individuals who work under the supervision of the PI and conduct research with biohazardous materials in an area for which the PI is responsible. Research staff members have the responsibility to practice safe use and handling of biohazardous materials. Other responsibilities include:

- Read, understand, and follow university safety policies and standards as well as guidelines outlined in the USC Biosafety Manual.
- Attend appropriate EH&S/DAR training.
- Attend site-specific safety training by PI or lab manager.
- Follow SOPs and safe handling practices when using biohazardous materials.
- Understand risks associated with their research and ask questions for any items that are unclear to them.
- Know where the nearest eyewash/ safety shower stations and fire extinguishers are and the emergency evacuation route for the building.
- Follow proper emergency procedures if an accident or incident occurs while handling biohazardous materials.
- Report any unsafe practices or concerns to the BSO or Biosafety Specialists.
- Notify the BSO or Biosafety Specialists regarding any accident or incident that occurs with infectious agents, chemicals.

4.0 Risk Group Classification

Microorganisms are classified by risk groups (refer to the Biosafety Manual for details). The classification of microorganisms considers the characteristics of the agent such as:

- Infectious dose
- Host range
- Pathogenicity
- Preventive therapies or current treatments
- Mode of transmission

There are four risk groups: Risk Group 1 (RG1) - the lowest risk group - through Risk Group 4 (RG4) - the highest risk group. The risk groups of different microorganisms are classified and defined by NIH Guidelines, the WHO Laboratory Biosafety Manual, and the Biosafety in Microbiological and Biomedical Laboratories (BMBL), 6th Edition.

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5.0 Animal Biosafety Levels (ABSLs)

Animal Biosafety Levels (ABSL) are similar to Biosafety Levels but are specifically used for areas of containment when conducting research in animals. The BMBL stipulates what is required to establish the four levels of animal biosafety. ABSL1 is the lowest level of containment and ABSL4 is the highest level of containment.

Animal Biosafety Level 1 (ABSL-1)

Animal Biosafety Level 1 (ABSL-1) is suitable for animal work involving well-characterized agents that are not known to consistently cause disease in immunocompetent adult humans and present minimal potential hazard to personnel and the environment. Special containment equipment or facility design may be required as determined by risk assessment. Personnel receive specific training in animal facility procedures and are supervised by an individual with adequate knowledge of potential hazards and experimental animal procedures.

Animal Biosafety Level 2 (ABSL-2)

Animal Biosafety Level 2 (ABSL-2) builds upon the practices, procedures, containment equipment, and facility requirements of ABSL-1. ABSL-2 is suitable for work involving laboratory animals infected with agents associated with human disease and posing a moderate hazard to personnel and the environment. It also addresses hazards from ingestion and from percutaneous and mucous membrane exposure. ABSL-2 requires that, in addition to the requirements for ABSL-1, a BSC or other physical containment equipment is used when procedures involve the manipulation of infectious materials or where aerosols or splashes may be created. Appropriate PPE is worn to reduce exposure to infectious agents, animals, and contaminated equipment. An appropriate occupational health program is in place, as determined by risk assessment.

Animal Biosafety Level 3 (ABSL-3)

Animal Biosafety Level 3 (ABSL-3) involves practices suitable for work with laboratory animals infected with indigenous or exotic agents, agents that present a potential for aerosol transmission, and agents causing serious or potentially lethal disease. ABSL-3 builds upon the standard practices, procedures, containment equipment, and facility requirements of ABSL-2. The ABSL-3 facility has special engineering and design features. ABSL-3 requires that in addition to the requirements for ABSL-2, all procedures are conducted in BSCs or by use of other physical containment equipment. Inward airflow at the containment boundary is maintained. Handwashing sinks are capable of hands-free operation. Appropriate PPE is worn to reduce exposure to infectious agents, animals, and contaminated equipment.

Refer to USC High Containment Program for more details

Animal Biosafety Level 4 (ABSL-4)

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

NOTE: No ABSL-4 facilities are present at USC.

6.0 Hazard Indentification

Hazards can be classified as biological, chemical, radioactive, or physical. Identification of the hazards is the first step in the risk assessment process. This involves identifying animals administered with different biological, chemical, and radioactive agents through proper labeling of the cages. If animals are caught in the wild, cages housing these animals should be properly labelled as well indicating the potential for infectious organisms harbored in these animals.

Biological Hazards

Specific biological hazards that could affect laboratory personnel, veterinary, and animal care workers are listed under each animal group. In general, animals infected with biological agents may shed them to the bedding of the cages. Hence, animal care workers have the potential to become exposed to biological agents carried by the infected animals by not using appropriate PPE (e.g., gloves, eye protection) while cleaning cages. Also, there should be awareness of increased potential for animal bites to animal care workers when handling animals. Any symptoms appearing after a potential exposure should be taken seriously and immediately reported to a supervisor and physician for medical management.

Chemical Hazards

Laboratory personnel, veterinary medicine, and animal care workers are at risk of exposure to many different chemical hazards. These include chemicals used during regular cleaning and other disinfectants as well as a variety of anesthetic drugs, chemotherapy agents and gases. Animal care workers could be exposed to these agents through dermal contact (touching the skin) and/or inhalation. Furthermore, splashes may result in chemical contact with the skin, eyes, or mucous membranes as well.

Radioactive Materials (RAM)

Animal care technicians retain responsibility for general room cleaning such as sweeping the floor, sanitizing of the sinks, etc. DAR personnel will not clean the cages of animals that contain radioactive material. Animals will stay contained in their cages or the designated location for isotope decay, as approved on the IACUC and RSC protocols. Cage and isolation location will be identified with a Radioactive label or sticker. In cases where the animal is not confined to a HEPA filtered cage, such as swine, then the whole room will be considered "hot" and must not be entered by the trained animal care technician. Cage cleaning and regular husbandry of the laboratory animals that are in isotope decay is the responsibility of the trained laboratory staff member/ researcher. Contact Radiation Safety radsafety@usc.edu for more information and training.

Allergies

Laboratory animal allergy is a relative common work-related condition occurring in an estimated one-third of laboratory animal workers. Risk factors include a personal or family history of atopy, other preexisting non-work-related allergies, and a significant exposure to laboratory animals. Inhalation is the most common route of exposure, followed by skin and eye exposures.

Rodents and Rabbits

Wild-caught rodents could pose a variety of other concerns that are not associated with rodents raised in specific pathogen-free facilities. The former may harbor potentially infectious microorganisms including viruses and bacteria.

Lymphocytic Choriomeningitis virus is a rodent-borne viral infectious disease caused by Lymphocytic Choriomeningitis Virus (LCMV). Humans acquire LCMV infection when they come into contact with the urine, droppings, saliva, and nesting materials of infected mice, hamsters, or guinea pigs. Hamsters and guinea pigs acquire this infection naturally from contact with infected wild mice. Clinical signs and symptoms of LCMV infection are mostly neurologic, including aseptic meningitis.

