

# Guidelines for Personnel Protection in Animal Facilities

## PURPOSE

The intent of this guideline is to provide a basis for understanding the potential hazards when working in an animal facility and the specific protective measures to reduce the risk, with an emphasis on personal protective equipment (PPE). Two principles serve as the basis for selecting appropriate protective measures: 1) protection of personnel from biological (e.g. bloodborne pathogens), physical (e.g. sharps), chemical (e.g. corrosives or flammables, or other types of hazards (e.g. allergens), and 2) protection of animals from the introduction of disease. It is essential to recognize that a variety of factors (e.g., personnel/animal disease status, immunocompetence, procedure/activity, use of hazardous agents, chemicals/radiation, physical factors such as facility design and function, etc.) influence the selection of appropriate PPE. For that reason, definitive guidelines are not provided, and this guideline outlines basic best practices to which exceptions may be warranted.

For a protective program to be effective, a job hazard analysis should be conducted and documented by a representative of the animal program staff working with their designated Division of Occupational Health and Safety (DOHS) occupational safety and health specialist to identify any potential hazards. This analysis will establish the framework in developing a comprehensive preventive strategy by incorporating principles of industrial hygiene, including engineering controls, administrative controls and the use of personal protective equipment. Personnel with questions regarding any research related safety concern or who may have a specific health concern, should contact the DOHS, the Division of Radiation Safety (DRS), or the Occupational Medical Service (OMS).

In addition to the protection provided by PPE, hand washing is an important adjunct to the use of gloves for prevention of the spread of infectious organisms, or other contaminants, to both personnel and animals. While the use of moisture impermeable gloves will greatly decrease the spread of contaminants from a person's hands, they will not eliminate this transfer due to micro-breaks in the glove materials, regardless of type (latex, vinyl or nitrile). For effective hand washing, soaps coupled with copious rinsing with free-flowing water are important. In situations where hand washing is impractical, or as a supplement to hand washing, alcohol-based hand sanitizing agents are recommended for use. In all situations, hands should be washed when exiting any animal facility.

The following pages provide a list of definitions, species summaries of potential hazards, tables of select zoonotic organisms, and tables providing best practices for protective clothing. The summaries and tables are organized according to six main categories: nonhuman primates, rodents/rabbits, carnivores, ungulates, fish/frogs and cage wash.

**Note:** The first line of defense against personnel injuries or exposures in the laboratory or animal care setting is minimizing any exposure of skin on the limbs or trunk of the body. This includes the foot which should be fully enclosed in the shoe. The covering of exposed skin

becomes even more important in an environment where there is a potential for animal bites, scratches, and/or exposure to dangerous splashes, droplets, or aerosols. (For further information about minimum clothing requirements see [NIH Exposure Control Program for Non-Hospital Personnel and](#) NIH Manual Chapter 1340 which contains an Appendix outlining the minimal clothing attire and required PPE for work in NIH laboratories.)

## DEFINITIONS

**Animal facility.** Any and all buildings, rooms, areas, enclosures, or vehicles, including satellite facilities, used for animal confinement, transport, maintenance, breeding, or experiments inclusive of surgical manipulation. Examples include central animal facility (i.e., an animal facility managed by the Division of Veterinary Resources, Office of Scientific Resources, Office of Research Services, and utilized by more than one Institute/Center), satellite facility (i.e., any containment outside of a core animal facility or centrally designated or managed area in which animals are housed for more than 24 hours), shared animal facility (i.e., facility shared by more than one IC and managed by a Lead IC), and study area (i.e., any building room, area, enclosure, or other containment outside of a core facility or centrally designated or managed area in which regulated animal species are housed more than 12 hours.)

**Burn protection.** Personal Protective Equipment (PPE) designed and intended to prevent burns resulting from contact with high temperature surfaces or liquids. Examples include aprons and heat resistant gloves which can be used for protection against burns in cage wash areas.

**Chemical protection.** PPE that is designed to prevent splash and contact exposure to hazardous chemicals. Selection of chemical protection should include assessment of chemical compatibility and breakthrough times, as well as extent of coverage required. Examples include chemical resistant aprons and gloves which can be used for protection against chemical hazards in preparation and administration of hazardous chemicals during animal research.

**DOHS.** [Division of Occupational Health and Safety.](#)

**Face mask/Surgical mask.** Mucous membrane protection used to prevent exposure to droplets or splashes. These may be useful in reducing mucous membrane exposure to allergens or droplets from oral and nasal discharge. Dust/face/surgical masks are not respiratory protection and do not provide protection against airborne respiratory hazards.

**Gloves.** PPE designed to protect the hands from exposure to chemical, biological, or physical hazards. Proper glove selection includes identifying the route of exposure, determining an appropriate barrier to the exposure, and understanding the limitations of the glove (e.g., breakthrough time for chemicals, potential allergic response to the glove material, etc.). examples of specific glove types include:

- **Arm length bite resistant gloves.** Heavy, reinforced gloves, usually of leather or similar material. The sleeves of these gloves should extend up to or over the elbows offering protection of the hands and forearms. These gloves do not necessarily prevent an animal from biting or causing injury; however, they usually prevent the bite from breaking the skin. A disadvantage of these gloves is that they greatly reduce tactile ability and mobility of the user.
- **Bite resistant gloves.** Gloves made from materials resistant to punctures, such as Kevlar® and stainless-steel mesh, which are worn either over impermeable gloves or under other protective

gloves to reduce bite punctures.

