Title: Animal Contact Occupational Health and Safety Program	**Document No.:** OCS-303 **Revision No.:** 04 **Date:** October 25, 2022 **Approved By**: Avraham Boruchowitz, CSP, CHMM

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1.0 Purpose & Introduction

The Guide for the Care and Use of Laboratory Animals (Institute of Laboratory Animal Research, National Research Council) states that "Each institution must establish and maintain an occupational health and safety program (OHSP) as an essential part of the overall program of animal care and use (CFR 1984 Subparts A, B, C; DHHS 2009; PHS 2015).” The OHSP must be consistent with federal, state, and local regulations and should focus on maintaining a safe and healthy workplace (Gonder 2002; Newcomer 2002; OSHA 1998a). The components of this program are based on guidelines in the NIH Guide for the Care and Use of Laboratory Animals, the PHS Policy on Humane Care and Use of Laboratory Animals, the NRC Occupational Health and Safety in the Care and Use of Research Animals, the CDC Biosafety in Microbiological and Biomedical Laboratories, and the NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules.

The purpose of an occupational health and safety program is to minimize risks of occupational injury and illness by controlling or eliminating hazards in the workplace. Due to continuous changes in the hazards and risks associated with new research programs, new technologies, emerging biological hazards, and workforce diversity, a multidisciplinary approach to occupational health and safety that permits the continuing evaluation of potential workplace hazards and of the risks to those working with animals is necessary. For this OHSP to be effective, it requires coordination between the research program (as represented by the principal investigator), the animal care and use program (as represented by the Attending Veterinarian (AV), the Institutional Official (IO), and IACUC), Environmental Health and Safety (EHS), the Research Compliance Office (RCO), a physician or other licensed health care professional (PLHCP), and administration and management (e.g., Human Resources, Budget and Finance, and Facilities Management personnel).

The Guide for the Care and Use of Animals (Guide) (Institute of Laboratory Animal Resources, National Research Council) states that "An occupational health program is mandatory for personnel who work in laboratory animal facilities or have substantial animal contact." All persons who have contact with animals, unfixed animal tissue, or infectious organisms must be made aware of the potential hazards of working with animals and of the procedures available at the university to prevent and mitigate such hazards. It is the responsibility of the Principal Investigator (PI) of each Institutional Animal Care and Use Committee (IACUC) approved protocol to assure the IACUC that all individuals under their supervision (co-investigators, staff, students, and volunteers) who have contact with animals have been informed of the potential dangers involved and are aware of the procedures available to prevent and ameliorate such hazards. All program participants must be enrolled in this Animal Contact Occupational Health

and Safety Program and cleared prior to initiating animal contact. Completing the tasks laid out in this program will fulfill that responsibility.

Any individual who has been bitten or scratched while working with an animal, is experiencing signs and symptoms consistent with a work related exposure to an animal or an infectious organism being studied, or who has a known exposure to a zoonotic disease must report this information to his/her supervisor and to the appropriate health officials (EHS and any medical personnel providing treatment for the injury/exposure). In addition, an injured employee, or his or her supervisor, must fill out the Employer's Accident Report (EAR) and the Accident Investigation Report form. The Accident Investigation Report form should be completed for injuries/illness/exposures for all individuals, even non-employees (e.g. students, visitors). Both the EAR and Accident Investigation Report should be submitted to HR and EHS, respectively, within 24 hours. A copy of the EAR can be found in Appendix A and a copy of the Accident Investigation Report in Appendix B. Should the injury be a sharps injury (needle-stick, cut, etc.) completion of a Sharps Injury Report, *see the University Exposure Control Plan*, is required and must be submitted to EHS.

While an IACUC protocol may be approved before all the requirements of this program are fulfilled, no animals may be ordered for use with the protocol until the PI, and any other individual listed on the protocol, is in full compliance with the provisions of the program.

2.0 Scope

This program applies to all university faculty, staff, students and visitors, who by the nature of their work or activities, have contact with animals, which may include contact with unfixed animal tissue or infectious organisms and thus, should be made aware of the potential hazards of working with animals and of the procedures available at the university to prevent and mitigate such hazards.

Individuals who enter animal research facilities infrequently and have no direct contact with animals or environmental exposure are not required to fully participate in the OHSP. These individuals should not spend more than a minimal amount of time (e.g. 20-30 minutes) in hallways and animal rooms within the facilities, and should not spend more than a few minutes in a cagewash area. These individuals should be educated by their supervisor or tour guide on the potential hazards in the facility. Basic PPE (gloves and/or safety glasses/goggles) shall be provided by the employee/individual's supervisor, PI, and/or tour guide, however, any PPE that is additionally required by the facility will be provided by the animal research facility to the individual entering the space. Additionally, they will be offered the opportunity to voluntarily enroll and fully participate in the OHSP if they choose. Examples of roles that meet these criteria include: IACUC members, inspectors, visitors, Radford University Police and emergency

responders, EHS staff performing safety inspections or conducting hazardous waste collection, and Facilities Management staff performing minimal facility maintenance.

3.0 Responsibilities

Responsibilities for elements of the program and compliance are outlined in this section.

Institutional Official (IO): The institutional official (IO) allocates the resources needed to ensure the Program's overall effectiveness. Program needs should be clearly and regularly communicated to the IO by the AV, the IACUC, and others associated with the Program (e.g., Facilities Management staff, occupational health and safety personnel, scientists). As a representative of senior administration, the IO is responsible for resource planning and ensuring the alignment of Program goals of quality animal care and use with the institution's mission.

Attending Veterinarian (AV): The attending veterinarian is responsible for the health and well-being of all laboratory animals used at the institution.

Institutional Animal Care and Use Committee (IACUC): The IACUC is responsible for assessment and oversight of the institution's program components and facilities. It should have sufficient authority and resources (e.g., staff, training, computers and related equipment) to fulfill this responsibility.

Environment, Health and Safety Office (EHS): EHS should be involved in the establishment of prudent practices that comply with Occupational Safety and Health Administration (OSHA) standards. EHS should participate with a physician or other licensed health care professional (PLHCP) in the assessment of risk. Relevant training and hazard communication should involve all appropriate employees and students. Information on zoonoses and specific animal-facility hazards should be provided. Review of hazardous properties of agents used in research should be performed.

Principal Investigator (PI): It is the responsibility of the principal investigator of each IACUC-approved protocol to ensure that all individuals working on the protocol (co-investigators, staff, and students) and who have contact with animals or animal tissues have been informed of the potential hazards or risks involved to include the following

1. Review the Animal Contact Occupational Health and Safety Program and attend all required trainings.
2. Maintain the Animal Contact OHSP document so that it is readily available in your laboratory or similar work area and that of any co-investigators or off-site research

locations. Make its contents available to all animal handlers working in those labs and for semi-annual IACUC facilities inspections.

3. Make sure all animal handlers working in the laboratory and the laboratories of any co-investigators working under the protocol review this document and receive any required training.
4. Inform all relevant individuals of the procedures and personal protective equipment (PPE) available to prevent and reduce hazards or risks of injury or exposure to infectious disease. This also includes communicating hazards or risks specific to the research protocol to the animal care staff working with the PI's animals, but who are not under the PI's supervision. The PI must inform the animal facility manager of the risks and protective procedures to be followed, and the animal facility manager will instruct his or her staff.
5. Train animal handlers on the signs and symptoms related to any infectious disease work performed, or the zoonotic diseases that could potentially be transmitted by the species of animals with which the individuals are working. Notify Radford University EHS if there are reports of any suspicious signs and symptoms.
6. Complete the Notice of Understanding and Compliance, located in Appendix C. This notice should be submitted to EHS. A copy will be forwarded to the RCO, for semi-annual IACUC laboratory inspections.
7. When a medical care provider is seen for any illness, always let them know about work performed with animals and/or infectious organisms.

Animal Handler:

1. Review the Animal Contact Occupational Health and Safety Program training.
2. Enroll in the Animal Contact Occupational Health and Safety Program. (*Refer to Section 4.0 for enrollment procedures*
3. Follow established safe work practices, practice appropriate personal hygiene, and properly use and care for required personal protective equipment (PPE).
4. Inform their supervisors of any accident, injury, or near-miss that occurs.
5. Know the signs and symptoms related to the infectious disease work performed or the zoonotic diseases that could potentially be transmitted by the species of animals with which you work. Report any suspicious signs and symptoms to your PI or supervisor whether or not you recall an exposure incident.
6. When a primary care physician (PCP) or other medical care provider is seen for any illness, always let him/her know about work performed with animals and/or infectious organisms.

4.0 Program Procedures

4.1 – Initial or Changes of Duty

1. The PI or supervisor notifies EHS with the name and contact information of the individual(s), and works with personnel to fill out the Medical History & Risk Assessment Survey Questionnaire, located in Appendix D. *Note: PI's must complete this step as soon as possible after a protocol is submitted for approval so that there is sufficient time for vaccinations, if required, to take effect before work begins.* [On the form, Part I—Sections A-C are to be completed by Supervisor/Principal Investigator (PI); section D by the animal handler. Supervisor/PI only needs to complete this form one time for each individual under their supervision unless one or more of the following has changed: the duration of animal contact, the type of activity, and/or the type of animal. A Supervisor/PI should complete this form for him/herself. Part II—Sections A-D are confidential and are to be completed by the animal handler. All information must be completed and returned to the EHS to be delivered to the contracted medical provider.] **Each animal handler must also complete Appendix C.**
2. EHS performs an initial work practice evaluation to determine if an individual needs medical services beyond a review of the questionnaire by a PLHCP, and follows up on documentation of previous vaccinations.
3. A PLHCP reviews the medical questionnaire.
4. The PLHCP provides a written opinion to EHS documenting an individual's fitness for duty status.
5. EHS sends a list of people who are enrolled in the OHSP to the Research Compliance Office.