Rat Bite Fever is an infectious disease that can be caused by two different bacteria: *Streptobacillus moniliformis* (in the US) or *Spirillum minus* (in Asia). People typically become infected with these bacteria after a bite or scratch from rodents carrying the bacteria. A person can also become infected through consumption of food or water contaminated with the urine and droppings of rodents carrying the bacteria. If not treated, RBF can be a serious or even fatal disease.

Hanta Viruses are rodent-borne viruses causing clinical illness in humans of varying severity. There are several different hantaviruses, with known geographical ranges which cause different clinical diseases. Transmission of the virus to humans occurs through the inhalation of infected rodent urine, droppings, or saliva. Three main clinical syndromes can be distinguished after hantavirus infection are hemorrhagic fever with renal syndrome (HFRS), mainly caused by Seoul, Puumala and Dobrava viruses; nephropathia epidemica, a mild form of HFRS caused by Puumala virus; and hantavirus cardiopulmonary syndrome, which may be caused by Andes virus, Sin Nombre virus, and several others.

Tularemia is a disease caused by the bacterium *Francisella tularensis*. It mainly affects wild rodents, squirrels, birds and rabbits. People and animals most commonly get tularemia from a bite by an infected tick or fly or following contact with an infected animal hence personnel working with wild rodents are at a greater risk of exposure. There are different forms of clinical presentations for tularemia including Ulceroglandular tularemia, Glandular tularemia, Pneumonic tularemia, Oculoglandular tularemia, Oropharyngeal tularemia, Typhoidal tularemia.

Plague is an infection caused by the bacterium *Yersinia pestis*. The bacteria are found mainly in rats and in the fleas that feed on them. People and other animals can get plague from rats or flea bites. Different forms of plague include Bubonic plague, Septicemic plague, and Pneumonic plague.

Pasteurellosis is common in domestic rabbits but also in other domestic pets such as dogs and cats. The disease is caused by the bacterium *Pasteurella multocida*. Humans can be exposed to the disease through a bite or a scratch from an infected animal which could lead to rapidly progressing soft tissue, respiratory, or other serious invasive infections.

Non-Human Primates (NHPs)

B-virus, Herpes B, or Macacine Alphaherpesvirus 1 - The most important biohazard faced by personnel working with monkeys is the simian B-virus, a type of herpes-virus that is highly prevalent among macaque monkeys. Monkey-to-monkey transmission occurs primarily from biting, scratching, and breeding activities. Those potentially at risk include animal technicians, veterinarians and veterinary technicians, laboratory personnel, students, faculty, or anyone who is exposed to macaque monkeys or their tissues. B-virus exposures in humans could result from animal bites and scratches, splashes, needle stick injuries, and other contact of mucous membranes or broken skin with infected body fluids from macaques or with wet, unfixed tissues or primary cell culture tissue material. Contaminated husbandry and research equipment can potentially spread B virus, however its viability is not expected to be prolonged (less than 24 hours in most cases); however, B virus may survive for longer periods when protected from environmental exposure in certain laboratory settings.

Mycobacterium tuberculosis, M bovis, and M avium - Monkeys and large apes can contract tuberculosis leading to severe disease of the lungs and other organs. While primates could be infected primarily through the aerosol route from an infected animal technician, the pathogens then may have the ability to jump from a subsequently infected animal to an otherwise healthy animal technician caring for the infected animal.

Birds

Psittacosis is an uncommon infectious disease that mainly infects birds by the bacterium *Chlamydia psittaci*. It is most often transmitted to humans through exposure to infected birds, especially parrots, cockatiels, parakeets and similar pet birds. Psittacosis can affect the lungs and may cause inflammatory illness of the lungs (pneumonia). Additional common symptoms include fever, muscle pain (myalgia), headaches, and a dry cough.

Salmonellosis is an infection caused by the bacterium *Salmonella enterica*. The bacterium is known mostly for infecting food supply for humans often causing outbreaks.

However, Birds are one of the animals most frequently associated with this bacterium where the resulting symptoms include diarrhea, fever, and stomach cramps. Salmonellosis is primarily transmitted by fecal contamination of food and water by birds, though it can also be transmitted by bird-to-bird contact. Infected birds shed the bacteria in their feces, and if they are frequenting a bird feeder, the surface of the feeder or the food itself is likely to become contaminated with their feces. In this way, the feeder becomes a vector for the disease, spreading it to other birds.

Newcastle Disease is a contagious viral disease of birds and considered one of the most important poultry diseases worldwide caused by virulent Newcastle disease virus (NDV). While it is mostly known due to its association with poultry, people in direct contact with infected birds can get conjunctivitis (swelling and reddening of the tissues around the eyes) hence personnel working with wild birds should be extra cautious.

Avian Tuberculosis is one of the more important diseases that affect domestic and pet birds. Several mycobacterial species can be involved in the etiology of avian tuberculosis. The disease is most often caused by *Mycobacterium avium*. In humans, *M. avium* is capable of inducing a progressive disease characterized by cause local wound infections with swelling of lymph nodes in the region of the infection. Infection with this bacterium is extremely rare and is of higher risk to severely immunocompromised individuals.

Cryptococcosis is caused by a fungus known as *Cryptococcosis neoformans*. The infection may be spread to humans through contact with pigeon droppings. Cryptococcosis is an opportunistic infection and are usually rare in people who are otherwise healthy.

Canines

Brucellosis is a canine bacterial infection caused by the bacterium *Brucella canis* that primarily causes reproductive failure in dogs. Humans acquire *B. canis* infection through direct contact with infected dogs or their reproductive or blood products. Clinical signs and symptoms include undulant fever, chills, malaise, splenomegaly, and peripheral lymphadenomegaly (enlarged lymph nodes).

Campylobacteriosis is a bacterial intestinal infection caused by *Campylobacter jejuni* and *Campylobacter upsaliensis*. It is a major cause of human bacterial enteritis. Infected canines shed the bacterium into their feces. Hence, humans can contract the disease if they do not practice proper hygiene after encountering an infected animal.

Rabies is a viral disease caused by rabies virus that can infect all warm-blooded animals, including dogs and people. Rabies virus does not survive long outside a mammal's body. Since the virus can be shed in the saliva of infected animals, the virus is usually transmitted when the saliva of an infected animal is introduced beneath the skin of a bite wound. Hence personnel working with canines should be aware of accidental bites.

Felines

Cat Scratch Disease (CSD), also called cat scratch fever, is a bacterial infection caused by *Bartonella henselae*, which is generally spread to people through cat bites or scratches. Most healthy people do not develop any symptoms, and those with a mild infection usually get better without any treatment.