- **Moisture impermeable gloves.** Vinyl, latex or nitrile gloves which greatly decrease contamination of skin by wet or dirty surfaces. Chemical compatibility is very important in selecting these types of gloves. Additionally, compatible gloves may have a limited lifespan for chemical protection before the chemicals permeate the glove.

**Hand sanitization.** The process of removing biological, chemical, or physical contamination from the skin using cleaning or disinfecting agents, such as alcohol-based hand sanitizers. The use of alcohol-based hand rubs can reduce skin pathogens; however, they are not a substitution for hand washing.

**Hand washing.** The use of soap coupled with manual scrubbing of the hands and copious rinsing with free-flowing water.

**Hearing protection.** Equipment worn to protect the ear when exposed to >85 decibels (e.g., foam plugs, ear muffs).

**Mucous membrane protection.** A device or combination of devices, which protect the mouth, nose and eyes from splashes or droplets. Examples of mucous membrane protection are full face shields, safety glasses/protective glasses, surgical face masks, surgical face mask and eye shield combinations, form fitting goggles plus a surgical face mask, and Powered Air Purifying Respirators (PAPRs).

**OMS.** Occupational Medical Service, Building 10 Clinical Center 6<sup>th</sup> Floor, Room 6C306. [https://www.ors.od.nih.gov/sr/dohs/HealthAndWellness/OccupationalMedical/Pages/oms\\_main.aspx](https://www.ors.od.nih.gov/sr/dohs/HealthAndWellness/OccupationalMedical/Pages/oms_main.aspx)

**PAPR.** Powered Air Purifying Respirator – an article of PPE that provides protection from splashes and other mucous membrane exposures, as well as aerosolized respiratory hazards. PAPRs utilize a battery-powered pump that filters ambient air and delivers clean air to the user. PAPRs are limited by the types of filters used and may not be appropriate for all situations. <http://www.ors.od.nih.gov/sr/dohs/Documents/Respiratoryprotectionprogram.pdf>

**Respiratory protection.** A device or combination of devices which protects the mouth, nose, eyes, upper-airways, bronchi and lungs from splashes, droplets and aerosols; DOHS approved full face shield plus a fitted N95 face mask or other approved respirator; form fitting goggles plus a fitted N95 face mask or other approved respirator; Powered Air Purifying Respirator (PAPR).

**Shoe covering.** Stretch booties, usually made of paper or plastic, worn over street shoes that may protect them from contamination.

**Safety/Steel toed shoes.** Work shoes reinforced with steel or other impact and puncture resistant materials over the toes.

**Street clothes covering.** A garment such as a lab coat or coveralls, worn to protect street clothes from contamination.

**Uniform.** A dedicated facility uniform may be substituted for a covering garment. If uniforms are dedicated for the facility, they should be covered when exiting the facility.

## NONHUMAN PRIMATES

### HAZARDS TO PERSONNEL

**Zoonotic Diseases:** Nonhuman primates (NHPs) and humans are similar enough to share many of the same diseases, and dissimilar enough that agents relatively asymptomatic in one species can devastate the other. *Macacine herpesvirus-1* (B Virus), tuberculosis, and various enteric infections are some of the more common zoonoses associated with old world nonhuman primates. New world primates also harbor zoonotic diseases including tuberculosis, measles, and enteric bacterial infections. While all nonhuman primates used for research at NIH undergo extensive quarantine testing and monitoring, many originate from free ranging, outdoor housing areas, and can still harbor zoonotic diseases. Regardless of origin, all old world NHPs are considered potentially infected with Herpes B virus. Non-fixed tissues from nonhuman primates, especially neural, ocular and oral tissue can be infectious and require extra care when handling. **Table 1** lists some relevant pathogens that are transmissible from monkeys to humans that can be of concern.

**Allergies:** Allergies to NHPs have been reported but are less common than those to some other laboratory animals as described below.

**Wounds:** All animal procedures should be performed by properly trained personnel, with a vigilant approach to the prevention of bites, scratches, and splashes both for the minimization of physical injury and the prevention of disease transmission, especially *Macacine herpesvirus-1* (B Virus) for macaque species. Proper personal protective equipment should be worn when working with all NHPs as described below, especially when scratches, bites, and splashes are possible. All facilities must have appropriate bite/scratch kits available to staff and should have appropriate standard operating procedures for first aid of wounds and mucous membrane splashes. Staff working with NHPs should be trained on how to effectively manage and treat injuries, splashes, or other sources of contamination in their working environment. All wounds and splashes, even injuries resulting from the handling of non-fixed nonhuman primate tissue or equipment potentially contaminated with the animal's saliva or other bodily fluids must be reported to OMS.