4.2 – Annual

1. Animal handlers and PIs provide an annual update to the Medical History & Risk Assessment Survey Questionnaire, located in Appendix D, ***if*** there have been any exposure, species, or job duty changes. **Each animal handler must also complete Appendix C.**
2. EHS reviews the annual update information.
3. If changes have occurred, EHS reviews work practices to determine if revisions are needed given the provided updates.
4. Annual updates and any new questionnaires are forwarded to a PLHCP for review.
5. The PLHCP provides a written opinion to EHS documenting an individual's fitness for duty status.

5.0 Occupational Health Considerations for Animal Users at Radford University

Personnel working with animals in research or teaching programs are potentially at risk for a variety of illnesses or injuries. Personnel working with animals may be exposed to zoonotic diseases, animal bites and scratches, injury from heavy caging equipment, burns and scalds from cage washing activities, hearing loss from animal vocalizations or machinery noise (especially in cage wash areas), sharps injuries (needle-sticks, cuts, etc.), biohazardous agents introduced into the animals, toxins, carcinogens, or radioisotope use. The presence of immunocompromised or pregnant animals or personnel in the workplace is also a concern. See below for additional information on specific risks when working with animals.

All employees must complete the Medical History & Risk Assessment Survey Questionnaire to document their medical history and work related exposures. Based on the information provided by the animal handler on the questionnaire, the PLHCP and EHS may recommend vaccinations, medical tests (such as TB, pulmonary function or titer/other blood tests) and other assessments as needed.

Personnel should always wear personal protective equipment (PPE) when working with animals. Such clothing may minimally include a laboratory coat, gloves and eye protection. Additionally, respiratory protection may need to be worn when working with diseases that may be airborne, when working with species that are known to be highly allergenic, or when an individual is allergic to a specific animal species. All employees who utilize respiratory protection must be enrolled in Radford University's Respiratory Protection Program. Please contact EHS at 540-831-7790 or ehs@radford.edu if you use or need to use a respirator and are not already enrolled in this program.

5.1 – Mechanical-Related Injuries and Other Physical Hazards

Crush injuries from handling heavy caging, hearing loss from loud mechanical equipment or animal vocalizations, slip and fall injuries that occur while working in wet environments, sprains and strain injuries from heavy lifting or restraint of large animals are examples of this type of injury. Proper training of personnel and the use of appropriate work practices and use of PPE is very important to prevent harm to workers. Contact your PI or supervisor for information regarding appropriate PPE and safety procedures if you work in such areas. Supervisors and PI's should contact EHS at 540-831-7790 or ehs@radford.edu if guidance is needed. *For additional information relating to Physical Hazards, and actions that may be necessary to mitigate such hazards, please consult Appendix F.*

5.2 – Chemical Hazards

The diversity of chemical-related hazards associated with animal research is tremendous. Chemicals are ubiquitous in the laboratory and animal room environments; chemicals are used to disinfect and clean surfaces, anesthetize animals, and process tissue samples. Most employees engaged in the care and use of research animals are familiar with the hazards of chemicals used in animal care and laboratory environments. Employee knowledge of chemical hazards and of relevant protective measures has been focused and increased in recent years through employers' responses to two important health and safety standards promulgated by OSHA: the Hazard Communication Standard (29 CFR 1910.1200) and the Occupational Exposure to Hazardous Chemicals in Laboratories (29 CFR 1910.1450), which is known as the laboratory standard. *For additional information relating to Chemical Hazards, and actions that may be necessary to mitigate such hazards, please consult Appendix G.*

5.3 – Experiment Related Injuries and/or Illnesses

Experimental animals that have been exposed to human pathogens or zoonotic diseases, human cell lines, toxins, carcinogens, or radioisotopes that are excreted by the animal, whether via bodily fluids (including saliva and respiratory excretions) or bodily wastes, can present significant human health risk. IACUC protocols include questions to assess these risks and the protocols are also reviewed by EHS. Supervisors must train animal handlers and animal users to ensure appropriate practices. Animal handlers and users are expected to review the protocol before handling any animals that have been experimentally infected with any agent or may be excreting hazardous substances. Animal handlers and laboratory staff should know the signs and symptoms of the disease caused by the infectious organism or animal species they are working with or the signs of any toxic exposure and report any illness with similar symptoms to their supervisors and EHS. *For additional information relating to hazards associated with Experimental Protocols, and actions that may be necessary to mitigate such hazards, please consult Appendix H.*

5.4 – Zoonotic Diseases

Zoonotic diseases are capable of being transmitted between humans and animals. They often do not cause obvious signs and symptoms in one species but may cause significant illness in another species. Over 150 diseases may be classified as zoonotic. Many of these diseases are of great concern and include Rabies, Herpes B Virus, Tuberculosis, Hepatitis, Q fever and Cat Scratch fever. *For additional information relating to hazards associated with Experimental Protocols, and actions that may be necessary to mitigate such hazards, please consult Appendix I.*

5.5 – Animal Allergies

Laboratory Animal Allergy (LAA) reactions are among the most common conditions affecting the health of workers involved in the care and use of research animals. It is a significant occupational health concern for many animal attendants, staff, scientists, and technicians engaged in the care and use of laboratory animals.

LAA is a hypersensitivity reaction from exposure to a laboratory animal or its fur, dander, urine, saliva, or other body tissues. The nature and intensity of the symptoms are dependent on the level of exposure to the laboratory animal allergen by the individual. Once the worker has been sensitized, symptoms generally occur rapidly (within minutes) of exposure. Continued daily exposure can result in chronic symptoms that may require daily treatment. Individuals with a history of asthma or allergies to pollens, animals, or cigarettes are at greater risk of developing sensitivity to laboratory species.

Before working with animals, individuals should read the NIOSH pamphlet "Preventing Asthma in Animal Handlers"; a web-based version of this pamphlet may be found at http://www.cdc.gov/niosh/docs/97-116/. Animal handlers should understand the risk of developing asthma and allergies from working with animals and follow the precautions described in the NIOSH Alert.

Several species of animals commonly used in animal research and teaching are also species that frequently cause allergic reactions in people. Among these species are the cat, rabbit, rat, mouse, dog and horse. Proper use of PPE can greatly reduce the allergenic effects of these species in sensitive persons. In addition, use of PPE can prevent sensitization in someone who is not currently allergic to laboratory animals. Contact EHS for guidance on the use of PPE to mitigate or prevent allergic reactions to the animals you are working with. *For additional information relating to Allergens, and actions that may be necessary to mitigate them, please consult Appendix J.*

5.6 – Animal Related Injuries

Such injuries would include bites, kicks, scratches and similar animal-inflicted wounds. Proper training for those handling animals, plus proper use of PPE, is essential for reducing the frequency and severity of these types of injuries. Consider bite/cut resistant gloves when handling certain animals. Contact your PI or supervisor for additional training or PPE, especially when being re-assigned to a new area or species of animal. Supervisors and PI's should contact EHS if guidance is needed. *For additional information relating to Animal Related Injuries, and actions that may be necessary to mitigate such injuries, please consult the same appendix as related to Physical Hazards, Appendix F.*

6.0 Occupational Health and Safety Program Elements and Procedures

The motivation for and commitment to conducting occupational health and safety programs are derived from two principal sources: a moral obligation to safeguard employees from unnecessary risks and a regulatory requirement that employers provide a safe and healthful workplace for their employees.

6.1 – Facility Design and Operation

During the design of a new facility or the renovation of an existing one, hazards associated with the care and use of animals should be addressed in a collaborative effort involving investigators who will use the facility, the manager and other principal staff of the IACUC, and Environmental Health and Safety staff. The design process begins with defining the species of animals expected to be housed in the facility and the nature of the research programs that will use them. Thorough consideration of hazards is necessary to ensure that the design will allow compliance with federal, state, and local government safety requirements and meet relevant accreditation standards. For example, adequate space should be made available for storage of hazardous materials and for the collection, storage, and processing of wastes. The potential users, the manager of the animal care and use program, a representative from EHS, the building engineer, and the architect should remain involved in the design and construction process until completion.

Special consideration should be given to the ventilation system, space arrangement and layout, support areas, traffic patterns, and access to utilities and mechanical areas. Criteria for selecting mechanical systems and equipment should be based on reliability, operational integrity, projected length of service, and ease of maintenance. The selection of space, layout of equipment, work surfaces, and traffic patterns will influence the operational effectiveness of the facility and the ease with which staff can maintain established administrative procedures for operating the facility safely. A program of preventive maintenance is necessary to ensure continued safe operation of a well-designed facility; this is an important aspect of occupational health and safety, particularly when efforts to minimize substantial risks require the use of engineering controls.

Careful attention should be given to prevention and control of ergonomic hazards in the design of animal facilities (NRC 1996). Engineering controls that reduce physical stress in repetitive operations and in the lifting and movement of heavy loads by animal care staff are important design objectives. Ergonomic design criteria should be used in the selection of fixed equipment, such as animal caging, necropsy tables, and sinks. Several authoritative references are available which provide comprehensive coverage of this important subject (CCAC 1993, DiBerardinis and others 1993, NRC 1996, Ruys 1991).

6.2 – Exposure Control Methods

Exposures to occupational hazards are controlled through the application of engineering controls, work practices, and the use of personal protective equipment. Those measures are used in a hierarchical structure. That is, it is first attempted to isolate employees from hazards with engineering controls. If engineering controls do not adequately control the exposure potential, work practices are modified to help to minimize exposure potential. Finally, personal protective equipment (PPE) might be required to provide a barrier between employees and hazards that cannot be otherwise controlled.

6.2.1 – Engineering Controls

Engineering controls are a combination of safety equipment and physical features of the facility that help to minimize hazardous exposures of personnel and the surrounding environment. Safety equipment provides a barrier between employees and hazards, and physical features can prevent or reduce the potential for release of hazardous agents from the immediate work area. Some engineering controls commonly used in animal care and research are barriers and airlocks, chemical fume hoods, biological safety cabinets, and isolation cages.

