

Guidelines for Personnel Protection and Minimum Requirements for Protective Clothing in Animal Facilities

Purpose: The primary intent of this guideline is to provide a basis for discussion of risk when working with various animal species and specific protective measures to reduce the risk, with an emphasis on personnel protective equipment. Two principles serve as the basis for selecting appropriate protective measures: 1) reducing or avoiding animal related accidents by understanding the potential for physical risks unique to each species, i.e. biting, scratching, kicking, etc.; and 2) decreasing or eliminating exposure to zoonotic diseases by understanding common diseases that may be encountered with each species. For a protective program to be effective, personnel working with animals should be convinced that the recommendations in place will significantly increase their safety. As such the most important preventive strategy is providing education and training in proper animal interactions and handling, and proper use of protective clothing and equipment. Personnel who are knowledgeable about the risks they face with a given species of animal and the protection offered by each device, article of clothing, and procedure should in turn be motivated to comply with the protection program.

In addition to the protection provided by Personal Protective Equipment (PPE), hand washing is an important adjunct to the use of exam gloves or in place of exam gloves for prevention of the spread of infectious organisms or other contaminants to both personnel and animals. While the use of exam gloves will greatly decrease the spread of contaminants from a person's hands, they will not completely 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 is required. 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 minimum requirements for protective clothing. The summaries and tables are organized according to five main groups of laboratory animals: rodents/rabbits, nonhuman primates, carnivores, ungulates, and fish/frogs.

Limits: This guideline should be used as a basis for developing internal Standard Operating Procedures for each site. This guideline is not meant to cover all the specific concerns that might be encountered in animal facilities, areas or labs, or to limit the requirements of these sites. Nor does this guideline intend to establish requirements for experiments that have special safety requirements such as the use of infectious disease organisms, hazardous chemicals or radiation sources, or for individuals with special health needs, such as pregnancy or immune deficiency. Personnel with questions regarding any research related safety concern or may have a specific health concern, should contact the Division of Occupational Health and Safety (DOHS), the Division of Radiation Safety (DRS), or the Occupational Medical Service (OMS).

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.

DOHS – Division of Occupational Health and Safety

Gloves:

- Arm length bite protection 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.
- Bite protection gloves – gloves made from materials resistant to punctures, such as Kevlar and stainless steel mesh, which are worn either over exam gloves or under other protective gloves to reduce bite punctures.
- Exam – Vinyl, latex or nitrile gloves which prevent contamination of skin by wet or dirty surfaces.

Hand sanitization – the use of alcohol-based hand rubs to reduce skin pathogens. NOTE: hand sanitization is not a substitution for hand washing.

Hand washing – the use of soap coupled with copious rinsing with free flowing water.

Mucous membrane protection – a device or combination of devices, such as a full face shield, surgical face mask combined with form fitting goggles or approved protective glasses, etc., which protect the mouth, nose and eyes from splash or droplet contamination.

OMS – Occupational Medical Service, 6th floor of the Clinical Center, Building 10

Shoe covering – stretch booties, usually made of paper or plastic, worn over street shoes to protect them from contamination. These should not be worn outside the animal facility. Dedicated footwear may be substituted for shoe coverings. If dedicated shoes are worn, shoe coverings may be used to cover them when moving outside the facility.

Street clothes covering – a garment such as a lab coat or coveralls, worn to protect street clothes from contamination. This garment should not be worn outside the animal facility. A uniform may be substituted for a covering garment.

Uniform – clothing dedicated for use only in the animal facility. In most circumstances it would not be worn outside the animal facility without appropriate covering.

References:

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NONHUMAN PRIMATES

HAZARDS TO PERSONNEL:

Zoonotic Diseases: Nonhuman primates and humans are similar enough that many of the same agents that cause disease in one species cause disease in the other, and dissimilar enough that agents relatively asymptomatic in one species can devastate the other. Cercopithecine herpesvirus-1 (B Virus), tuberculosis, and various enteric infections are some of the more common zoonoses associated with old world nonhuman primates. Even though research nonhuman primates go through a specific quarantine process, because they may be wild caught and/or living in outdoor housing areas, they can still harbor certain zoonotic diseases. Because the tissue can still harbor B Virus, care should be taken when handling non-fixed tissue, especially neural, ocular and oral tissue, from nonhuman primates. **Table 1** lists some prevalent pathogens that are transmissible from monkeys to humans that can be of concern.