### PROTECTIVE MEASURES

***Each facility should set their own requirements for entry into the facility, work within the facility, and specific unique situations to their facility; the requirements should be based on documented communication between the animal program and NIH Division of Occupational Health and Safety.*** Table 2 describes risk assessment and potential PPE considerations for various risk levels. Some general recommendations are as follows:

- Clothing:
  - o According to NIH Policy Manual 1340, all personnel must wear a lab coat or equivalent body covering while performing laboratory operations or in areas adjacent to work with hazardous materials. Based on this NIH requirement, personnel must wear dedicated facility clothing or a covering over street clothes (lab coat or Tyvek® (or similar) suit) upon entering nonhuman primate rooms. Use is further recommended in hallways, procedure rooms, or other areas where there is a likelihood of encountering primates, dirty cages, or other soiled equipment.

- Hair covering should be considered to reduce allergen exposure and prevent contamination of one's hair.
- Gloves:
  - Moisture impermeable gloves must be worn when a scratch hazard is present, when handling an animal or soiled equipment, or when any other biological or chemical hazard is involved
  - Double gloves are recommended, and the outer layer of gloves should be changed when soiled.
  - If two layers of gloves are used, consideration should be given to the use of a combination of materials as different glove materials provide different levels of protection in different circumstances.
- Shoe covers:
  - To reduce the spread of contaminants to areas outside of the facility and to protect personnel's shoes from exposure to zoonotic agents, facilities should consider requiring either shoe covers or dedicated facility shoes within the animal facility.
  - Shoe covers or dedicated shoes must be removed before exiting the animal facility and entering common use areas.
- Mucous membrane and eye protection:
  - Mucous membrane protection, including eye protection, is required when working within 3 ft of nonhuman primates and suggested when there is a reasonable likelihood of encountering primates (for example in a hallway used to transport animals). In the latter situation, protection should be available in case there is unanticipated and unavoidable contact.
  - Mucous membrane protection, including eye protection, is required when entering a primate animal holding room, especially when old world primates are present.
  - Specific PPE to provide mucous membrane and eye protection should be determined by the facility but can include surgical face masks, dust masks, goggles, disposable face shields, reusable face shields, PAPRs, N95 respirators, or any combination thereof.
- Additional precautions:
  - Working with awake NHPs: Protective measures should be determined based on a documented communication between the animal program and DOHS
  - When performing surgery, necropsies or other activities that may increase the risk of aerosol generation, mucous membrane protection must be worn, and consideration should be given to the use of respiratory protection.
  - Puncture resistant gloves should be considered when performing necropsies on nonhuman primates
  - All personnel should wash their hands prior to or upon exiting the NHP facility

**TABLE 1 – RELEVANT ZONOTIC DISEASES OF NONHUMAN PRIMATES**

Zoonosis	Agent	Route of Transmission
Diarrhea; gram negative sepsis	<i>Enterobacteriaceae: Salmonella spp. Shigella spp., Campylobacter spp., Yersinia spp.</i>	Fecal-oral
Protozoal Diarrhea	<i>Entamoeba histolytica, Giardia spp., Balantidium coli, Cryptosporidium spp.</i>	Fecal-oral
Tuberculosis	<i>Mycobacterium tuberculosis, M. bovis</i>	Splash/spray
B Virus Meningoencephalitis	<i>Macacine herpesvirus-1</i>	Bite, scratch, or splash exposure of mucous membranes or open skin
Hepatitis	Hepatitis A virus, Hepatitis E virus	Fecal-oral
Measles	Rubeola virus	Splash/spray
Foamy virus	Spumavirus	Direct Blood/Tissue Contact with infected tissue or contaminated materials
Herpes simplex	<i>Herpes simplex</i>	Direct contact
Helminths	<i>Oesophagostomum spp. Strongyloides spp., Bertiella spp.</i>	Fecal-oral
Dermatomycosis (Ringworm)	<i>Trichophyton spp.</i>	Direct contact

**TABLE 2 – PERSONAL PROTECTIVE EQUIPMENT RECOMMENDATIONS FOR PERSONNEL WORKING IN NONHUMAN PRIMATE FACILITIES**

**Considerations:** The appropriate protection for specific work depends on the degree of risk involved. In general work activities can be characterized as low, moderate, or high risk as detailed below. *Donning a street clothes covering, or dedicated lab coat/uniform is required to enter a Nonhuman Primate room at the NIH.* Thorough washing of hands is recommended when exiting any animal facility or laboratory. The following provides a framework for risk assessment and establishment of facility SOPs and best practices for PPE<sup>1</sup>:

Activity Risk Level	Description	Suggested PPE
<p><b>Low</b></p>	<ul style="list-style-type: none"> <li>• <b>Working Environment:</b> Generally clean areas such as corridors, transport vehicles, and laboratories with animals restrained in enclosed transport vessels or otherwise enclosed</li> <li>• <b>Splash/droplet potential:</b> Does not support the generation of splashes or droplets</li> <li>• <b>Animal Activities:</b> No risk of direct contact with an awake, restrained, sedated, or anesthetized NHP or their unfixed tissues or body fluids</li> <li>• <b>Equipment Contact:</b> Very low risk of contact with equipment and surfaces which have been in contact with NHPs or their unfixed tissues or body fluids</li> <li>• <b>Proximity Risk:</b> Low. Personnel can stay out of the proximity (&gt; 3 feet) of NHPs, as well as unfixed NHP tissues or body fluids</li> </ul>	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering is recommended</li> <li>• Facilities may require additional PPE including:               <ul style="list-style-type: none"> <li>• Moisture impermeable gloves</li> <li>• Shoe covering</li> <li>• Mucous membrane protection (Face mask and eye protection)</li> <li>• Hair covering</li> </ul> </li> <li>• For situations of unexpected primate contact, it is advisable to have additional PPE close/nearby to prevent risk of accidental exposure</li> </ul>
<p><b>Moderate</b></p>	<ul style="list-style-type: none"> <li>• <b>Working Environment:</b> Areas, such as holding rooms, procedure rooms, etc, where exposure to NHPs as noted below is likely and/or which are likely contaminated by NHP bodily fluids or other contaminated materials</li> <li>• <b>Splash/droplet potential:</b> Supports the generation of splashes, but not aerosols</li> <li>• <b>Animal Activities:</b> Direct contact, activities where direct contact may occur, or activities that require close proximity (<math>\leq 3</math> ft) to awake, restrained, sedated, or anesthetized NHPs or their unfixed tissues and bodily fluids</li> <li>• <b>Equipment Contact:</b> Activities may generate contact with or splashes from equipment and surfaces which have been in contact with an</li> </ul>	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Moisture impermeable gloves (double gloves recommended)</li> <li>• Mucous membrane protection: Face mask (surgical mask, dust mask or full face shield) and eye protection (goggles, face shield, other)</li> <li>• Facilities may require additional PPE including:               <ul style="list-style-type: none"> <li>• Shoe covering</li> <li>• Hair covering</li> <li>• Bite resistant gloves for some activities</li> </ul> </li> </ul>

	<p>NHP or body fluids</p> <ul style="list-style-type: none"> <li>• <b>Proximity Risk:</b> Personnel cannot always stay out of the proximity (&gt; 3 feet) of NHPs as well as unfixed NHP tissues or body fluids where a splash risk exists</li> </ul>	<ul style="list-style-type: none"> <li>• Puncture resistant gloves for some activities</li> </ul>
<b>High</b>	<ul style="list-style-type: none"> <li>• <b>Working Environment:</b> Areas, such as holding rooms, procedure rooms, etc., where exposure to NHPs as noted below is likely and/or which are likely contaminated by NHP bodily fluids or other contaminated materials</li> <li>• <b>Splash/droplet potential:</b> <i>Supports the generation of aerosols</i></li> <li>• <b>Animal Activities:</b> Direct contact, activities where direct contact may occur, or activities that require close proximity (<math>\leq 3</math> ft) to awake, restrained, sedated, or anesthetized NHPs or their unfixed tissues and bodily fluids and which are expected to generate aerosols</li> </ul> <p><b>Equipment Contact:</b> Activities which have the potential to generate aerosols from equipment and surfaces which have been in contact with live or dead (including unfixed tissues and body fluids) NHPs</p>	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Moisture impermeable gloves (double gloves recommended)</li> <li>• Shoe covering</li> <li>• Mucous membrane protection: face mask (surgical mask, dust mask, or full face shield) and eye protection (goggles, face shield, other)</li> <li>• Hair covering</li> <li>• Respiratory protection required for aerosols and strongly recommended depending on risk assessment<sup>1</sup></li> <li>• Facilities may require additional PPE including: <ul style="list-style-type: none"> <li>• Heat resistant gloves for some autoclave, cagewash activities</li> <li>• Bite resistant gloves for some activities</li> <li>• Puncture resistant gloves for some activities</li> </ul> </li> </ul>

1. ABSL2, ABSL2 with 3 practices, ABSL3, ABSL4, and radioactive work environments may require additional PPE as directed by the DOHS and/or Division of Radiation Safety.

## RODENT AND RABBIT SPECIES

### HAZARDS TO PERSONNEL

**Zoonotic Disease:** Zoonotic disease associated with NIH's rodent and rabbit research holding facilities is infrequent in incidence due to the use of sentinel health monitoring programs, approved vendor procurements, and adherence to local policies for the importation of rodents and rodent products free from major zoonotic disease threats. Most zoonotic threats from rodents (e.g. rabies in woodchucks) would come from wild caught species used for research (which would necessitate special PPE requirements), the use of contaminated rodent products, the introduction of pathogens for research purposes, or rarely from feral rodents gaining access to research animals. **Table 3** lists some relevant pathogens that are transmissible from rodent and rabbit species to humans that can be of concern.

**Allergy:** Allergic skin and respiratory reactions are quite common in personnel working with laboratory animals. Hypersensitivity reactions to animal allergens are serious occupational health problems that develop in many individuals after repeated exposure. Hypersensitivity reactions include nasal congestion, rhinorrhea (runny nose), sneezing, itching of the eyes, asthma and a variety of skin manifestations such as redness, localized itching and flaking skin, and hives. Of the species used in biomedical research, the guinea pig, rabbit, mouse and rat appear to be the most allergenic. Urinary and salivary proteins from the animal's fur, bedding, and caging are known sources of allergens.

Methods of prevention as based on the DOHS Lab Animal Allergy Prevention Program ([LAAPP](#)) involve using engineering controls, administrative controls, and PPE. In practice this will include reduction of direct animal contact time, use of biological safety cabinets, filter tops on animal cages, ventilated caging rack systems, HEPA filtered bedding dump stations, and protective clothing, masks, or respirators when working with these species. Individual concerns should be discussed with OMS or a personal physician.