Rabies is a viral disease caused by rabies virus that can infect all warm-blooded animals, including cats and people. Rabies virus does not survive long outside a mammal's body. Since the virus can be shed in the saliva of infected animals, the virus is usually transmitted when the saliva of an infected animal is introduced beneath the skin of a bite wound. Hence personnel working with felines should be aware of accidental bites.

Toxoplasmosis is an infection caused by a single-celled parasite called *Toxoplasma gondii*. Humans can become infected with this agent by accidentally swallowing the parasite through contact with cat feces that contain Toxoplasma. Most people are asymptotic for Toxoplasmosis with severe toxoplasmosis more likely occurring in individuals who have weak immune systems, though occasionally, even persons with healthy immune systems may experience eye damage from toxoplasmosis.

Pigs, Sheep, and Goats

Campylobacteriosis is the disease caused by the infection with Campylobacter. Campylobacter species are widely distributed in most warm-blooded animals. They are prevalent in food animals such as poultry, cattle, pigs, sheep and ostriches; and in pets, including cats and dogs. The two main bacteria that cause the disease are *Campylobacter jejuni* and *C. coli* which are transmitted by the fecal-oral route as well as through direct contact and on fomites including food or water. Hence, personnel handling farm animals should be aware of the exposure risks. Complications from the disease are relatively rare but infections have been associated with reactive arthritis, hemolytic uremic syndrome, and septicemia.

Q Fever is a disease caused by the bacteria *Coxiella burnetii*. This bacterium naturally infects some animals, such as goats, sheep, and cattle. *C. burnetii* bacteria are found in the birth products (i.e., placenta, amniotic fluid), urine, feces, and milk of infected animals. People can get infected by breathing in dust that has been contaminated by infected animal feces, urine, milk, and birth products. Some individuals never become sick; however, those who do usually develop flu-like symptoms including fever, chills, fatigue, and muscle pain.

Salmonellosis is caused primarily by ingestion of Salmonella bacteria which lives in the intestines of poultry (especially chicks and ducklings), swine, cattle, and other animals. It can survive for long periods of time in the environment (up to 28 weeks). It can be found in water, food, or on surfaces that have been contaminated with the feces of infected animals or humans hence it is especially worrisome for animal handlers.

Contagious Ecthyma (orf or sore mouth) is a quite common disease of sheep and goats caused by a poxvirus. Animals infected with orf virus typically develop scabby sores (lesions) around their lips, muzzle, and in their mouth. Humans that are infected typically develop ulcerative lesions or nodules on their hands. Infection with orf virus occurs throughout the world, wherever small ruminants exist.

Amphibians, Reptiles, and Fish

Red-Leg Syndrome is a serious condition in amphibians that is caused by septicemia characterized by hyperemia of the ventral skin that accompanies systemic infection in amphibians. The most common causative organism is Aeromonas hydrophila. Human infections normally occur due to poor husbandry and sanitation, in addition to ingestion of contaminated food material.

Mycobacteriosis is caused by the genus Mycobacterium, which can pose a serious risk to immunocompromised individuals. *M. marinum* of amphibians seem to have the most significant zoonotic risk to humans. Infection can cause a localized inflammation (granuloma) or lymphangitis, leading possibly to complications such as persistent ulceration, draining sinuses, septic arthritis and bone infection.

Salmonella is caused by the species Salmonella. Fish, amphibian, and reptile carriers rarely show any clinical disease but will have intermittent shedding leaving animal handlers more vulnerable to the disease. Salmonellosis is primarily transmitted by fecal contamination of food and water leading to abdominal pain and acute gastroenteritis. The disease is more serious and prevalent in immunocompromised patients.

Campylobacter, **Edwardsiella**, ***Escherichia coli***, **Klebsiella**, **Serratia**, and ***Flavobacterium meningosepticum*** are some of the other bacterial pathogens which may be transmitted by contact with abraded skin or wounds or accidental ingestion of feces, contaminated water or other materials when handling amphibians, reptiles and fish.

Autoclaves

The hazards associated with autoclaves are potential heat and steam burns, hot fluid scalds, injuries to hands and arms from the door. Exposure to biohazardous material may occur if biohazardous waste is improperly packaged or handled. It is considered best practice to follow an established SOP to streamline the process of using autoclaves and prevent any accidental exposures. Specifically, the animal handlers should verify that the autoclaves reach the manufacturer's recommended temperature and pressure for a thorough decontamination of the animal cages.

Bedding Dumping Station

The hazards associated with working with bedding dumping stations are potential exposure to allergens or biohazardous materials in the bedding. When using dumping stations to remove any bedding material from the dirty cages, it will be best practice to follow the established SOP to prevent any accidental exposure to the bedding material.

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7.0 Risk Assessment and Mitigation Strategies

Risk Assessment

Risk assessment is a term used to describe the overall process to:

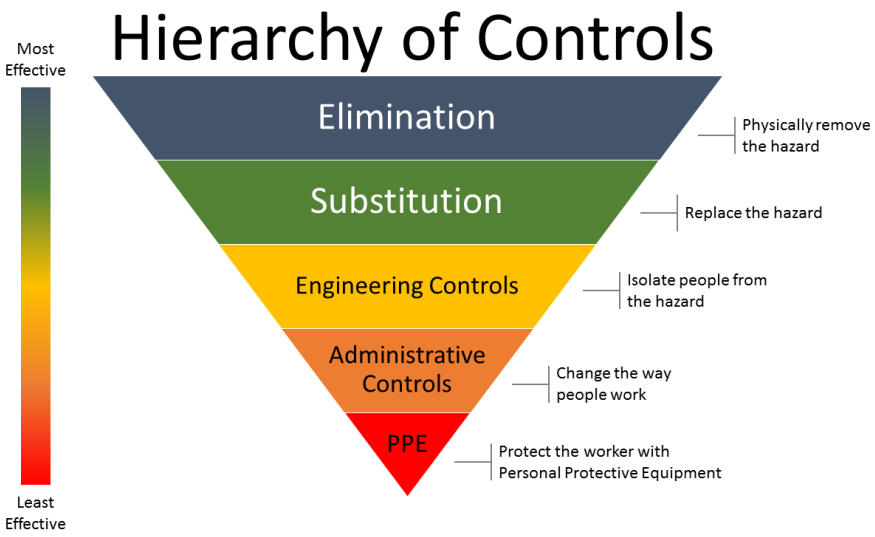
- Identify hazards and risk factors that have the potential to cause harm (hazard identification).
- Analyze and evaluate the risks associated with the hazard (risk assessment).
- Determine appropriate ways to eliminate the hazards or control the risk when the hazard cannot be eliminated (risk mitigation).