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 damage and the prevention of disease transmission, especially Cercopithecine herpesvirus-1 (B Virus) for macaque species. Proper sleeves, mucous membrane protection and appropriate gloves should be worn when scratches, bites, and splashes are possible. All facilities should have appropriate standard operating procedures for first aid of wounds and mucous membrane splashes. 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 should be immediately reported to OMS.

PROTECTIVE MEASURES: **Table 2** outlines recommendations for specific activities associated with different risks of exposure. The guidelines assume that nonhuman primates have passed through an appropriate quarantine.

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 current use of Specific Pathogen Free animals and breeding programs, sentinel health monitoring programs, approved vendor procurements, and local policies for the importation of rodents and rodent products. Most zoonotic threats from rodents would come from wild caught species used for research (which would necessitate special PPE requirements), the use of contaminated rodent products or rarely from feral rodents gaining access to research animals. **Table 3** lists some prevalent 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, surgical 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 protection gloves can be helpful when working with fractious rodent species, and wearing long sleeves while handling rabbits can help in avoiding scratches

PROTECTIVE MEASURES: Table 4 outlines recommendations for specific activities associated with different risks of exposure from rodent and rabbit species.

CARNIVORE SPECIES

HAZARDS TO PERSONNEL:

Zoonoses: 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. A number of parasitic organisms are also of concern. Even though research dog and cats go through a specific quarantine process, because they may be from random sources and/or living in indoor/outdoor housing areas, they can still contract and harbor certain zoonotic diseases. In addition, 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 prevalent 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 regards 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 aerosolization/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 aerosol 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: Table 6 outlines recommendations for specific activities associated with different risks of exposure from carnivore species.

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. Although 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 prevalent 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: Table 8 outlines recommendations for specific activities associated with different risks of exposure to ungulate species.

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. Table 9 lists some prevalent 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: Table 10 outlines recommendations for activities associated with fish and frog species.

Table 1 – Prevalent Zoonotic Diseases of Nonhuman Primates

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

Table 2 - Protective Clothing Requirements for Personnel in Nonhuman Primate Facilities

ACTIVITY	REQUIREMENTS <i>(Hand washing should be performed upon leaving all animal facilities)</i>
Corridor activities: no contact with the animals or the cages	Mucous membrane protection as appropriate* and street clothes covering
Enter NHP room, no direct contact with the animals	Mucous membrane protection as appropriate*, street clothes covering or uniform and exam gloves.
Contact with a restraint device holding an awake macaque	Mucous membrane protection as appropriate*, street clothes covering or uniform and exam gloves.
Transfer alert monkey using a stand-off method such as pole/collar technique or transfer cage	Mucous membrane protection as appropriate*, street clothes covering or uniform and exam gloves.
Handling (e.g. hand catching or restraining) of an alert old world monkey .	Mucous membrane protection as appropriate, street clothes covering or uniform and arm length bite protection gloves.
Physical contact with an anesthetized monkey.	Mucous membrane protection as appropriate*, street clothes covering or uniform and exam gloves.
Cleaning cages.	Mucous membrane protection as appropriate* uniform, dedicated shoes, and exam gloves
Physical contact with restrained alert monkey	Mucous membrane protection as appropriate*, street clothes covering or uniform and exam gloves.
Physical contact with infant monkeys	Mucous membrane protection as appropriate*, street clothes covering or uniform and exam gloves. As infants mature, heavier gloves may be required.
Perform portions of experiments in a laboratory that do not involve physical contact with monkey or body fluids.	Protection appropriate for non-animal aspects of research.
Handling awake New World Species	Mucous membrane protection as appropriate*, street clothes covering, or uniform protective gloves appropriate for the species and size of animal being handled. Larger species such as Cebus should be handled with the arm length bite protection gloves, while very small species such as marmosets may be handled with lighter weight protection.

* **Mucous membrane protection** should be appropriate to the potential for splash hazard. The level of mucous membrane protection should be detailed in facility standard operating procedures (SOP's). SOP's are subject to review and approval by the IC ACUC with the concurrence of the Division of Occupational Health and Safety with consult by the IBC as necessary. The **degree of risk** involved in entering an animal holding room or working with awake animals varies with the design of the facility, the species involved and the nature of the task being performed. **Examples of high risk** situations include any procedures which may aerosolize NHP wastes or body fluids, e.g. hosing down animal rooms, dental work or tracheal intubation, especially of macaques. **Lower risks** are associated with fully restrained animals, anesthetized animals (However, Ketamine increases salivation which is a major source of potential B virus contamination from macaques.), and increased distance from animals. In **very low risk** situations, e.g. entering hallways through which animals in restraint devices may briefly pass, mucous membrane protection may not be required. The future definition and availability of SPF animals may alter these requirements.