6.2.1.1 - Barriers

Barriers help to confine potential contamination to areas where it is generated and to control access to these areas. In animal biosafety level 3 facilities, barriers isolate animal areas from other, adjacent areas. The principal barriers are exhaust air ventilation systems that provide directional airflow, architectural barriers that control access to the animal facility, and airlocks that help to maintain air pressure differentials to ensure the proper direction of airflow. Access control barriers also have value for any animal facility because they can be used to prevent unauthorized people from entering the animal facility; this kind of control is difficult to accomplish without constructing an access foyer or special entrance area through which authorized people must pass before entering the facility.

6.2.1.2 – Chemical Fume Hoods

Chemical fume hoods are local exhaust devices that help to prevent toxic, offensive, and flammable vapors or dusts from entering a work area (DiBerardinis and others 1993, NRC 1995). They provide employee protection from such hazards as chemical spills, splashes or sprays, other accidentally released materials, fires, and minor explosions. Hoods should be properly located in the laboratory away from doors, supply air ducts, and high traffic areas. Hoods should be evaluated before use to ensure adequate face velocities (typically 80-120 ft/min) and the absence of excessive turbulence (NRC 1995). The hood installation should include a continuous airflow

monitoring device to allow the user to check operating conditions before conducting hazardous procedures. If inadequate hood performance is suspected, correct operation should be verified before the hood is used. The hood sash opening should be kept as narrow as reasonably practicable to improve the overall performance of the hood. The containment capability of hoods is also influenced by the amount and placement of equipment in the hood, persons walking by the hood, and the opening and closing of doors. Careful technique by the user is essential in achieving optimal performance.

6.2.1.3 – Biological Safety Cabinets

Biological safety cabinets (BSCs) are among the most effective, as well as the most commonly used, primary containment devices for work with infectious agents. Several types of cabinets are available, and authoritative references should be reviewed before a cabinet is selected for a particular experimental use (CDC-NIH 2009, Fleming and others 1995, Kruse and others 1991). As with any piece of laboratory equipment, personnel should be trained in the proper use of BSCs. Air balance and inward airflow are critical in the safe operation of these cabinets. BSCs should be certified in accordance with the National Sanitation Foundation Standard 49 (NSF 1992). This certification is arranged by EHS annually. Containment can be compromised by interruption in airflow caused by insertion and removal of a worker's arms through the work opening, opening and closing of room access doors, and movement of staff near the cabinet. Fans, heating and air conditioning diffusers, and other air-handling devices near the cabinet can also disrupt airflow patterns. BSCs can be configured to provide containment space for cleaning cages. They can protect both the animals and personnel from exposures to aerosols that are generated by cleaning procedures.

6.2.1.4 – Other Engineering Controls

Cage filter tops are used in animal research to prevent cross contamination with infectious agents. They prevent transmission of agents between and among animals and people by preventing particles from entering the cage. Isolation cages with filter tops that fit tightly to the cage rim can constitute an effective barrier to transmission of agents by the aerosol route, but they should be used in conjunction with a BSC to ensure containment during procedures that involve removing the cage top.

Ventilated caging systems also control hazards. Exhaust fans create a negative pressure gradient between the cage and the surrounding environment, and exhaust air is filtered with a high-efficiency-particulate-air (HEPA) filter before discharge into the animal room or the building exhaust; this combination can prevent the escape of bioaerosols from the animal environment.

Downdraft necropsy tables capture chemical vapors generated during necropsy. The tables are constructed with exhaust fans that produce a downdraft by drawing air through the work surface. Air velocities above the work surface, however, are not sufficient to capture aerosols that are generated by the procedure. The protective capacity of these tables can be compromised by air turbulence in the room, the size of the animal on the table, and general work practices. Their use should be carefully assessed by knowledgeable health and safety professionals.

Room ventilation is an important engineering control used to maintain comfortable temperature and humidity in the work area. Changing air continuously can reduce the concentration of airborne contaminants but does not replace the use of such containment devices as chemical fume hoods, biological safety cabinets, and filter top cages. A ventilation system that provides directional airflow can prevent the migration of airborne contaminants to unprotected space in the facility.

Cage cleaning and cage washing can result in high concentrations of particulate contaminants and very high heat loads from the cage washing equipment. Consequently, high ventilation rates are important for providing acceptable environmental conditions for personnel. Biological safety cabinets have been designed as bedding dump stations to protect workers from hazardous aerosols that might be generated during cage cleaning. Bedding disposal stations also provide such protection.

Local exhaust can be effective in controlling contaminants at the point of generation. Properly engineered and used canopy hoods and flexible exhaust ducts can substantially reduce occupational exposures to such hazards as animal dander and excreta liberated during cage cleaning, aerosols and vapors generated during anesthesia or necropsy, and heat emanating from cage cleaning or waste decontamination. Slot hoods can also be used in controlling these exposures, but their effectiveness depends on the correct static pressure, flow rate, and hood geometry (NRC 1995, p.190). Local exhaust devices are particularly useful for controlling emissions from equipment or procedures that cannot reasonably be contained in a hood (De Berardinis and others 1993, p.451). Local exhaust devices are not as effective as chemical fume hoods, so engineering and industrial hygiene professionals should be consulted to assist with selection or design for each specific application (NRC 1995, p.190).

6.2.2 – Work Practices

Work practices are the most important element in controlling exposures. Employees should understand the hazards associated with the procedures that they are performing, recognize the route through which they can be exposed to those hazards, select work practices that minimize exposures, and through training and experience acquire the discipline and skill necessary to

sustain proficiency in the conduct of safe practices. Several categories of work practices should be considered:

- Practices to reduce the number of employees at risk of exposure:
  - Restrict access to the work area.
  - Provide warnings of hazards and advice about special requirements.
- Practices to reduce exposures by direct and indirect contact:
  - Keep hands away from mouth, nose, eyes, and skin.
  - Wash hands when contaminated and when work activity is completed.
  - Decontaminate work surfaces before and after work and after spills of a hazardous agent.
  - Use appropriate methods to decontaminate equipment, surfaces, and wastes.
  - Substitute less-hazardous materials for hazardous materials whenever possible.
  - Wear personal protection equipment (gloves, gowns, and eye protection).
- Practices to reduce percutaneous exposures:
  - Eliminate the use of sharp objects whenever possible.
  - Do not recap needles.
  - Use needles with self-storing sheaths or those designed to protect the user.
  - Keep sharp objects in view and limit use to one open needle at a time.
  - Use appropriate gloves to prevent cuts and skin exposure.
  - Select products with puncture-resistant features whenever possible.
  - Use puncture-resistant containers for the disposal of sharps.
  - Handle animals with care and proper restraint to prevent scratches and bites.
- Practices to reduce exposure by ingestion:
  - Use automatic pipetting aids; never pipette by mouth.
  - Do not smoke, eat, or drink in work areas used for the care and use of research animals.
  - Keep hands and contaminated items away from mouth.
  - Protect mouth from splash and splatter hazards.
- Practices to reduce exposure by inhalation:
  - Use chemical fume hoods, biological safety cabinets, and other containment equipment to control inhalation hazards.
  - Handle fluids carefully to avoid spills and splashes and the generation of aerosols.
  - Use in-line HEPA filters to protect the vacuum system.

6.2.3 – Handling and Transport of Animals

Safety precautions are needed during animal handling and animal transportation to prevent human injury from animal bites, scratches, etc. and/or transmission of zoonotic agents. Handlers should wear personal protective equipment specifically chosen for the exposures that might be

related to the animals being handled or transported. Safety concerns are relevant to all who have access to the animals being transported and those who receive and use them.

6.2.4 – Personal Hygiene

Scrupulous attention to personal hygiene is essential for all personnel who care for and use research animals. They should wash their hands before and after handling animals and whenever protective gloves are removed. There should be no eating, drinking, smoking, application of cosmetics, or other activities that can increase the risk of ingesting hazardous materials or contaminating mucous membranes in animal care and animal use areas. Any protective clothing worn in an animal facility or procedure area must be removed before leaving. Airborne animal dander and other airborne contaminants can adhere to the employee's clothing, hair, and skin. A requirement for showering before leaving the facility may be necessary.

6.2.5 - Housekeeping

All animal care areas, including areas in which hazardous materials are used or stored, should be kept neat and clean. Clutter can become contaminated and add to problems of employee exposure, area decontamination, and waste disposal. Work surfaces should be wiped with disinfectant before work begins, immediately after any spill, and at the end of the workday. Floors should be disinfected or decontaminated daily or weekly as appropriate to the potential hazards. Appropriate dust suppression methods should be routinely used. Wet mopping and the use of a HEPA-filtered vacuum cleaner are appropriate for suppressing dust.

6.2.6 – Waste Disposal

Wastes need to be removed at scheduled intervals based on the amount of waste generated and the risk posed by the hazardous agents in the waste material. Planning is required to ensure that sufficient space is available for on-site collection, storage, treatment, and disposal of waste. The disposal of hazardous wastes is subject to federal, state, and local regulations. EHS staff work to stay informed of regulations, which change often, and to keep all on-site generators of hazardous waste informed of disposal procedures to ensure that they are in compliance with current requirements. *Consult Radford University's Hazardous Waste Management Guidebook for additional information regarding waste disposal.*

6.2.7 – Restraint of Animals

Species specific safe techniques should be used to restrain animals (NRC 1996, p.11). Physical restraint might require more than one animal handler. Hand catching of nonhuman primates should be discouraged; use of a pole and capture collar is a safe alternative. The use of

mechanical restraint devices or chemical restraints can reduce the potential for escape or injury when animals are being examined or handled. Employees should be aware that physical restraint can increase the inherent risks associated with the animal by intensifying excretions, secretions, and aggressive behavior of the animal.