A risk assessment is a thorough look at the workplace to identify those things, situations, processes, etc. that may cause harm. After identification is made, you analyze and evaluate how likely and severe the risk is. When this determination is made, you can next, decide what measures should be in place to effectively eliminate or control the harm from happening.

Risk Management and Mitigation

Risk management is the identification, evaluation, and prioritization of risks. In an ideal risk management, risks with the greatest loss (or impact) and the greatest probability of occurring are handled first. Risks with lower probability of occurrence and lower loss are handled in descending order.

The first step in risk management is to eliminate risks. The risks that cannot be avoided or eliminated is reduced to an acceptable level. The following pictogram illustrates Hierarchy of Controls:



Administration of Hazardous Substances

Hazardous substance administration to laboratory animals requires considerable thought and preparation in order to maximize the agent's distribution while minimizing the animal's potential for adverse reactions. Substance administration can be done in a variety of ways for all animals. The research team and IACUC members should be aware of the reasons for choosing various routes, as well as the training and competency required for staff to properly use these routes. Once a route has been chosen, concerns such as dosage, delivery site, pH, sterility of the chemical, and other aspects must be examined in order to finalize the procedure. Inadequate training or a lack of attention to detail during this phase of a study could lead to unintended negative effects on experimental animals and equivocal results, as well as undue stress or pain to the experimental animals

Restraint, sedation, or general anesthesia are all main ways of delivery in experimental animals. When choosing an administration route, such changes should be considered to make procedures less intrusive to the animals. Furthermore, depending on the final effect desired, each route has advantages and disadvantages that should be considered, and the route chosen will have a significant impact on the substance's pharmacokinetics.

Labeling and Sign Identification

The cage cards system in the animal facility assists DAR representatives, EH&S employees, and research personnel communicate the hazards associated with the study animals. Labeling cages is one of the more important aspects of animal research, and it must meet the following requirements.

Biological Hazard Notification and Labeling

- Inform the animal facility supervisor at least one week (7 days) prior to the start of your study to receive the necessary carcass bags, waste receptacles, labels, and orange cage cards.
- Ensure that the Biohazard Sign is posted on the door of the rooms in which treated animals are housed upon the first administration of the materials.
- Mark cages with animals that were treated with biohazardous materials or toxins of biological origin with orange biohazard cage cards upon the first administration of the materials, and leave the card posted according to SOP. Indicate the agent(s) and date(s) of administration on the card.

- When changing cages, transfer the card to the new cage. When the card is full, please request a new card from DAR.

Chemical Hazard Notification and Labeling

- Inform the animal facility supervisor at least one week prior to the start of your study to receive the necessary carcass bags, waste receptacles, labels, blue cage cards, and door signage.
- Post the Hazard Communication Sign (Exposure Control Plan) for chemical agents on the door of the rooms in which treated animals are housed upon the first administration of chemicals.
- Mark cages with animals that were treated with chemical agent(s) in addition to biohazardous materials (or without biological hazard) with blue chemical hazard cage cards and leave the card posted for one week post last chemical hazard dose administration. Indicate the agent(s) and date(s) of administration on the card.

- Include removal date to blue cage card. Bedding is considered potentially hazardous 7 days after the last dose administration.
- When changing cages, transfer the card to the new cage. When the card is full, please request a new card from DAR.

Cages/Bedding Change

The frequency of changing the bedding of rodents treated with hazardous substances has a significant impact on their health and the results of the research study. Bedding collection should be done according to biological hazard cage change SOP and/or chemical hazard cage change SOP (refer to appendices). Technicians must be properly gowned and trained for bedding changes. Bedding of animals treated with hazardous substances must be disposed of as hazardous waste.

A class II certified biosafety cabinet must be used when moving animals from dirty to clean cages. If multiple cages are being changed in the same biosafety cabinet, cages with animals infected with the (biohazardous agent) should be changed last. Refer to appropriate SOP for biological and chemical hazards. Decontaminate the biosafety cabinet between cages to minimize cross-contamination.

Replication-Competent Biological Hazard

- The use of pathogenic organisms and materials that may be hazardous to animals or humans should be clearly indicated on the IACUC protocol and IBC protocol (BUA).
- Contact DAR Manager/Supervisor one week prior to administration of biological hazardous materials to obtain cages cards and other items required for procedures (e.g., waste container, biohazard stickers, etc.).
- Properly prepare samples in laboratory inside the BSC and transport these to animal facility using a secondary container to avoid spills. Label secondary container with biohazard sticker. Post the Hazard Communication Sign (Exposure Control Plan) on the door leading to animal holding room.
- Mark the cages with "Pathological Carcass".
- Label cages with "Orange Biological Hazard" labels.
    - Include hazard name and date of administration (first and last dates).
    - It is recommended to change bedding prior to administration.
- Animals will be labeled with Orange Biological Hazards labels for the duration of the study.
- Dispose of bedding according to Biohazard Cage/Bedding Change SOP.
- After animals are euthanatized, place carcasses in a biohazard bag, place in lab/animal facility freezer, and contact EHSA for waste pick up.

NOTE: Euthanized animals must be disposed as "Pathological Waste". See Hazardous Waste Management Manual, Section 5 for detailed instructions.

Replication Incompetent Biological Hazards (e.g., viral vectors)

- The use of potentially pathogenic organisms that may be hazardous to animals or humans should be clearly indicated on the IACUC protocol and IBC protocol (BUA).
- Contact DAR Manager/Supervisor 1 week prior to administration of biological hazardous materials to obtain cages cards and other items required for procedures (e.g., waste container, biohazard stickers, etc.).
- Properly prepare samples in laboratory inside the BSC and transport these to animal facility using secondary container to avoid spills. Label secondary container with biohazard sticker.
- Post the Hazard Communication Sign (Exposure Control Plan) on the door leading to animal holding room.
- Mark the cages with "Pathological Carcass".
- Label cages with "Orange Biological Hazard" cage cards.
    - Include biological hazard name and dates of administration (first and last).
    - It is recommended to change bedding prior to administration.

- Cages will be labeled with Orange Biological Hazards cage cards up to 1 week post last administration of biological hazard.
- Dispose of bedding according to Biohazardous Bedding Change SOP during hazard administration and up to one week post last administration inside the BSC.
- One (1) week after last dose administration, change animals into new clean cage and bedding. Remove Orange Cards labels from cages. These animals are now considered ABSL1 for husbandry.
- After animals are euthanatized, place carcasses into a red biohazard bag and contact EH&S for Pathological Waste Pick Up (rDNA-transgenic carcass).

NOTE: Euthanized animals must be disposed as "Pathological Waste". See Hazardous Waste Management Manual, Section 5 for detailed instructions.