Table 3 – Prevalent Zoonotic 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>); from feral rodent exposure
Lymphocytic Choriomeningitis	LCM virus	Rodents	Aerosol, bites, direct contact, fecal-oral ; from feral rodent exposure and rodent products.
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 ; from feral rodent exposure

Table 4 - Protective Clothing Requirements for Personnel in Rodent and Rabbit Facilities

ACTIVITY	REQUIREMENTS <i>(Hand washing should be performed upon leaving all animal facilities)</i>
Enter Animal Holding Room for Brief Visual Inspection	Street clothes covering or uniform
Contact with Primary Enclosures	Street clothes covering or uniform
Direct Contact with Animals	Street clothes covering or uniform, and exam gloves; mucous membrane protection should be worn to minimize allergen exposure*
Cage cleaning or change out	Street clothes covering or uniform, exam gloves, and mucous membrane protection appropriate for the risk of exposure to allergens and chemical agents*

* Additional mucous membrane protection may be required by individuals with known sensitivities to various species. Individuals are encouraged to consult with DOHS/OMS for further information.

Table 5 – Prevalent Zoonotic Diseases of Carnivores

Zoonosis	Agent	Species	Route of Transmission
Bite & scratch bacterial agents	<i>Capnocytophaga canimorsus</i> <i>Bartonella henselae</i> (Cat scratch Fever) <i>Pasturella multocida</i>	Dog, Cat Cat Dog, Cat	Direct contact Bite Scratch
Rabies	<i>Rabies virus (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

Table 6 - Protective Clothing Requirements for Personnel in Carnivore Facilities

ACTIVITY	REQUIREMENTS <i>(Hand washing should be performed upon leaving all animal facilities)</i>
Entry into animal runs or pens	Street clothes covering or uniform
Cleaning procedures for caging, runs or pens	Uniform, dedicated shoes or shoe covers, exam gloves, and mucous membrane protection as appropriate
Direct Contact with Animals	Street clothes covering or uniform, shoe covers and exam gloves for clinical procedures; exam gloves may not be required for socialization or enrichment procedures

Table 7 – Prevalent Zoonotic Diseases of Ungulates

Zoonosis	Agent	Species	Route of Transmission
Q Fever	<i>Coxiella burnetii</i>	Sheep, Cattle, Goats	Aerosol ; or direct contact , especially when dealing with the birth products
Contagious Ecthyma (ORF)	<i>Pox virus</i>	Sheep, Goats	Direct contact
Tuberculosis	<i>Mycobacterium bovis, avium or tuberculosis</i>	Swine, Sheep, Goats	Aerosol, or Direct contact
Campylobacteriosis	<i>Campylobacter jejuni</i>	Swine, Sheep, Cattle	Fecal/oral
Dermatomycoses (Ringworm)	<i>Trichophyton, or Microsporium spp.</i>	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 - Protective Clothing Requirements for Personnel in Ungulate Facilities

ACTIVITY	REQUIREMENTS <i>(Hand washing should be performed upon leaving all animal facilities)</i>
Entry into indoor animal holding areas	Street clothes may be worn
Entry into outdoor pens, runs, stables, etc.	Uniform, street clothes covering, shoe covers. If working in outdoor pens or runs dedicated shoes or rubber work boots are recommended.
Direct contact with animals	Street clothes covering or uniform, shoe covers and exam gloves for clinical procedures; exam gloves may not be required for socialization or enrichment procedures.
Cleaning animal holding areas (indoor or outdoor)	Uniform, or street clothes covering, exam or other protective gloves. Dedicated shoes or rubber work boots are recommended. Mucous membrane protection should be used as is appropriate.
Contact with pregnant sheep\goats\cattle; during parturition, their birth products, bedding and other wastes	Uniform, or coveralls, exam gloves and mucous membrane protection as is appropriate. Dedicated shoes or rubber work boots are recommended.

Table 9 – Prevalent Zoonotic Diseases of Fish & Frogs

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

Table 10 - Protective Clothing Requirements for Personnel in Fish & Frog Facilities

ACTIVITY	REQUIREMENTS <i>(Hand washing should be performed upon leaving all animal facilities)</i>
Direct handling of fish	Hand sanitizing necessary if exam gloves are not worn
Direct handling of frogs	Powder-free exam gloves suggested; hand sanitizing necessary if gloves are not worn
Placing hands into the water for husbandry, feeding, manipulating, etc.	Powder-free exam gloves suggested; hand sanitizing necessary if gloves are not worn