6.2.8 – Cleaning Cages

Caution should be used in removing animals from their cages before cage cleaning to avoid escape. Contaminated shavings, feces, urine, and other potentially biohazardous, contaminated, or allergenic materials should be removed with methods that protect the workers (NRC 1996, p.43-4). Biological safety cabinets have been designed as bedding dump stations to protect workers from hazardous aerosols that might be generated during cage cleaning. Bedding disposal stations also provide such protection. Protective clothing is required to protect workers from contact and percutaneous exposure. The eyes, face, and body should be protected during use of hazardous chemicals. Automatic cage washers pose several problems that should be addressed, including excess noise that might require hearing protection and ergonomic deficiencies that might contribute to back injuries and repetitive-motion injuries. Sharp edges on cages and ancillary equipment should be identified and eliminated. Heat in cage washing areas might require changes in ventilation and work practices to avoid excessive heat exposure. Employees should wear appropriate footwear and remain vigilant to the ever-present hazard of wet, slippery surfaces.

6.2.9 – Personal Protective Equipment

The use of personal protective equipment is the final measure for controlling exposures to potentially hazardous agents. Personal protective equipment provides a physical barrier to hazardous materials that might otherwise come into contact with employees' skin, eyes, mucous membranes, and clothing. The equipment should protect the part of the body that is reasonably expected to come into contact with hazardous agents. Selection should be based on specific knowledge of the potential hazards, experience, and sound professional judgment.

Gloves are the most commonly used personal protective clothing. They are designed to protect the wearer's body from exposure to infectious agents or allergens associated with animals. Latex, vinyl, nitrile, or other appropriate protective gloves should be worn for handling potentially contaminated animals or hazardous materials. Care should be taken to ensure that the glove material provides an adequate barrier against the expected hazard. For example, nitrile or rubber gloves might be required to protect against some solvents, whereas thick leather would provide better protection against animal bites or scratches. Gloves should be long enough to cover the area to be protected. When handling certain animals, such as rats, consider wearing Kevlar

gloves or another cut-resistant glove under the exam gloves. Kevlar gloves can prevent some bite and scratches from breaking the skin barrier.

Disposable vinyl or latex examination or surgical gloves should not be re-used. Heavy duty rubber gloves will hold up well in cleaning and disinfecting; these are of the type commonly used for washing cages.

Uniforms, gowns, laboratory coats, bonnets and shoe covers are often provided to prevent contamination of animal care personnel by animal urine and feces. Such garb should not be worn outside the work area (unless it is covered). Protective clothing should be selected so that it provides an adequate barrier against the type and extent of exposure expected. For example, cage washing personnel might wear heavy rubber aprons to protect themselves when using strong detergents and cleaning agents. Safety shoes might be advisable for employees engaged in moving cage carts and other heavy equipment. Similar protective clothing might be needed by those who clean and disinfect animal rooms. The need to decontaminate and dispose of protective equipment is an important consideration in its selection. Reprocessing contaminated laundry can be more expensive than providing disposable gowns.

Face protection is advised if the eyes, nose, or mouth might be exposed through splashes or splatters of potentially hazardous agents. Safety glasses should be considered minimal eye protection and worn to prevent injury from projectiles, minor splashes, or contact of contaminated hands with eyes. Goggles or face shields might be needed for tasks involving infectious or hazardous liquids if there is a potential for splashing and splattering. Goggles or face shields are especially important when disinfectants and cleaning agents are used under pressure. Surgical masks also provide some protection of the mouth from splashes.

Respiratory protection might be necessary to control occupational exposures to aerosols. Employees who require respiratory protection should be enrolled in a respiratory program that is in compliance with OSHA standards. The selection and use of proper respiratory protection equipment should be coordinated with EHS staff.

6.3 – Education and Training

Occupational health and safety objectives can be achieved only if employees know the hazards associated with their work activities; understand how the hazards are controlled through University programs, engineering controls, work practices, and personal protective equipment; and have sufficient skills to execute safe work practices proficiently. All that requires a multifaceted education and training effort that addresses the full range of health and safety issues related to the care and use of research animals.

Supervisors must ensure that animal care, laboratory and support personnel receive appropriate training regarding their duties, animal husbandry procedures, potential hazards, manipulations of infectious or biohazardous agents, necessary precautions to prevent exposures, and hazard/exposure evaluation procedures (physical, chemical, and biological hazards). Personnel must receive periodic updates and additional training when procedures or policies change.

EHS staff can provide guidance on the use of biological, chemical, radiological, and physical agents. Individuals should be educated on potential hazards (e.g., zoonoses that may or may not be present) in addition to confirmed hazards (e.g., allergens). Training should contain information on general and species-specific hazards. This training is required for animal users and support staff, and optional for all other individuals. Trainings, both training conducted by EHS and training conducted by supervisors/PIs, must be documented.

The PLHCP reviews all medical questionnaires prior to work with animals and on an ongoing basis, which is currently defined as every three years. Medical conditions that may predispose the individual to allergic reactions, infectious diseases, or other physical disabilities maybe discussed with the individual. After completing the medical questionnaire, the PLHCP makes a recommendation whether the individual's health or the health of any animal would be compromised by the individual working with animals. This clearance is provided to the individual, animal facility director, IACUC and EHS.

6.4 – Equipment Performance

The value of engineering controls in protecting the health and safety of employees depends on the performance and operational integrity of the protective equipment. EHS has programs for certifying and monitoring certain equipment (e.g. chemical fume hoods, BSCs, snorkels, etc.) to ensure that it is capable of providing the necessary protection and maintaining adequate performance.

The American National Standards Institute (ANSI) has published consensus guidelines for laboratory ventilation systems, which include recommendations regarding chemical fume hood performance. The ANSI standards are excellent reference documents and provide relevant guidance for engineering control of hazards in the care and use of research animals. Biological safety cabinets are to be tested and certified after installation and whenever a stationary cabinet is moved and are recertified at least once a year. Performance certification criteria have been established by the National Sanitation Foundation (NSF 1992). Ultraviolet (UV) radiation of 254-nanometer (254-nm) wavelength may be used to control airborne and surface microorganisms in various locations in an animal care and research facility. The biocidal capacity of UV bulbs decreases with time and is adversely affected by contamination with dust

or chemical films. They should be cleaned once a week and replaced on a regular schedule or monitored at least once a year to verify adequate performance (Fleming and others 1995, p.233).

HEPA filtration units require periodic monitoring to ensure filtration efficiency (NSF 1992). Performance tests should be conducted at least once a year. Appropriate controls or decontamination should be used during replacement and certification because filters can become contaminated with potentially infectious agents, toxic chemicals, or radioisotopes during use.

Ventilation system performance should be checked periodically to document adequacy of room air exchanges and air pressure gradients in accordance with authoritative guidelines (NRC 1996). Air pressure gradients indicate airflow relationships; the frequency of monitoring them should be based on the degree of risk associated with the hazardous materials being used. Continuous readout monitoring instruments might be appropriate to provide instantaneous performance information in high containment facilities.

Validation and verification are important aspects of autoclave performance testing. The use of biological indicators that contain bacterial spores is an effective method of validating sterilization cycles for various load types. Monitoring of autoclave operational measures (temperature, pressure, and time) can verify performance routinely.

Fire protection systems and equipment (such as fire extinguishers) are inspected and tested periodically by both EHS staff and Facilities Management Life Safety staff to ensure operational integrity.

7.0 Instructions for an Exposure or Injury from an Animal Bite or Scratch

Any animal handler who has been injured by an animal or exposed to an infectious disease while working at Radford University must notify his/her supervisor or PI and either the animal handler or their supervisor fill out an Accident Investigation Report, found in Appendix B, and submit it to EHS within 24 hours. If the individual is an employee of the University, the employee or their supervisor must complete the Employer's Accident Report, found in Appendix A, and submit to Human Resources within 24 hours. Anyone who has been exposed to human blood or other human material should get the contact information of the source and nature of the exposure so that EHS can follow up to determine whether there is a risk of a blood-borne pathogen or other human pathogen exposure. For a laboratory exposure to a known infectious agent, laboratory staff must provide an SDS or other data on the specific strain to which the individual was exposed. In the case of an animal handler's injury by an animal that may carry a zoonotic disease, the animal should be observed by veterinary personnel and tested as deemed appropriate to determine whether there is a risk of zoonotic disease transmission.

7.1 – Non-Infection Agent Exposure Incident

For accidents not involving a known exposure to infectious agents:

1. Provide immediate first-aid. Stop the bleeding of wounds and wash the affected areas with soap and water. For field work where soap and water may not be readily available, the use of baby or similar cleaning wipes (available in small portable packages) or alcohol-based cleansing gel is acceptable. Alcohol-based gels are neutralized by organic matter so the first application should be wiped off to remove debris, or the area can be cleansed first with a baby wipe, and the next application of gel can be left on the skin.
2. Immediately report the incident to the Facility Director, Field Supervisor, Faculty Supervisor/Mentor, or Manager.
3. Those individuals needing immediate medical treatment for serious injuries may visit an appropriate healthcare provider for treatment (e.g., emergency room, primary care physician, students may also be treated at Student Health Services). Immediate medical treatment may be required if:
    i. an individual's ability to breath properly is affected;
    ii. bleeding is excessive and difficult to control;
    iii. an injury clearly needs sutures; or
    iv. loss of consciousness associated with the incident.
4. Where appropriate and feasible, an individual seeking medical attention, or the person assisting an injured individual, should take with them a Hazard Summary sheet or agent SDS' and present the documents to the healthcare provider prior to or as soon as possible when receiving services. It is important that the healthcare provider be made aware of the hazards present in the facility in order to appropriately diagnose and treat an individual.
5. Employee's supervisor completes an Employer's Accident Report and delivers it to the Human Resources Office within 24 hours of the incident. This document is specific to the Workers Compensation Program and is required prior to any follow-up medical services being provided. A copy of this document may be found in Appendix A.
6. Facility Director, Field Supervisor, Faculty Supervisor/Mentor, or Manager completes an Accident Investigation Report, located in Appendix B, and submits to EHS. **If the incident results in hospitalization or fatality, EHS must be notified within 8 hours.** The Accident Investigation Report is to be used by the Facility Director, Field Supervisor, Faculty Supervisor/Mentor, Facility Manager, and EHS for review of the incident.