Established Human Cell Lines

Human tissues and cells have the potential to harbor infectious agent(s). Research with these materials, including primary human tissue and human cell lines, must be conducted in accordance with Cal-OSHA Bloodborne Pathogen Standard and the CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL), 6th Edition.

- Properly prepare samples in laboratory inside the BSC and transport these to animal facility using secondary container to avoid spills. Label secondary container with biohazard sticker.
- Mark the cages with "Pathological Carcass".
- After animals are euthanatized, place carcasses into a red biohazard bag and contact EH&S for Pathological Waste Pick Up (human tumor cells carcass).

NOTE: Euthanized animals must be disposed as "Pathological Waste". See Hazardous Waste Management Manual, Section 5 for detailed instructions.

Primary Human Cell Lines

Human tissues and cells have the potential to harbor infectious agent(s). Research with these materials, including primary human tissue and human cell lines, must be conducted in accordance with with Cal-OSHA Bloodborne Pathogen Standard and the CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL), 6th Edition.

- Properly prepare samples in laboratory inside the BSC and transport these to animal facility using secondary container to avoid spills. Label secondary container with biohazard sticker.
- Post the Hazard Communication Sign (Exposure Control Plan) on the door leading to animal holding room.
- Mark the cages with "Pathological Carcass".

- Label cages with "Orange Biological Hazard" labels.
  - Include hazard name and date of administration (first and last dates).
  - It is recommended to change bedding prior to administration.
- Animals will be labeled with Orange Biological Hazards labels for the duration of the study.
- Dispose of bedding according to Biohazard Cage/Bedding Change SOP.
- After animals are euthanatized, place carcasses into a red biohazard bag and contact EH&S for Pathological Waste Pick Up (human tumor cells carcass).

NOTE: Euthanized animals must be disposed as "Pathological Waste". See Hazardous Waste Management Manual, Section 5 for detailed instructions.

Chemical Hazards

- Use pharmaceutical-grade chemical hazards for experimental purposes, if available. Non-pharmaceutical grade drugs/chemicals may be used when a pharmaceutical grade product is not available or when there is a scientifically valid reason.
- To obtain cage cards and other items required for procedures (e.g., waste container, chemical stickers, etc.), laboratory personnel should contact DAR Manager/Supervisor one week prior to administration of hazardous materials.
- Chemicals must be properly prepared in laboratory fume hood or BSC.
- Post the Hazard Communication Sign (Exposure Control Plan) on the door leading to animal holding room.
- Label the cages with Blue Chemical Hazard cards.
  - Include hazard name and date of administration (first and last dates).
  - It is recommended to change bedding prior to administration.
- Animal cages will be labeled with Blue Chemical Hazards cards up to one week post last administration of chemical hazard.
- Dispose of bedding in the chemical waste container inside the BSC during chemical hazard administration and up to one week post final administration.
- Change animals into new clean cage(s) and bedding. Remove Blue Cards labels from cages. These animals are now considered ABSL1.

NOTE: If animals are euthanized within one week of chemical hazard administration, dispose of carcasses as "Chemical Waste Carcass". Place carcasses in a brown bag and place it inside a leak-proof bag (Ziploc) labeled with chemical stickers, place in lab/animal facility freezer and contact EHSA for waste pick up. See Hazardous Waste Management Manual, Section 5 for detailed instructions.

8.0 Hierarchy of Safety Controls

The Hierarchy of Safety Controls embodies engineering controls, administrative controls, and personal protective equipment. The Chemical Hygiene Plan, Section 4. Basics of Laboratory Safety and Biosafety Manual, Section 7. Biosafety Practices discuss the hierarchy in depth.

Engineering Controls

The fume hood or biosafety cabinet (BSC) is frequently used for procedures involving chemicals or biological hazardous substances. The ventilated cage-changing station is another apparatus where animal-related activities can be performed. Note that contaminated bedding shall be collected inside a BSC or ventilated cage-changing station. BSCs and fume hoods must be certified annually.

All animal handling and related injections must occur inside a certified biological safety cabinet in a procedure room using safety engineered sharps.

NOTE: Biosafety cabinet must be decontaminated with Bleach Rite 10% solution (or appropriate disinfectant) after use or cage change. Follow up with 70% ethanol or water to prevent surface corrosion.

Administrative Controls

Administrative controls (or work practice controls) are changes in work procedures such as written safety policies, rules, supervision, labeling, schedules, and training with the goal of reducing present risks. Administrative controls must be established and followed by all laboratory workers once developed and approved.

A standard operating procedure (SOP) is a collection of written instructions that explains how to operate safely with hazardous materials (biological, chemical, or radioactive), hazardous equipment, or hazardous processes.

Potential human health risks are related to working with laboratory animals or tissues from laboratory animals; awareness and good training are essential components for reducing these risks. Laboratory personnel handling hazardous substances will be trained by EH&S and DAR staff.

Another important aspect of administrative controls/hazard communication is proper signage and labeling. All containers housing hazardous materials shall be appropriately labeled per requirements of the Chemical Hygiene Plan, Section 5. Hazard Communication, Biosafety Manual, Section 7. Biosafety Practices, and Radiation Safety Manual, Section 7. Good Laboratory Practices.

Personal Protective Equipment (PPE)

Personal protective equipment (PPE) provides a physical barrier to materials that might otherwise come into contact with employees' skin, eyes, mucous membranes, and clothing. Selection should be based on specific knowledge of the potential hazard gained through training, experience, and sound professional judgment. NIOSH-approved respirators (e.g., N95, PAPR) should be worn when exposure to aerosols may occur. When the animal study requires additional protection, the employee will be given specific instruction from EH&S on the type of additional protection needed.

Use of protective clothing and safety devices is mandated when working with laboratory animals. Risk assessments assist in selecting the proper PPE. A disposable gown, gloves, bonnet, and surgical masks are supplied by the Department of Animal Resources (DAR). Reusable clothing is provided for husbandry staff and is laundered onsite and must not be taken home.

EH&S representatives are available to assist with the proper selection of equipment and training for staff. The extent of PPE required for an operation is established based on the risk involved and required PPE is posted on the entry sign into the facility. It is the responsibility of all personnel entering an area to note the specific equipment required and ensure its proper use.

Employees must wear the following personal protective equipment for handling animals, cages, and bedding.

- Disposable gown
- Safety glasses/face shield*
- Latex/Nitrile gloves
- Hair bonnet
- Shoe covers
- Surgical mask

* Safety glasses/face shield (safety googles if a splash hazard is present) are worn if animal is handled outside of a BSC or ventilated cage changing station.

9.0 Hazardous Waste Management

The storage, handling, and disposal of laboratory waste is tightly regulated to protect workers and the environment. Laboratory personnel must understand and follow directions on correct waste disposal practices, as communicated by the Hazardous Waste Management Manual.