**Wounds:** Training in proper handling and restraint of rabbits and rodents is the single most effective measure in protecting personnel from bites and scratches from these species. Bite resistant gloves can be helpful when working with fractious rodent species and wearing long sleeves can help in avoiding scratches. Injuries should be reported to OMS.

### PROTECTIVE MEASURES

*Each facility should set their own requirements for entry into the facility, work within the facility, and specific unique situations to their facility; the requirements should be based on documented communication between the animal program and NIH Division of Occupational Health and Safety.* Table 4 describes risk assessment and potential PPE considerations for various risk levels.

**TABLE 3 – RELEVANT ZONOTIC DISEASES OF RODENTS AND RABBITS**

Zoonosis	Agent	Species	Route of Transmission
Rat Bite Fever	<i>Streptobacillus moniliformis</i> , <i>Spirillum minus</i>	Rodents	Bites, fecal-oral ( <i>S. moniliformis</i> ) Bites ( <i>S. minus</i> )
Lymphocytic Choriomeningitis	LCM virus	Rodents	Aerosol, bites, direct contact, fecal-oral
Hantavirus pulmonary syndrome	Hantavirus	Rodents	Aerosol
Cheyletiellosis	<i>Cheyletiella parasitivorax</i>	Rabbit	Direct contact
Dermatophytosis (Ringworm)	<i>Trichophyton sp.</i> , <i>Microsporum sp.</i>	Rodent, Rabbit	Direct contact
Tapeworm	<i>Hymenolepis nana</i>	Rodents	Fecal-oral
Tularemia	<i>Francisella tularensis</i>	Rabbit	Tissues
Plague	<i>Yersinia pestis</i>	Rodents	Infectious droplets, flea bites, contact with contaminated tissue
Leptospirosis	<i>Leptospira sp.</i>	Rodents	Contact with urine, contaminated bedding
Rabies	Rabies virus	Wild rodents	Saliva, bites

**TABLE 4 – PERSONAL PROTECTIVE EQUIPMENT RECOMMENDATIONS FOR PERSONNEL WORKING IN RODENT AND RABBIT FACILITIES**

**Considerations:** In rodent and rabbit facilities PPE functions to reduce staff exposure to allergens, protect staff from zoonosis, and to protect animals from the spread of infectious agents. The type of PPE needed depends on multiple factors including the use of allergen reducing equipment such as ventilated racks and biosafety cabinets, the susceptibility of the animal colony being housed, and the activity being performed. ***Donning a street clothes covering, or dedicated lab coat/uniform is required to enter a rodent and rabbit room at the NIH.*** Thorough washing of hands is recommended when exiting any animal facility. The following provides a framework for risk assessment and the establishment of facility SOPs and best practices for PPE:

Activity Risk Level	Description	Suggested PPE
Low Risk	Entering area with no anticipation of physical exposure to animals or soiled caging (such as a hallway in the animal facility)	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering is recommended and facilities may require use</li> <li>• Hair covering may be used, and facilities may require use</li> </ul>
Moderate Risk	Exposure to animals, animal allergens, or soiled caging from animals not exposed to biohazardous materials	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Hair covering</li> <li>• Moisture impermeable gloves</li> <li>• Mucous membrane protection<sup>1</sup>: face mask (surgical or dust mask)</li> <li>• Bite resistant gloves for some activities</li> <li>• Eye protection (goggles, face shield, other) for some activities</li> </ul>
High Risk	Potential exposure to biohazardous material or zoonotic agents	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Hair covering</li> <li>• Moisture impermeable gloves</li> <li>• Mucous membrane protection: face mask (surgical or dust mask) and eye protection (goggles, face shield, other)</li> <li>• Shoe covering</li> <li>• Bite resistant gloves for some activities</li> <li>• Respirator based on risk assessment</li> </ul>

1. Additional mucous membrane protection may be required by individuals with known sensitivities to various species. Also, eye protection may be required where a splash hazard is involved. Individuals are encouraged to consult with DOHS/OMS for further information.

## CARNIVORE SPECIES

### HAZARDS TO PERSONNEL

**Zoonotic Disease:** The most commonly used carnivores in the laboratory are dogs, cats and ferrets. Rabies is the most significant zoonotic disease associated with carnivores and is typically transmitted through bites and scratches. Carnivores procured for research at NIH are all purpose bred and housed in facilities that minimize the risk of exposure to rabies. Carnivores can carry enteric pathogens that pose a zoonotic potential for humans.

Personnel who work with carnivores must be aware that they can serve as vectors for the transmission of infectious agents between their own dogs, cats, ferrets, etc., and the same or similar species that they support at NIH. **Table 5** lists some relevant pathogens transmissible from carnivores to humans that can be of concern.