7.2 – Known or Suspected Infectious Agent Exposure Incident

For accidents also resulting in a known or suspected exposure to an infectious agent:

1. In addition to completing the Employer's Accident Report and following the previous procedure, the Facility Director, Field Supervisor, Faculty Supervisor/Mentor, or Manager must record the details of the known or suspected exposure (on the RU EHS Exposure Incident Report Form, see Appendix E) including:
   i. the infectious agent(s) involved;
   ii. circumstances of the exposure;
   iii. the possible route(s) of exposure;
   iv. an estimate of the dose received by each individual exposed;
   v. whether or not the individual(s) is/are symptomatic and, if asymptomatic, what signs and symptoms to monitor; and,
   vi. any known post exposure prophylaxis or treatment protocol.

2. Those individuals needing immediate medical treatment for serious injuries in conjunction with a known or suspected exposure may visit an appropriate healthcare provider for treatment (e.g., emergency room, primary care physician, students may also be treated at Student Health Services).
   a. Prior to seeking medical treatment after any exposure incident, known or suspected, the individual must be decontaminated (i.e., contaminated clothing removed and affected areas washed) and the information from step 1 along with a Hazard Summary sheet and/or SDS' must be presented to emergency response personnel, if summoned, and the healthcare provider.
   b. In addition, the individual (or other informed person, if the individual is incapacitated) must notify the healthcare provider **BEFORE** they arrive that an exposure or suspected exposure has occurred. This allows the healthcare provider to designate the use of an alternate entrance to prevent contamination of primary receiving rooms or areas.
3. EHS (540-831-7790) must also be notified immediately of any exposure incident and provided the information recorded in Step 1 above to ensure proper evaluation and follow-up by the University contracted PLHCP or a Worker's Compensation Panel Physician.
4. Following any incident, a review must be conducted by the Facility Director, Field Supervisor, Faculty Supervisor/Mentor, Facility Manager, and EHS to determine possible causes, review work practices, and determine preventative measures for future incidents. Documentation of incidents and corrective actions will be maintained by EHS.

7.3 – Animal Bites from Known or Suspected Rabid Animals

For bites involving suspected or known rabid animals and/or exposure to their saliva or cerebrospinal fluid:

1. In addition to completing the Employer's Accident Report and/or the Accident Investigation Report and following the previous procedures for first aid and thoroughly cleaning the wound or area of exposure, the Facility Director, Field Supervisor, Faculty Supervisor/Mentor, or Manager must contact the Virginia Department of Health (VDH) at (540) 381-7100 to document the bite and/or possible exposure.
2. All Instructions provided by VDH regarding the animal that inflicted the bite must be followed. Typically:
   a. If the bite is inflicted by a domesticated animal, the animal responsible may be quarantined for at least 10 days for observation by a veterinarian.
   b. If the animal responsible is wild and can be captured and/or euthanized safely; it should be delivered to the nearest state laboratory as directed by VDH.
3. The individual exposed shall be evaluated promptly by an appropriate healthcare provider, as directed by VDH, to determine the need for post exposure prophylaxis and/or other treatment as necessary.
4. Complete step 4 from above.

7.4 – Procedures for Submission of Tetanus Vaccination Records and/or Rabies Pre-exposure Prophylaxis

As a requirement of the program, for recordkeeping and monitoring purposes, all faculty or staff members working with animals, or as a supervisor/PI, must provide in person, or by mail, to the office of Environmental Health and Safety, within thirty calendar days of the submission of a protocol, initial documentary evidence from a licensed health professional of current tetanus immunization, or a signed declination form found in Appendix K.

These records will be maintained by the Environmental Health and Safety Office until the end of employment or institutional enrollment. At which time the records will be destroyed. EHS will monitor these records and inform employees when boosters are required, usually a period of ten years.

Students are already required by the code of Virginia § 23-7.5., to provide documentary evidence from a licensed health professional of current tetanus immunization.

All animal handlers working with wild species that exhibit a high potential for rabies virus; e.g. bats, must also provide initial documentary evidence from a licensed health professional of pre-exposure prophylaxis, or current titer, to EHS in person or by mail, within thirty calendar days of the submission of a protocol, or a signed declination form found in Appendix K.

These records will be maintained by the Environmental Health and Safety Office until the end of employment. At which time the records will be destroyed. EHS will monitor these records and inform handlers who continue work with high potential animals when titer is required, usually a period of two years, in accordance with Virginia Department of Health.

8.0 Recommendations for Immunocompromised or Pregnant Employees Working with Mutagenic, Teratogenic and Infectious Agents

The purpose of this section is to establish guidelines to be followed when employees working with mutagenic, teratogenic and/or infectious agents are immuno-compromised, pregnant, or considering conception.

Any employee who has an autoimmune disease (no matter how well managed) or is taking immune suppressing medications or is pregnant or planning conception should be aware that working with mutagenic, teratogenic and/or infectious agents poses a special risk to them or their fetus. *See NIOSH guides Effect of Work place Hazards on Female Reproductive Health and Effect of Workplace Hazards on Male Reproductive Health for more information.* If you work with chemicals, heavy metals, gases, radiation, or biological agents (virus, bacteria, fungus, or parasites) you may need to take extra precautions during pregnancy. Some hazardous agents may enter into the mother's blood and can pass to the fetus. Others can affect the mother's health or harm the fetus directly. Individuals who are pregnant, and those intending to become pregnant, should seek advice from knowledgeable sources before working with such substances. These sources include, but are not limited to, their health care provider, their Laboratory Supervisor or Principal Investigator, Safety Data Sheets (SDS), and the Radford University Environmental Health and Safety office. Talk to these sources about any specific concerns you may have. Always follow all safety procedures to minimize exposure.

9.0 Program Evaluation

The quality and effectiveness of this OHSP can be sustained only through periodic evaluations of the program and a commitment to respond to changing circumstances. Evaluations will be based on objective data that will help in measuring the effectiveness of this program in reducing occupational risks to an acceptable minimum.

10.0 References

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11.0 Appendices

- Appendix A – Employer's Accident Report
- Appendix B – Accident Investigation Report
- Appendix C – Notice of Understanding and Compliance
- Appendix D – Medical History/Risk Assessment Survey Questionnaire
- Appendix E – Exposure Incident Report Form

- Appendix F – Physical Hazards
- Appendix G – Chemical Hazards
- Appendix H – Experiment Related Injuries and/or Illnesses
- Appendix I – Allergens
- Appendix J – Zoonoses
- Appendix K – Vaccination Declination Form

12.0 Document Revision History

Revision	Section(s) Changed	Change(s) Made:	Date
00	All	Initial Draft	5/29/19
01	All	All Sections – Program Updated	4/23/20
02	All	All Sections – Continuing 2020 Program Updates	9/1/21
03	All	All Sections – Continuing 2020 Program Updates	6/22/22
04	All	All Sections – Continuing 2020 Program Updates	10/25/22

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Appendix A – Employer's Accident Report

Employer's Accident Report

(formerly: Employer's First Report of Accident)
Virginia Workers' Compensation Commission
1000 DMV Drive Richmond, VA 23220
See instructions on the reverse of this form

The boxes to the right are for the use of the insurer	Reason for filing	VWC file number
	Insurer code or PEO Ref. No. **S0225**	Insurer location **762**
	Insurer claim number	

Employer

1. Name of employer (trading as or doing business as, if applicable)	2. Federal Tax Identification Number	3. Employer's Case No. (if applicable)
RADFORD UNIVERSITY	**546 00 1789**	
4. Mailing address **Radford University Dept of Human Resources 314B Tyler Place, P.O. Box 6889 Radford, Virginia 24142**	5. Location (if different from mailing address) **N/A**	
6. Parent corporation /Policy Named Insured (if applicable) or PEO name **Commonwealth of Virginia**	7. Nature of business **State Government**	
8. Name and Address of Insurer or self-insurer for this claim **Managed Care Innovations P.O. Box 1140, Richmond, VA 23208-1121**	9. Policy number **Self-Insured**	10. Effective date **July 1, 1992**

Time and Place of Accident

11. City or county where accident occurred	12. Date of injury	13. Hour of injury a.m. ☐ p.m. ☐ 13a. Time began work a.m. ☐ p.m. ☐	14. Date of incapacity	15. Hour of incapacity

16. Was employee paid in full of day of injury? ☐ Yes ☐ No	17. Was employee paid in full for day incapacity began? ☐ Yes ☐ No		
18. Date injury or illness reported	19. Person to whom reported	20. Name of other witness	21. If fatal, give date of death

Employee

22. Name of employee (Last, First, Middle)	23. Phone Number	24. Sex ☐ Male ☐ Female
25. Address	26. Date of Birth	27. Marital Status ☐ Single ☐ Divorced ☐ Married ☐ Widowed
	28. Social Security Number	
29. Occupation at time of injury or illness	30. Is worker covered by PEO policy? ☐ Yes ☐ No	31. Number of dependent children

32. How long in current job?	33. How long with current employer?	34. Was employee paid on a piece work or hourly basis? ☐ Piece work ☐ Hourly
35. Hours worked per day	36. Days worked per week	37. Value of perquisites per week: Food/Meals / Lodging / Tips / Other
38. Wages per hour $	39. Earnings per week (inc. overtime) $	$ **N/A** / $ **N/A** / $ **N/A** / $ **N/A**

Nature and Cause of Accident

40. Machine, tool, or object causing injury or illness	41. Specify part of machine, etc.

42. Describe fully how injury or illness occurred

43. Describe nature of injury or illness, including arts of body affected	43a. Overnight inpatient hospitalization? ☐ Yes ☐ No 43b. Treated in Emergency Room? ☐ Yes ☐ No

44. Physician (name and address)	45. Hospital (name and address)		
46. Probable length of disability	47. Has employee returned to work? ☐ Yes ☐ No	If Yes 48. At what wage?	49. On what date?
50. EMPLOYER: prepared by (name, signature, title)	51. Date		52. Phone Number
53. INSURER: (name of processor)	54. Date		55. Phone number

56. THIRD PARTY ADMINISTRATOR (if applicable)	57. Address	58. Phone number

This report is required by the Virginia Workers' Compensation Act

NOTE: Detail guidelines for completing the EAR are found at Item #4, Forms and Instructions.