Contact HazMat (hazmat@usc.edu) and Biosafety (biosafety@usc.edu) for assistance in hazardous waste characterization and management.

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10.0 Emergency Response

For general information on biohazardous, chemical, and radioactive spill clean-up, consult the Spill Response and Clean-Up web page. **LARGE SPILLS**: notify DPS (213) 740-4321 UPC or (323) 442-1000 HSC.

Biohazardous Spill Clean-Up

Follow instructions outlined in the Biohazardous Spill Clean-Up Guide Sheet.

Biohazardous Spill Inside a Biosafety Cabinet Clean-Up

1. Follow instructions outlined in the Biohazardous Spill Clean-Up Guide Sheet.
2. After clean-up, disinfect all surfaces of the biosafety cabinet with freshly prepared 10% bleach with a 15 minute contact time, followed by a wipedown with 70% ethanol to reduce corrosion.
3. Allow biosafety cabinet to run for at least 10 minutes before resuming work or turning off.

Animal or Veterinary Emergency

- **Animal Bite or Scratch**
  - Notify your supervisor and contact EH&S immediately at (323) 442-2200.
- **Animal-related or Veterinary Emergency** (e.g., injured or escaped animals, inappropriate animal activities)
  - Contact a USC DAR veterinarian: Dr. Ahrens (323) 527-8467; Dr. Aycock-Williams (213) 304-2946.
- **Animal Facilities-related Emergency**
  - Contact the the DAR facility manager Bruce Wilkison at (213) 280-5248.

Biohazardous Material Exposure

Potential Exposure/Minor Injury

1. Rinse affected body area with water for at least 15 minutes at eyewash/shower station or sink.
2. If the eyes are contaminated, forcibly hold them open and flush for at least fifteen (15) minutes.
3. Follow instructions for Non-Life-Threatening Workplace Injury or Illness at the Emergency Notification and Incident Reporting web page.

Emergency/Major Injury

1. Follow instructions for Emergency at the Emergency Notification and Incident Reporting web page.
2. NOTE: Cal-OSHA requires employers to immediately report any work-related death or serious injury or illness. Cal-OSHA defines a "serious injury or illness" {T8 CCR 330(h)} if the employee:
   a. Requires hospitalization for a period in excess of 24 hours for other than medical observation
   b. Suffers a loss of any member of the body
   c. Suffers any serious degree of permanent disfigurement

11.0 Occupational Health Program (OHP) for Laboratory Animal Users

Working with laboratory animals can present health risks to research personnel and other individuals that may have animal contact or incidental exposure. The USC Laboratory Animal Occupational Health Program is designed for personnel handling animals or animal tissues in research and/or fieldwork. Its purpose is to identify, evaluate, manage, and reduce the potential health risks associated with the care and use of animals.

An employee's risks are determined using the Animal Risk Assessment (ARA) form. Recommendations to prevent illnesses related to laboratory animal research is derived from the completed assessment. Anyone identifed in an animal protocol is required to submit the completed form every three years.

The Department of Animal Resources (DAR). the Institutional Animal Care and Use Committee (IACUC), and the Office of Environmental Health and Safety (EH&S) collaborate to implement this program and follow the recommendations documented in the following publications:

- Guide for the Care and Use of Laboratory Animals, (National Research Council; National Academy Press; Washington DC; 1996)
- Occupational Health and Safety in the Care and Use of Research Animals (National Research Council; National Academy Press; Washington DC; 1997)
- PHS Policy (OLAW, 1985)
- The current CDC/NIH Publication, (including the AAALAC) International Guidelines.

Occupational Health Screenings

All personnel covered by this program shall receive a preliminary medical evaluation through the administration of the ARA form. This shall include periodic re-evaluation under the following conditions:

- Anyone listed on an IACUC protocol as research personnel.
- Anyone working with animals for research, testing, or teaching purposes.
- Anyone having contact or exposure to laboratory animals (including casual exposure).
- Anyone with access to enter USC Animal facility
- Anyone enrolled in a Medical Surveillance program based on animal species (e.g., Primates, Sheep, and Goats) or high-risk work that involves practices suitable for work in an ABSL-3 facility with laboratory animals infected with indigenous or exotic agents or with agents that present a potential for aerosol transmission, and agents causing severe or potentially lethal disease (e.g., MPTP):

- Individuals who fall in this category may be asked to complete a medical exam or consult a medical professional to establish a health baseline and monitor the need for vaccinations or periodic medical evaluation. NOTE: This may include medical exams, pulmonary function tests, allergy tests, and any appropriate blood tests as required by the treating physician, including any required annual visit or follow-up medical evaluation and exit medical consults at the end of the project.
- If there is a change in an individual's health status (e.g., worsening allergies, pregnancy, diagnosis of an immune disorder). In this case, the individual will be required to be evaluated by an occupational medicine specialist for medical clearance to continue working in any high-risk environments and for taking prophylactic antiviral medications following high-risk exposure.
- If individuals stop working on high-risk projects before they move on to other projects on campus or depart from USC, a final consultation should be provided.
- Women of childbearing age who are planning to become pregnant shall receive a medical consult before commencing any potentially high-risk projects.

All personnel working with laboratory animals must submit a new ARA form, and written medical clearance shall be provided for each participant that opts in the program:

- Before being added to or listed on an IACUC protocol.
- Before the first contact with laboratory animals.
- Whenever there is a change in an individual's health status (e.g., worsening allergies, pregnancy, diagnosis of an immune disorder, etc.).
- Whenever exposure information changes (e.g., a new animal model is introduced in the lab).
- Whenever there is a change in procedures/agent that result in higher-risk procedures.
- Whenever an individual transfers to another laboratory and works with different agents or animals.
- At least every three years.
- Those who work in high-risk projects will need to meet the requirements set by an occupational health physician.

Appendix A

Standard Operating Procedures

- Administration of Biological Hazards (SOP2-0002)
- Administration of Chemical Hazards (SOP2-0001
- Biohazard Cage/Bedding Change (SOP2-0004)
- Chemical Hazard Cage/Bedding Change (SOP2-0003)
- BSC Proper Operation and Decontamination (SOP1-0001)

Appendix B

Hazardous Waste Disposal Guide Sheet

GuideSheet Hazardous Waste Disposal

The four major waste categories from university operations (e.g., research labs, medical clinics, and construction) are: chemical; biohazardous; radioactive; and universal. Strict regulations govern waste management and its disposal, and failure to comply may result in steep fines levied from local, state, and federal levels.