**Allergies:** Allergies to dogs and cats can occur and may sensitize workers to other lab species such as mice and rats. Allergies are most commonly thought of in regard to cats whose major allergy proteins are in the sebaceous glands of the skin that coat oil on the hair shaft and in their saliva. Allergic reactions to cats can come from contact with the fur or inhalation of the proteins. Dogs also carry a protein in their saliva that can result in allergic reactions. Methods of prevention include reduction in contact with the fur of cats (i.e., avoidance, or full coverage of arms and hands), and possibly the use of a surgical mask if splash or spray contact is a potential (i.e., spraying down cages or runs).

**Wounds:** Besides rabies, bites and scratches from dogs and cats are often associated with bacterial infections that can cause significant morbidity, and rarely, mortality. All facilities should have appropriate standard operating procedures for first aid of wounds. All wounds should be reported to OMS.

### PROTECTIVE MEASURES

*Each facility should set their own requirements for entry into the facility, work within the facility, and specific unique situations to their facility; the requirements should be based on documented communication between the animal program and NIH Division of Occupational Health and Safety. Table 6 describes risk assessment and potential PPE considerations for various risk levels.*

**TABLE 5 – RELEVANT ZONOTIC DISEASES OF CARNIVORES**

<b>Zoonosis</b>	<b>Agent</b>	<b>Species</b>	<b>Route of Transmission</b>
Bite & scratch bacterial agent	<i>Capnocytophaga canimorsus</i>	Dog, Cat	Direct contact
Cat Scratch Disease (Cat Scratch Fever)	<i>Bartonella henselae</i>	Cat	Bite
Pasturellosis	<i>Pasteurella multocida</i>	Dog, Cat	Scratch
Rabies	Rabies virus ( <i>Lyssavirus</i> )	All	Wound or bite Contact with saliva, brain
Dermatomycoses (Ringworm)	<i>Microsporum sp.</i> , <i>Trichophyton sp.</i>	Dog, Cat	Direct contact
Acariasis	<i>Sarcoptes scabiei</i>	Dog, Cat	Direct contact
Leptospirosis	<i>Leptospira sp.</i>	All	Urine, contaminated water, soil, or food
Salmonellosis	<i>Salmonella sp.</i>	All	Fecal-oral
Lyme disease	<i>Borrelia burgdorferi</i>	Dogs	Ticks
Toxoplasmosis	<i>Toxoplasma gondii</i>	Cats	Fecal-oral

**TABLE 6 – PERSONAL PROTECTIVE EQUIPMENT RECOMMENDATIONS FOR PERSONNEL WORKING IN CARNIVORE FACILITIES**

**Considerations:** In carnivore facilities PPE functions to reduce staff exposure to allergens, noise, and to protect staff from infectious agents. *Shoe covers or facility dedicated footwear is required to enter a carnivore facility at the NIH.* Hearing protection is recommended when working indoors with dogs. Thorough washing of hands is recommended when exiting any animal facility. The following provides a framework for risk assessment and the establishment of facility SOPs and best practices for PPE<sup>1</sup>:

Activity Risk Level	Description	Suggested PPE
Low Risk	Entering area with no anticipation of physical exposure to animals or soiled caging	<ul style="list-style-type: none"> <li>• Shoe covering</li> <li>• Hearing protection</li> </ul>
Moderate Risk	Exposure to animals, animal allergens, or soiled caging from animals not exposed to biohazardous materials	<ul style="list-style-type: none"> <li>• Shoe covering</li> <li>• Hair covering</li> <li>• Hearing protection</li> <li>• Bite resistant gloves for some activities</li> </ul>
High Risk	Potential exposure to biohazardous material or zoonotic agents	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Shoe covering</li> <li>• Hair covering</li> <li>• Hearing protection</li> <li>• Moisture impermeable gloves</li> <li>• Mucous membrane protection: face mask (surgical or dust mask) and eye protection (goggles, face shield, other)</li> <li>• Bite resistant gloves for some activities</li> <li>• Respirator based on risk assessment</li> </ul>

1. Additional mucous membrane protection may be required by individuals with known sensitivities to various species. Also, eye protection may be required where a splash hazard is involved. Individuals are encouraged to consult with DOHS/OMS for further information.

## UNGULATE SPECIES

### HAZARDS TO PERSONNEL

**Zoonotic Disease:** Zoonotic disease associated with ungulate holding facilities is usually limited, when the animals are kept in closed herds with proper vaccination and herd health programs. However, if they are kept in outdoor housing areas, they can still acquire and harbor certain zoonotic diseases. Of particular concern is the rickettsial disease caused by *Coxiella burnetii*, commonly known as Q Fever. Q Fever can be found in sheep, goats and cattle, but is most prevalent in sheep with a high infection rate throughout the US. *C. burnetii* is most commonly transmitted to humans from uterine tissues/fluids from infected ewes. Animals can be tested for Q fever before being brought into the vivarium to ensure a Q fever free colony. Although prion disease is rare in the US, caution should be used when handling non-fixed neural and ocular tissue from cattle because of the possibility of exposure to prions related to Bovine Spongiform Encephalopathy. **Table 7** lists some relevant pathogens transmissible from ungulates to humans that can be of concern.

**Allergies:** Allergies to cattle and horses have been reported but are less common than those to small laboratory animals.

**Wounds:** Because of the size of these species, injuries from being stepped on, kicked or butted can result from improper handling and restraint. Bite wounds may also occur. Training in proper use of halters, ropes and other restraint equipment is recommended. Wounds occurring when handling ungulates should receive proper, immediate disinfection, and should be reported to OMS.