INSTRUCTIONS

Employer's Accident Report
VWC Form No. 3

Employer

1. Fill out this form whenever one of your employees is injured or reports a possible work related injury or illness. Provide **all** the information requested, except the information in the top right corner. **Please type if possible. If you print the form please do so legibly in black ink. Do not complete the form in cursive.** Your signature is required at the bottom of the form.

2. Send the original beige form to your insurance carrier or claims servicing agency for processing. If you are self-insured, send it to your organization's designated office for handling workers' compensation claims.

3. If you are an employer subject to OSHA record-keeping requirements, you may retain a copy of this completed form as a supplementary record of occupational injury or illness. Use block #3 (Employer's Case No.) to cross-reference your master log of accidents and illnesses.

4. If you need additional copies of this form, please request them from your insurance carrier or claims servicing agency.

Insurance carriers, self-insured employers, and authorized representatives

1. For accidents meeting one of the seven criteria for establishing a Case File,* submit the original beige form and one copy to Managed Care Innovations (MCI), P.O. Box 1140, Richmond, Virginia 23208-1121. The code for the reason for filing should be written at the top right of the form.

2. When processing these forms prior to transmittal to MCI, please include the information requested at the top right of the form, verify that the carrier name and policy number given by the employer are accurate, and enter your name and phone number, and the date of processing at the bottom of the form.

3. Insurer code at the top right of the form refers to the five-digit code assigned by NCCI. If you are self-insured, it refers to a similar five-digit number assigned by the Virginia Workers' Compensation Commission.

4. Additional copies of this form are available without cost by writing to MCI. Please note that color coding of the forms greatly increases MCI's efficiency in processing claims, and that any alternate versions of the form you develop yourself require prior approval by MCI. Write to "Forms" at the listed MCI.

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*The criteria are: (1) lost time exceeds seven days, (2) medical expenses exceed $1,000, (3) compensability is denied, (4) issues are disputed, (5) accident resulted in death, (6) permanent disability or disfigurement may be involved, and (7) a specific request is made by MCI.

Appendix B – Accident Investigation Report

RADFORD UNIVERSITY

ENVIRONMENTAL HEALTH & SAFETY

LABORATORY ACCIDENT/INCIDENT INVESTIGATION REPORT

Directions: Complete this form to promptly report incidents/accidents occurring in labs or other research/ clinical work spaces that involve 1) injury, illness or harmful exposure (or potential illness/ harmful exposure) of persons in the lab or space, 2) spill or release of harmful materials, 3) fire or explosion, 4) property or environmental damage or loss, 5) unsafe conditions or acts that must be addressed. Prompt reporting of incidents to EHS is essential for determining how to minimize the occurrence of future incidents.

NOTE: If the incident has resulted in *employee* injury/illness, the employee and/or employee's supervisor must complete an Employers Accident Report (EAR) within 24 hours of the incident so the employee can be eligible for workers compensation. The EAR and this Accident Report serve completely different functions and are not interchangeable. The EAR can be accessed on Human Resources website.

REQUIRED INFORMATION *(Individual reporting the incident)*

Last Name, First Name:	**Email:**
Address *(Home or Work)*	

Phone:	**Incident Was Reported On:** *(MM/ DD/ YYYY)*	**Time Reported:** *(HH:MM)* __ am __ pm

My status:

___ Undergrad Student ___ Grad Student ___ Faculty ___ Staff ___Visitor Other: _____

I provided prompt notification of the incident to:

___The Principal Investigator ___ The Lab Manager ___ The Area's Supervisor Other: _____

INCIDENT INFORMATION

Date of Incident: *(MM/ DD/ YYYY)*	**Time:** *(HH:MM)* __ am __ pm	**Location of Incident:** *(Building; Room #)*

Type of Incident:

___ Injury/ Illness ___Spill/ Release ___ Fire/ Explosion ___ Property/ Environmental Damage or Loss ___ Unsafe Condition

Other: _____

Hazard(s) Involved: *(Select all that apply.)*

___ Biological/ Genetically Modified Material ___Chemical/ Particulate/ Nanomaterial ___Hazardous Energy (laser, x-ray, UV)

___ Electrical/ High Voltage ___ Radiation ___ Physical Hazard (heat, cold, pressurized, spinning/rotating, sharp, mechanical, confined space)

Other: _____

Description of Incident: (Visitors, please include your purpose for being at the location of the incident.)

Names of Parties Involved and/or Witnesses to the Incident: (PLEASE INCLUDE CONTACT INFORMATION FOR EACH PERSON.)

Description of any Engineering Controls/ Safety Equipment and Personal Protective Equipment in Use at the Time of the Incident:

INJURY OR ILLNESS

Type:

___ None ___ Physical Injury ___ Occupationally-Related Illness ___ Potential Harmful Exposure

Name of Parties Affected and Description of Injury/ Illness/ Exposure:

Treatment: *(Select all that apply.)*

___ None ___ First Aid ___ Student Health Services ___ Emergency Medical Services ___ Personal Physician

___ Hospital (outpatient) ___ Hospital (admitted) ___ Panel Physician

PROPERTY / ENVIRONMENTAL DAMAGE OR LOSS

___ Not Applicable

Description of Damage or Loss:

Promptly send completed Accident Reports to Environmental Health and Safety:

- By campus mail to PO Box 6909
- By U.S. mail (EHS mailing address is PO Box 6909, Radford, VA 24142)
- By scanning and emailing to ehs@radford.edu

Appendix C – Notice of Understanding and Compliance

RADFORD UNIVERSITY

ENVIRONMENTAL HEALTH & SAFETY

Notice of Understanding and Compliance

Animal Contact Occupational Health and Safety Program Acknowledgment

I have read AND UNDERSTAND the Radford University Animal Contact Occupational Health and Safety Program.

I agree to follow the recommendations, regulations, and the procedures contained in the document.

I agree to revisit the document whenever I begin to work with new animal species and/or zoonotic agents ***or*** when there is any modification to an animal protocol that could include chemical agents, biological/biohazardous agents, procedures, etc.

I acknowledge that I have read and understood the information in the NIOSH pamphlet "Preventing Asthma in Animal Handlers"; a web-based version of this pamphlet may be found at http://www.cdc.gov/niosh/docs/97-116/. I understand the risk of developing asthma and allergies from working with animals and agree to follow the precautions described in the NIOSH Alert.

Further, I agree to inform my primary physician, as well as any other appropriate medical professionals, that I engage in animal and/or wildlife research activities when I visit said primary care provider(s).

Date: _____

Print/Type Name: _____

Signature: _____

Name of PI/Supervisor (if you're a student researcher): _____

Please print this page and send the signed Agreement form to Environmental Health and Safety at ehs@radford.edu. Once received, a copy will be forwarded by EHS to the IACUC Administrator. Should you wish to decline participation in the Animal Contact Occupational Health and Safety Program, please instead complete the section below as well as the declination in the Questionnaire (Appendix D of the OSHP).

Declination of Compliance

I decline participation in the Occupational Health and Safety Program for animal handlers at this time.

- I have reviewed the Animal Contact Occupational Health and Safety Program
- I understand the occupational health risks associated with participation in animal and/or wildlife research activities

_____

Print Name of Participant

_____ _____

Signature of Participant Date

Appendix D – Medical History & Risk Assessment Survey Questionnaire

RADFORD UNIVERSITY

ENVIRONMENTAL HEALTH & SAFETY

MQ# _____
For EHS Use Only

Medical History & Risk Assessment Survey Questionnaire for Animal Handlers

Information provided in this questionnaire is considered part of your medical record, and is therefore CONFIDENTIAL. Completion of this questionnaire is required for all animal handlers working at Radford University with vertebrate animals. If you have any questions while completing this form, please call the Environmental Health and Safety (EHS) Office at 540-831-7790 or contact EHS at ehs@radford.edu. **Please provide ALL information requested; questionnaires missing required information may be returned**. (Throughout this form, the term "animal" refers to vertebrate animals.)

Part I—Sections A-C are to be completed by Supervisor/Principal Investigator (PI); **section D** by the animal handler. Supervisor/PI only needs to complete this form one time for each individual under their supervision unless one or more of the following has changed: the duration of animal contact, the type of activity, and/or the type of animal. A Supervisor/PI should complete this form for him/herself.
Part II—Sections A-D are confidential and are to be completed by the animal handler. All information must be completed and returned to EHS to be delivered to the contracted medical provider. An animal handler may decline to participate fully in the program by signing the declination form located on the last page of this questionnaire (*see Declination Form*), **however, Part I must be completed regardless of any declination.**
Information in Parts I and II may be forwarded to different groups, so participant information is needed twice.

Part I: Animal Contact Review Questionnaire

Section A: Participant Information	
Participant Name:	Date:
University ID:	Job Title:
Participant campus e-mail address:	
Department:	
Protocol/Program name:	
PI name and phone#: PI e-mail address:	
Supervisor name (if different) and phone#: Supervisor e-mail address:	

Section B: Must be completed by Supervisor/PI of Participant

1. Species Contact. Directions: Identify the level of exposure for each species for the participant named above and checkmark the appropriate box.

☐ **Participant work will NOT include exposure to animals, unfixed tissues, cells, or body fluids.**

☐ Participant work includes the following: *(check all that apply)*

- ☐ **Direct contact** with animals used in research or teaching
- ☐ Work in the **same room** as animals but **without direct animal handling or contact**
- ☐ Work with ***unfixed tissues, cells, or body fluids*** in research or teaching
- ☐ ***Providing routine care for animals*** used in research or teaching
- ☐ Ongoing ***field study*** *with*_____*(species) in*_____*(location, Country)*

Please review the list of species on the following page and place a check next to any species that participant may have exposure to.