Chemical Waste

US EPA defines hazardous waste as: ignitable; corrosive; reactive; and toxic. Commingling of incompatible waste streams may lead to unintended chemical reactions with disastrous outcomes. To start the collection process:

1. Segregate chemical waste into appropriate waste streams. Do not mix solid waste with liquid waste.
2. Select the appropriate chemical containers[1] for disposal (see chart on next page).
3. Fill out an adhesive hazardous waste label or tag (supplied by EH&S) and apply to each container (see Hazardous Waste Labeling Guide Sheet for details).
4. Stage the containers per instructions in the Hazardous Waste Prep and Staging Guide Sheet.
5. Request a hazardous waste pick-up via EHSA.

Biohazardous (Infectious) Waste

Biohazardous waste has potentially infectious pathogens that reside in cultures, fluids, sharps, pathological waste, and contaminated glassware. To start the collection process:

1. Select the appropriate bio containers[2] for disposal (see chart on next page).
2. Keep 33-gallon containers clean at all times. DO NOT remove the inner red bag.
3. DO NOT exceed the "fill line" of sharps and pharmaceutical/chemotherapy containers.
4. Request a hazardous waste pick-up via EHSA.

Radioactive Waste

Radioactive waste contains aqueous liquid, dry/solid, scintillation vials, organic liquid, sharps, and animal carcasses, and is segregated by each radioisotope.

Refer to the Radioactive Waste Disposal Guide Sheet for information on appropriate container(s) to collect waste and instructions for disposal.

What I need to know

- Chemical waste must NOT be poured down the sink for disposal. **Remember: "Dilution is NOT the Solution."**
- Keep waste containers capped/covered when not actively being used.
- Keep all glass waste containers in secondary containment. Do not store on the floor.
- Always wear appropriate personal protective equipment when handling hazardous waste.
- Questions? Contact hazmat@usc.edu.

Remember:

- **DO NOT** fill liquid containers completely. Leave enough head space to allow for expansion.
- **DO NOT** use structural formulas or abbreviations on the hazardous waste labels or disposal records.
- **DO NOT** store filled waste containers awaiting pick-up on the lab floor. Store in suitable cabinets.

Universal Waste

Universal waste applies to consumer products and business equipment that are near or at the end of their useful life. This includes: computer equipment, old lab equipment, batteries, aerosol cans, toner cartridges, light bulbs, and old office equipment to name a few. Refer to the Universal Waste Management Fact Sheet for more information.

To request a waste pick-up, complete the on-line form and submit. In the spirit of sustainability, EH&S always strives to recycle waste streams wherever possible.

[1] EH&S provides safety cans to recycle halogenated and non-halogenated solvents.
[2] EH&S supplies red bags and the following containers: sharps, pharmaceutical/chemotherapy, and 33-gallon.

USC University of Southern California

OFFICE OF ENVIRONMENTAL HEALTH & SAFETY
LABSAFETY@USC.EDU | HTTP://EHS.USC.EDU | 323.442.2200

Chemical Waste

Liquid

- Aqueous solutions containing toxic metals
- Concentrated acidic solutions (place in thick glass or plastic containers)
- Concentrated alkaline solutions (place in plastic containers)
- Mercury
- Silver salts (recycled)
- Used vacuum pump oil

Gross Solid

- Silica and alumina gels

Solid

- Contaminated PPE
- Kimwipes
- Chemicals no longer needed or wanted may remain in their original containers

Recycle

- Organic solvents
- Halogenated organic solvents

Pharmaceutical

- Outdated/empty vials, broken ampules, etc.

Chemotherapy

- Outdated/empty vials, broken ampules, etc.

Clean Glass

- Intact or broken glass NOT contaminated with chemical or biological agents
- Rinse three times and deface label before disposal
- Use heavy, puncture-resistant cardboard lined with plastic bag

Contaminated Glass

- Glass contaminated with chemicals only
- Use HDPE container or heavy, puncture-resistant cardboard lined with plastic bag
- Label box "Contaminated Glass"
- No microscope slides

Biomedical Waste

Solid Material

- Contaminated with human/animal fluids/blood or other biohazards e.g. gauze, paper towels, plastic-backed absorbents or bench coat, etc.
- Petri dishes
- Plastic pipettes
- Plastic pipette tips
- Plastic Vacutainer tubes
- Culture vials
- Live or attenuated vaccines in non-glass container
- Gloves and other personal protective equipment worn while working with biohazardous material or animals

Tabletop Container

- All items may be placed in small tabletop container, EXCEPT serological pipets.
- Place smaller waste bags into larger biohazardous waste can
- Do not overfill! NO SHARPS!

Liquid

- Decontaminate by approved method (e.g., in 10% bleach for 20 minutes); dispose down sink followed by water

Pathological Waste

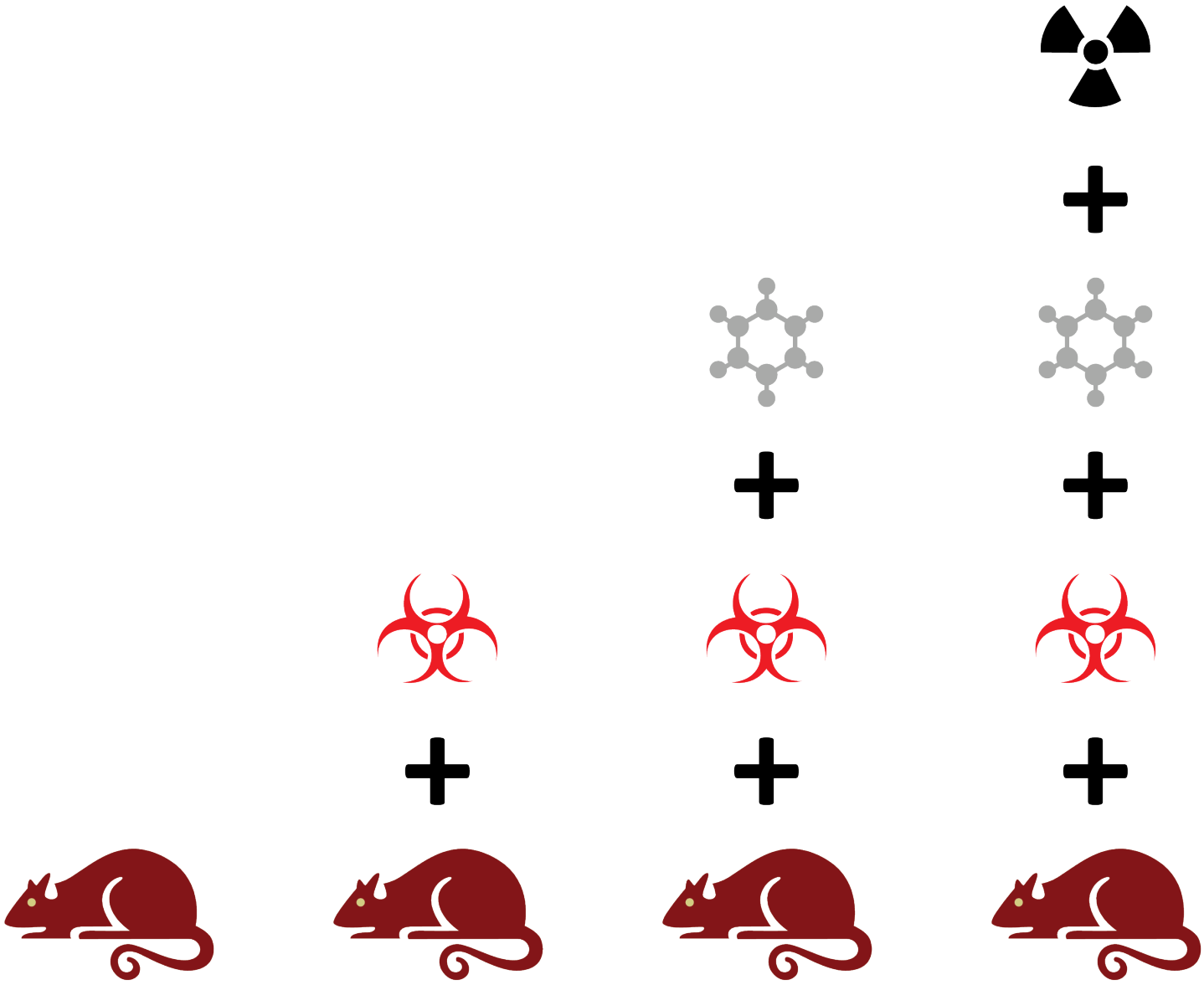
- Organs, tissues, and body parts removed by trauma, surgery, autopsy, or other medical procedure
- Animal carcasses with infectious materials
- Place materials in leak-proof bag