### PROTECTIVE MEASURES

***Each facility should set their own requirements for entry into the facility, work within the facility, and specific unique situations to their facility the requirements should be based on documented communication between the animal program and NIH Division of Occupational Health and Safety.*** Table 8 describes risk assessment and potential PPE considerations for various risk levels.

**TABLE 7 – RELEVANT ZOO NOTIC DISEASES OF UNGULATES**

Zoonosis	Agent	Species	Route of Transmission
Q Fever	<i>Coxiella burnetti</i>	Sheep, Cattle, Goats	Aerosol; or direct contact, especially when dealing with the products of conception
Contagious Ecthyma (ORF)	Pox virus	Sheep, Goats	Direct contact
Tuberculosis	<i>Mycobacterium bovis, avium</i> or <i>tuberculosis</i>	Swine, Sheep, Goats	Aerosol or direct contact
Campylobacteriosis	<i>Campylobacter jejuni</i>	Swine, Sheep, Cattle	Fecal/oral
Dermatomycoses (Ringworm)	<i>Trichophyton</i> or <i>Microsporum</i> spp.	Cattle, Sheep, Goats, Swine	Direct contact
Bovine Spongiform Encephalopathy	Prion	Cattle	Direct blood/tissue contact with infected tissue or contaminated material (e.g. brain, spinal cord, ocular/retina, etc.)

**TABLE 8 – PERSONAL PROTECTIVE EQUIPMENT RECOMMENDATIONS FOR PERSONNEL WORKING IN UNGULATE FACILITIES**

**Considerations:** In ungulate facilities PPE functions to reduce staff exposure to allergens and to protect staff from infectious agents. ***Shoe covers, or facility dedicated footwear and hearing protection are required to enter an ungulate facility at the NIH.*** Thorough washing of hands is recommended when exiting any animal facility. Safety shoes should be worn when working with large ungulates. The following provides a framework for risk assessment and the establishment of facility SOPs and best practices for PPE<sup>1</sup>:

Activity Risk Level	Description	Suggested PPE
Low Risk	Entering area with no anticipation of physical exposure to animals or soiled caging	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Shoe covering</li> <li>• Hearing protection</li> </ul>
Moderate Risk	Exposure to animals, animal allergens, or soiled caging from animals not exposed to biohazardous materials	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Shoe covering</li> <li>• Hair covering</li> <li>• Hearing protection</li> <li>• Moisture impermeable gloves</li> <li>• Mucous membrane protection: face mask (surgical or dust mask) and eye protection (goggles, face shield, other) for some activities</li> </ul>
High Risk	Potential exposure to biohazardous material or zoonotic agents	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Shoe covering</li> <li>• Hair covering</li> <li>• Hearing protection</li> <li>• Moisture impermeable gloves</li> <li>• Mucous membrane protection: face mask (surgical or dust mask) and eye protection (goggles, face shield, other)</li> <li>• Respirator based on risk assessment</li> </ul>

1. Additional mucous membrane protection may be required by individuals with known sensitivities to various species. Also, eye protection may be required where a splash hazard is involved. Individuals are encouraged to consult with DOHS/OMS for further information.

## FISH AND FROG SPECIES

### HAZARDS TO PERSONNEL

**Zoonotic Disease:** Zoonotic diseases associated with fish and frog research holding facilities is infrequent in incidence but can occur. *Mycobacteria ulcerans*-like bacteria is a water borne pathogen that is endemic to tropical regions of Africa and can be transferred to humans from handling fish and frogs. **Table 9** lists some relevant pathogens transmissible from fish and frog species to humans that can be of concern.

**Allergy:** Aerosolized fish proteins can be a source of allergic reactions for people and symptoms can range from allergic rhinitis to asthma. There are also reports of occasional reactions to frog skin and secretions that range from cutaneous to respiratory signs.

### PROTECTIVE MEASURES

*Each facility should set their own requirements for entry into the facility, work within the facility, and specific unique situations to their facility; the requirements should be based on documented communication between the animal program and NIH Division of Occupational Health and Safety.* Table 10 describes risk assessment and potential PPE considerations for various risk levels.

**TABLE 9 – RELEVANT ZONOTIC DISEASES OF FISH & FROGS**

Zoonosis	Agent	Species	Route of Transmission
Mycobacteriosis	<i>Mycobacterium xenopi, fortuitum, marinum chelonae, ulcerans</i>	Fish, Frogs	Breaks in skin surface
Salmonellosis	<i>Salmonella spp.</i>	Frogs	Breaks in skin surface
Vibriosis	<i>Vibrio vulnificus</i>	Fish	Breaks in skin surface