Species	Participant Works With Animal (✔)	Species	Participant Works With Animal (✔)
Amphibian	☐	Hamster	☐
Bat	☐	Marine Mammal	☐
Birds/Poultry	☐	Mice	☐
Cat	☐	Horse	☐
Cattle	☐	Primates	☐
Camelid	☐	Rabbit	☐
Dog	☐	Rat	☐
Fish	☐	Reptile	☐
Gerbil	☐	Sheep	☐
Guinea Pig	☐	Swine	☐
Goat	☐	Other:	

2. Education: List a basic outline of material covered in training and briefly describe training provided (e.g., discussion, presentation, reading). Training topic should include personal hygiene, zoonotic agents, animal-related illness/injury procedures, and procedures for handling animals. Also list specific zoonotic agents discussed:

Animal –related illness/injury discussed	☐ Yes	☐ No
Personal hygiene discussed	☐ Yes	☐ No
Allergies and diseases communicable from animals discussed	☐ Yes	☐ No

3. Participant Work also includes exposure to (check all that apply):

Hazard	✔	Identify Specific Agent
Chemical Agents	☐	
Infectious Agents	☐	
Bloodborne pathogens: Human tissues, cells, blood or other potentially infectious material	☐	
Recombinant or synthetic nucleic acid molecules (r/sNA) (regardless of origin) and r/sNA-containing organisms or cell cultures including creation or use of transgenic plants and animals	☐	
Select agents and toxins	☐	
Any material requiring a CDC import license or a USDA permit	☐	
Zoonotic Agents	☐	
Controlled Substances	☐	
Anesthetic Gases	☐	
Radiation/Radioisotopes	☐	
Lasers	☐	
Loud noise: _____ hours per day, _____ days per week	☐	

Other occupational hazards: Please describe and list any exposures of concern:

_____

_____

_____

Specific training for all items identified in this section has been completed. ☐ **Yes** ☐ **No**

Please identify all PPE that will be utilized (or potentially utilized) by the animal handler [Remember, anyone using a respirator must be enrolled in the University's Respiratory Protection Program and receive appropriate training, medical review, and respirator fit-testing.]:

_____

_____

_____

_____

_____

SECTION C: Supervisor/PI Certification

By signature, I certify that the information provided is accurate, that I have provided the participant named in Section A with a copy of the Radford University Animal Contact Occupational Health and Safety Program, and that I have provided necessary training on the items detailed in that policy and as specified on this form. I have provided the appropriate personal protective equipment to the participant. The participant has read the relevant species-specific guides.

Printed Supervisor Name: _____

Signature: _____

Date: _____

SECTION D: Participant Certification

By signature, I certify that I have received the training documented on this form, and have reviewed training materials as provided by my Supervisor/PI. I have received the appropriate personal protective equipment, and have reviewed the Radford University Animal Contact Occupational Health and Safety Program.

Printed Participant Name: _____

Signature: _____

Date: _____

SUPERVISOR/PI STOP HERE; EMPLOYEE FILLS OUT PART II.

Part II: Initial Health Surveillance Questionnaire

Information in this part is confidential and should be completed by employee / student only.

You are being asked to complete this questionnaire to help evaluate risks to your health from exposure during animal and/or wildlife research activities. After reviewing your responses to this questionnaire, you may be contacted to discuss further medical evaluation and diagnostic procedures. You may decline to participate fully in the program by signing the declination form located on the last page of this questionnaire (*see Declination Form)*.

Section A: Participant Information			
Participant name			
Work address:			Date:
Employee/Student ID:	Date of Birth:		M ◯ F ◯
Work phone:	Campus e-mail address:		
Participants status (Check all that apply):	Faculty ☐ Staff ☐	Graduate Assistant ☐ Work Study Student ☐	Student ☐ Other:_____

Section B: Animal Handling Risks

Category 1 ☐	*Animals in this category may include*: Fish, reptiles or amphibians. *Associated risks*: Potential for cuts, bites and scratches from the animal or trapping/housing apparatus, zoonotic diseases (e.g., *Salmonella* spp.) *Medical requirements*: Up-to-date tetanus immunization. (To be valid, tetanus immunization must have been received within 10 years*.) Date of your last tetanus vaccine (MM/DD/YY): _____
Category 2 ☐	*Animals in this category may include*: Laboratory animals (e.g., rats, mice, guinea pigs, hamsters, gerbils, other rodents, rabbits), or domestic birds. *Associated risks*: Some potential for risk of injury from bites and scratches, zoonotic diseases (e.g., *Salmonella* spp.), allergies. *Medical requirements*: History and physical exam, allergy evaluation and education, up-to-date tetanus immunization. (To be valid, history and physical exam must have been conducted within 5 years, and tetanus immunization must have been received within 10 years*.) Date of your last physical exam (MM/DD/YY): _____ Name, phone number, and address of your healthcare provider: _____ _____ Date of your last tetanus vaccine (MM/DD/YY): _____
Category 3 ☐	*Animals in this category may include*: Bats, sheep, cattle, horses, goats, other farm animals, deer, wild rabbits, wild rodents, wild birds, feral animals as well as unvaccinated dogs and cats. *Associated risks*: Significant potential for injury from bites and scratches, kicks and crushing, zoonotic diseases, (e.g., *Cryptosporidium* spp., *Histoplasma* spp., Influenza virus, Rabies virus, *Salmonella* spp., *Toxoplasma* spp.), and allergies. *Medical requirements*: History and physical exam, up-to-date tetanus immunization.** (To be valid, history and physical exam must have been conducted within 5 years, and tetanus immunization must have been received within 10 years*.) What is your risk of exposure to rabies? ◯ Low ◯ Moderate ◯ High Date of your last physical exam (MM/DD/YY): _____

	Name, phone number, and address of your healthcare provider: _____ _____ Date of your last tetanus vaccine (MM/DD/YY): _____ Completion of rabies series (if appropriate) (MM/DD/YY): _____ (**It is strongly recommended that all persons having contact with live raccoons, skunks, bats, fox or those animals' tissues in an unfixed state undergo the rabies vaccination process. This is based on the local statistics, which reveals these species to be the most likely to carry the rabies virus.)

** Available from either a Primary Care Physician (PCP) or other PLHCP (charges for these services will be covered by EHS for each faculty, staff, or student involved with working with vertebrate animals; a department may choose to cover such costs through its own administrative procedures, if desired).*

Section C: Medical History

Immunizations

Have you ever had any of the following immunizations?

Tetanus:	yes☐ no☐ Don't know☐	Year(most recent) _____	
Hepatitis B (series of 3)	yes☐ no☐ Don't know☐	#1_____#2_____#3 _____	
Hepatitis B Titer	yes☐ no☐ Don't know☐	Year(most recent) _____	
Rabies (series of 3)	yes☐ no☐ Don't know☐	#1_____#2_____#3 _____	
Rabies Titer	yes☐ no☐ Don't know☐	Year(most recent) _____	

Personal Health	**Yes**	**No**
1. Have you ever contracted an illness from animals, or experienced an animal related injury?	☐	☐
If yes, please explain:		
Illness/injury symptoms well managed in work environment?	☐	☐
If **no,** please explain**:**		
2. Do you have any medical conditions (or take any medication) that might suppress your immune system? This includes recent treatment (within 6 months) with chemotherapy or radiotherapy or high-dose steroids, cancer, rheumatoid arthritis or other autoimmune disorder, and even pregnancy.	☐	☐
If **yes**, please explain		
3. Are you currently taking any medications?	☐	☐
If **yes**, please list		
4. For women: Because some animal–borne infections can affect fetal outcome, are you pregnant, or planning to become pregnant in the next year? I choose not to answer ☐	☐	☐
Environmental Allergies/Asthma	**Yes**	**No**
1. Are you allergic to any animal(s)?	☐	☐
If **yes**, please list animals:		
2. Do you have any other known allergies?(e.g., Latex, animal feed, or substances/chemicals used)	☐	☐
3. List symptoms that occur when you are suffering from your allergies:		
Severity of Symptoms: ☐Mild ☐Moderate ☐Severe ☐N/A		
4. List treatment that you receive to relieve your allergies:		
5. Do you have asthma?	☐	☐
If **yes**, please list cause(s) of asthma (if you do not know, write unknown):		
6. Do you have allergy symptoms or asthma specifically related to animals that you currently work with?	☐	☐
If **yes**, please list symptoms:		
Severity of Symptoms: ☐Mild ☐Moderate ☐Severe ☐N/A		

7. Do you experience any of the following when you work with/are exposed to animals? **Check all that apply:**

☐ Watery, burning, itchy eyes	☐ Wheezing	☐ Chest Tightness
☐ Nasal dripping	☐ Shortness of breath	☐ Rash
☐ Sneezing	☐ Coughing	☐ Hives

Do any of the above symptoms interfere with your ability to work with animals? ☐ **Yes** ☐ **No**

If **yes**, please explain:

Environmental Allergies/Asthma Continued	**Yes**	**No**
8. Do you have any skin problems related to work?	☐	☐
If **yes**, please describe:		
9. Do you experience shortness of breath at work?	☐	☐
If **yes**, please explain:		
10. Do you wear a respirator/mask to perform any activities at work?	☐	☐
If yes, what kind?		
Were you fit tested by EHS staff?	☐	☐
Additional personal health concerns		
Do you have any health or workplace concerns not covered by the questionnaire that you feel may affect your occupational health and would like to confidentially discuss with the campus medical provider or your personal care physician?	☐	☐
If **yes**, please explain:		

Section D: Signature of participant in program (Complete section A, B, C, D)

The above information is true and complete to the best of my knowledge and I am aware that deliberate misrepresentation may jeopardize my health. I understand that this information is confidential and will not be released without my knowledge and written permission.