Sharps

- Needles
- Razor blades, scalpels
- Microscope slides
- Glass pipettes
- Dental wires
- Glass Pasteur pipettes
- Blood vials (glass Vacutainer tubes)
- Any contaminated material that can puncture/ penetrate the skin or Red Bag

Radioactive Waste: Refer to Page 2 of the Radioactive Waste Disposal Guide Sheet to select appropriate rad containers.

Animal Carcass Disposal Hierarchy



BROWN BAG

DAR INCINERATOR

RED BIOHAZARD BAG

PATHOLOGICAL WASTE
(HUMAN CELLS, PATHOGENS, VIRAL VECTOR)

ZIPLOC BAG & HAZMAT WASTE LABEL

EHSA CHEMICAL CARCASS

ZIPLOC BAG & RADIATION LABEL

EHSA RAD CARCASS

Appendix C

Biohazardous Spill Clean-Up Guide Sheet

GuideSheet Biohazardous Spill Clean-Up

Refer to the steps below to fully contain, deactivate, and clean up a minor biohazardous spills in the laboratory. For major spills, notify EH&S Hazmat at (323) 442-2200.

A. Notification and Response

1. Inform personnel in the area of the hazard.
2. Post a warning sign to inform others (see illustration at right).
3. Block off the area or minimize foot traffic (see floor placard at right).
4. Ask for help if you need it.
5. Check yourself for visible contamination.
6. Remove contaminated Personal Protective Equipment (PPE) and place it into a biohazardous waste container.
7. If the agent you are working with is aerosol-transmissible, leave the lab for thirty (30) minutes to let aerosols settle.
8. Put on new PPE (e.g., gloves, disposable gown, eye protection, and face mask) as necessary. It is recommended to don two pairs of gloves to prevent accidental exposure if the top pair becomes compromised.

B. Spill Clean-Up

1. Mix up fresh decontamination solution of 10% household bleach: one (1) part bleach + nine (9) parts water.
2. Place absorbent material (e.g., pads, paper towels) over the spill. DO NOT push on the paper towels with your hand as this may contaminate your gloves.
3. Pour - DO NOT spray - decontamination solution on the spill in a spiral motion from the outside edges to the center.
4. Wait for ten (10) to thirty (30) minutes depending on the nature of the spilled material. For example, a contact time of ten (10) minutes is sufficient for an all liquid material spill and a contact time of up to thirty (30) minutes is required for liquids with organic materials present.
5. Collect the absorbent material.
6. If large pieces of glass and/or other sharps are present, use tongs (not your hands) to retrieve them.
7. Use a broom and dustpan for needles and small pieces of broken glass.
8. Wipe up the excess liquid. Repeat steps 1 through 6, if necessary.

USC Environmental Health & Safety

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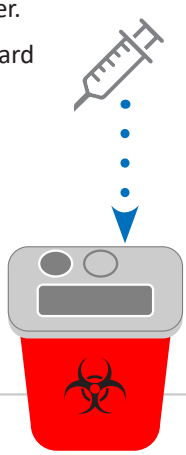
3434 South Grand Ave, CAL 120
Los Angeles, CA 90089-2815

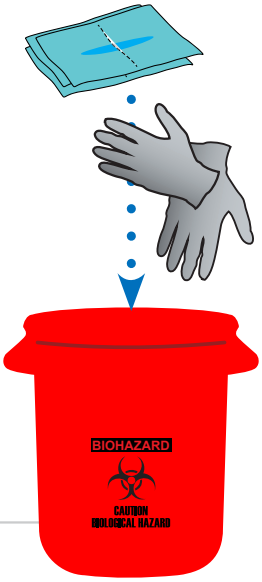
Health Sciences Campus
2001 N Soto St, SBA 329
Los Angeles, CA 90032

323.442.2200
biosafety@usc.edu
http://ehs.usc.edu

C. Post Spill Clean-Up

1. Discard all contaminated non-sharps into a red bag-lined, biohazardous waste container.
2. Discard all glass shards and other sharps in a sharps container.
3. Remove PPE and discard (if contaminated, dispose in biohazard waste container).
4. Wash hands with soap and water.
5. Report the incident to your Supervisor.
6. If the spill is large and you are unable to perform the cleanup in a safe manner, notify DPS at (213) 740-4321.





DIY Biological Spill Kit Contents

- Disposable gloves (different sizes)
- Eye protection (goggles, safety glasses)
- Disposable gowns, aprons, and sleeve covers
- Shoe covers
- Surgical loop masks or face shield
- Tongs or long metal forceps
- Biohazard waste bags
- Decontamination solution (e.g., Bleach)
- Squirt bottle
- Paper towels or other absorbent material
- Sharps container
- Spill cleanup instructions
- Warning signs
- Storage container with lid (puncture and leak proof is preferred, as the container can be used to collect the solid biohazard waste generated during the spill cleanup)
- Broom with dustpan

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Office of
Environmental
Health and Safety

(323) 442-2200
ehs@usc.edu