**TABLE 10 - PERSONAL PROTECTIVE EQUIPMENT RECOMMENDATIONS FOR PERSONNEL WORKING IN FISH AND FROG FACILITIES**

**Considerations:** In aquatic facilities, exposure to potential zoonotic agents or allergens occurs through direct contact with the fish or frogs or indirect through exposure to system water. Personnel safety includes the wearing of closed-toed shoes with non-skid soles as the work environment includes wet floors. Waterproof gloves should be worn when holding/manipulating animals. Many husbandry tasks involve exposure to water without direct contact with animals. Use of gloves can limit exposure in some of these tasks, however; many routine tasks may involve immersing the hands into system water. In these situations, the gloves can trap system water against the skin causing prolonged exposure and no opportunity for the skin to dry. Thus, with some husbandry tasks involving contact with system water it may be more appropriately performed without gloves. As with other animal facilities, thorough washing of hands when exiting is essential. Hand wash or hand sanitation stations should be available after exiting the aquatic facility. The following provides a framework for risk assessment and the establishment of facility SOPs and best practices for PPE<sup>1</sup>:

Activity Risk Level	Description	Suggested PPE
Low Risk	Entering area with no anticipation of physical exposure to animals or system water	<ul style="list-style-type: none"> <li>• Shoes with non-skid soles</li> </ul>
Moderate Risk	Exposure to animals, system water, or dirty tanks	<ul style="list-style-type: none"> <li>• Shoes with non-skid soles</li> <li>• Moisture impermeable gloves (some husbandry tasks involving contact with system water may be more appropriately performed without gloves; based on risk assessment)</li> <li>• Mucous membrane protection: face mask (surgical or dust mask) and eye protection (goggles, face shield, or other) based on risk assessment for some tasks</li> </ul>
High Risk	Potential exposure to biohazardous or chemically hazardous material	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Shoe covering; shoes with non-skid soles</li> <li>• Moisture impermeable gloves</li> <li>• Mucous membrane protection: face mask (surgical or dust mask) and eye protection (goggles, face shield, or other) based on risk assessment</li> </ul>

1. Additional mucous membrane protection may be required by individuals with known sensitivities to various species. Also, eye protection may be required where a splash hazard is involved. Individuals are encouraged to consult with DOHS/OMS for further information.

## CAGE WASH AREAS

### HAZARDS TO PERSONNEL

**Allergy:** As discussed under the rodents and rabbits section of this guideline, rodent and rabbit salivary and urinary proteins are potential allergens. Exposure during dumping of cages should be minimized primarily through engineering mechanisms with supplemental PPE as appropriate. Washing cages from primate, carnivore or other species may also pose a risk of exposure to allergens.

**Physical Hazards:** Physical hazards for cage wash areas include mechanical injury (injuries and/or burns), hot water and/or steam, and chemical hazards. Cage wash involves the use of large equipment, pressurized equipment (e.g., autoclaves), heavy containers, hot water temperatures and the use of caustic chemicals. Personnel spray off equipment, prewashing racks and/or cages, dump water bottles, connect chemical drums to cage wash equipment and descale equipment.

**High Noise Levels:** Noise levels in cage wash areas can exceed 85 decibels and hearing protection is required.

### PROTECTIVE MEASURES

*Each facility should set their own requirements for entry into the facility, work within the facility, and specific unique situations to their facility; the requirements should be based on documented communication between the animal program and NIH Division of Occupational Health and Safety.* Table 11 describes risk assessment and potential PPE considerations for various risk levels.

**TABLE 11 – PERSONAL PROTECTIVE CLOTHING RECOMMENDATIONS FOR PERSONNEL IN CAGE WASH AREAS**

**Considerations:** The appropriate protection for cage wash- related activities depends on the degree of risk involved. *Donning a disposable street clothes covering or dedicated lab coat/uniform, and shoe covers or facility specific steel toe safety shoes, are required to enter a cage wash area at the NIH.* Thorough washing of hands is recommended when exiting any animal facility. The following provides a framework for risk assessment and the establishment of facility SOPs and best practices for PPE<sup>1</sup>:

Activity Risk Level	Description	Suggested PPE
Low Risk	Entering area with no anticipation of physical exposure to caging or equipment	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Steel toe safety shoes +/- shoe covering</li> </ul>
Moderate Risk	Procedures performed in wet areas or may involve exposure to high volumes of water; physical exposure to caging, bedding, water, and equipment	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Steel toe safety shoes +/- shoe covering</li> <li>• Hearing protection for some activities</li> <li>• Moisture impermeable gloves</li> <li>• Mucous membrane protection: face mask (surgical or dust mask) and eye protection (goggles, face shield, or other)</li> <li>• Rubber boots and waterproof apron for some activities</li> </ul>
High Risk	Procedures that may actively aerosolize waste/fluids or generate potentially contaminated fluids at either a high velocity/high volume; exposure to large volumes of steam; exposure to chemicals; risk to mucous membranes	<ul style="list-style-type: none"> <li>• Dedicated facility clothes or street clothes covering</li> <li>• Steel toe safety shoes +/- shoe covering</li> <li>• Hearing protection for some activities</li> <li>• Moisture impermeable gloves</li> <li>• Mucous membrane protection: face mask (surgical mask or dust mask) and eye protection (goggles, face shield, or other)</li> <li>• Rubber boots and waterproof apron for some activities</li> <li>• Heat resistant gloves for some activities</li> <li>• Respirator based on risk assessment</li> </ul>

1. Additional mucous membrane protection may be required by individuals with known sensitivities to various species. Also, eye protection may be required where a splash hazard is involved. Individuals are encouraged to consult with DOHS/OMS for further information.

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