_____

Print Name of Participant

_____ _____

Signature of Participant Date

Thank you for completing this questionnaire. Please submit via one of the options below:

1. **Mail in an envelope (Mark Confidential) to:**
   Environmental Health and Safety / Radford University / PO Box 6909 / Radford, VA 24142

2. **Use SendSecure EHS Dropbox:** https://sendsecure.xmedius.com/r/19901d8a13c54b338e2188fbe2e827d6

[For Occupational Health Medical Provider Use ONLY]

Recommendations:

☐	The participant's information contained within this Medical History and Risk Questionnaire has been evaluated by an occupational health provider. The participant is medically cleared to begin working with animals based on the review. Should the participant have any questions regarding their evaluation, please contact the provider at the number identified below.
☐	The participant's information contained within this Medical History and Risk Questionnaire has been evaluated by an occupational health provider. It has been determined that additional follow-up with the participant is required before the individual can begin working with animals. Please contact the provider at the number identified below to schedule a consultation.

Provider Signature:		Date:		Phone Number:	

Occupational Health & Safety Program

Medical Questionnaire/Examination Declination Form

NAME: (Please Print) :_____(RUID) _____

The purpose of the Occupational Health and Safety Program (OHSP) is to provide a mechanism whereby Radford University can fulfill and manage its institutional responsibility to provide a safe workplace for personnel involved in the care and use of animals used for research, teaching, and/or testing. Utilizing the principles of hazard identification, risk assessment, risk management, hazard/risk communication and training, as well as preventive medicine, we encourage you to take full advantage ofthe program. However, you may decline to participate fully in the program by signing this declination form.

Declination Statement:
I understand that due to my occupational exposure to animals used for research, teaching and/or testing, Radford University has established an Occupational Health and Safety Program for my benefit. I further understand that all personnel involved in the care and use of vertebrate animals at Radford University are required to enroll in the OHSP and that this program is offered at no charge to me.

Although I am enrolled in the program by submission of Part I of this questionnaire, I decline to:
(Please initial the box beside each item you decline.)

☐ Complete a medical questionnaire

☐ Participate in a risk assessment

☐ Participate in a medical examination

I also understand that by declining any one of these portions of the OHSP I may be putting my health at risk but I make this decision freely.

If in the future I continue to have occupational exposure to animals at Radford University and I decide to participate fully in the OHSP by completing the medical questionnaire, participating in a risk assessment, and/or participating in the medical examination, I will be afforded the opportunity to do so at no charge to me.

Signature: _____ Date: _____

Appendix E – Exposure Incident Report Form

RADFORD UNIVERSITY
ENVIRONMENTAL HEALTH & SAFETY

EXPOSURE INCIDENT REPORT FORM

(Complete this form if there is a Known or Suspected Infectious Agent Exposure Incident, email form to ehs@radford.edu)

EXPOSED EMPLOYEE INFORMATION	
Name:	Employee ID No.:
Job Title:	Department:
Phone Numbers Work:	Cell:
Brief Summary of Job Duties (*Description of General Duties*):	
HBV Vaccination Series? ☐ Yes ☐ No	Dates Received:
Previous Titer Analysis Performed? ☐ Yes ☐ No	Date: Results:

EXPOSURE INCIDENT INFORMATION

Date of Incident: _____/_____/_____ Campus Location:

Time of Incident: _____:_____ am pm Infectious Agent (if known):

Route of Exposure (check): ☐ Non-Intact Skin ☐ Mucous Membrane ☐ Puncture ☐ Cut/Bite ☐ Needle-stick

Circumstances of Exposure (*work being performed, how the exposure occurred, estimate of dose recieved, PPE used at the time, actions taken, recommendation for avoiding a repeat incident*):

SOURCE INDIVIDUAL INFORMATION (IF APPLICABLE)	
Name (if known):	Employee ID/SSN No.:
Consent For Testing Obtained? ☐ Yes ☐ No	
HBV Status:	HIV Status:

FOLLOW-UP		
Physician's Visit Yes No		
Physician Name:_____ Phone Number: _____ Address: _____ _____		
Please Check All That Apply		Comments
Baseline Blood Collection	☐	
HIV Serological Status	☐	
HBV Post-Exposure Series	☐	
HBV Immune Globulin	☐	
HBV Titer	☐	
Counseling	☐	
Other:	☐	

Please provide any other pertinent information in this section (including, but not limited to: whether or not the individual is symptomatic/asymptomatic, any known post exposure prophylaxis or treatment protocol other than those listed above, actions taken to mitigate a repeat of the incident, etc.)

_____

_____

_____

_____

_____

_____

_____

_____

Appendix F – Physical Hazards

PHYSICAL HAZARDS

Animal care and use by their very nature present many situations that require safe practices to protect workers from physical hazards. The hazards of bites, kicks, and scratches are associated inevitably with most laboratory animal contact. A survey of animal-related injuries among veterinarians indicated that 35% required sutures for lacerations during their career. Working with heavy animals and equipment, such as metal cages, can stress muscles and joints. The potential for wet floors in animal rooms and cage washing areas increases risks of slipping and falling. Workers can also be exposed to physical hazards that are commonly found in the research environment, such as flammable solvents, ultraviolet radiation, ionizing radiation, pressure vessels, noise, and electric shock. The physical hazards selected for discussion in this section present the highest potential for causing serious harm and are likely to be present in most animal facilities.

I. Animal Bites, Scratches, Kicks, and Related Hazards

Bites, scratches, and kicks are ubiquitous hazards associated with laboratory animal contact. They are largely preventable through proper training in animal-handling techniques. People working with large domestic animals might sustain crushing injuries when the animals kick, fall, or simply shift their body weight.

Personnel should be aware of environmental factors, as well as factors intrinsic to the animal, that can precipitate a traumatic event in a research animal facility. Several factors need to be considered in work with animals (Grandin 1987). Animals respond to sounds and smells as people do; they also hear, smell, and react to things that people might not detect. If an animal hears a high-pitched sound, it might become frightened. Such situations can result in an unexpected response that results in injury to the animal handler. Many animals have a “flight zone”: approaches by another animal or a person cause an attempt to escape. Being aware of an animal’s flight zone will help to avoid injuries. Many animals, including monkeys and livestock, are social and show visible signs of distress if isolated from others of their kind. Knowledge of animal behavior is important in reducing risks.

Inappropriate handling can induce discomfort, pain, and distress, provoking an animal to inflict injury on its handler. Personnel should review educational materials pertinent to safe animal-handling techniques (Fowler 1986; Kesel 1990) and should have supervised instruction before undertaking new animal-handling procedures. The institution should be prepared to evaluate the causes of any injuries that result from newly adopted procedures. The injured persons should participate in this evaluation.

Special attention should be given to the training of personnel involved in the handling and restraint of nonhuman primates. In addition to posing a bite and scratch hazard, nonhuman primates can be challenging and difficult to handle safely because of their great strength, dexterity, intelligence, and tenacity. Unsuspecting personnel have been injured when nonhuman primates have grabbed and pulled neckties, loose-fitting laboratory coats, or long hair, and some individual great apes have been known to throw their feces. When it is compatible with the experimental conditions of animal use and the clinical condition of the particular animal,

consideration should be given to chemical immobilization of nonhuman primates to facilitate the ease of handling them and to reduce the risk of injury of personnel. Personnel who work with nonhuman primates should wear face shields and other protective garments and equipment appropriate for the circumstances and species involved.

In a survey of animal bites among the general population, dogs were the species most commonly involved, with cats and rodents second and third (Moore and others 1977). Comparable data on bites in animal facilities are not available, but rodent bites probably predominate because of the large number of rodents used and the broader exposure of personnel to them.

Animal bites, especially those by rodents that inflict little tissue damage, are sometimes considered inconsequential by personnel who are unfamiliar with the host of diseases that can be spread by this mechanism and the complications that can result from wound contamination by the normal oral flora of the animals involved. Personnel should be alerted to the need to ascertain their current tetanus-immunization status, seek prompt medical review of wounds, and initiate veterinary evaluation of the animal involved if it is warranted. Rabies, B-virus infection, Hantavirus infection, cat-scratch fever, tularemia, rat-bite fever, brucellosis, and orf are among the specific diseases that can be transmitted by animal bites with profound consequences.

The early initiation of antimicrobial therapy, as prescribed by a PLHCP, for all animal bites that are not trivial appears warranted because there is a high probability of wound contamination with a potential pathogen. That approach will limit the progression of a localized infection and avert the more serious complications of wound infection, which could include cellulitis, abscess, septic arthritis, tenosynovitis, osteomyelitis, sepsis, endocarditis, and meningitis. If infections do not respond to therapy, additional microbiological studies that encompass unusual and fastidious organ-isms should be pursued. Fungal agents should not be overlooked as possible wound contaminants; the transmission of blastomycosis to humans by dog bite has been reported (Gnann and others 1983).

A wide variety of poisonous and venomous reptiles (Russell 1983), marine animals (Halstead 1978), and arthropods (Biery 1977) might be maintained in the laboratory or animal facility for research or instructional purposes. Institutions that host these uncommon research animals have a special obligation to perform a comprehensive review of safety precautions to ensure the security of animal housing and the appropriate training of personnel who are involved in their care and use. Institutions also should have a plan for the immediate delivery of definitive medical care in response to envenomation, including the use of antivenin if available. Many types of envenomation cause massive tissue destruction that predisposes a wound to secondary bacterial infection and indicates a need for treatment with tetanus toxoid and antimicrobial therapy (Goldstein 1990a; Sanford 1985).

II. Sharps

Sharps are ubiquitous in animal care. Needles, broken glass, syringes, pipettes, scalpels—all are commonly used in animal facilities and laboratories. Controls include installing puncture-resistant and leak-proof containers for sharps at critical locations in the facilities. Workers should be trained to handle and dispose of sharps safely. Improper disposal of sharps with regular trash can expose housekeeping staff to puncture wounds and cuts and potentially to exposure to

infectious agents and hazardous chemicals. Regulations that specify how to dispose of sharps should be checked to ensure that disposal practices are in compliance.

Special care is required in the use of needles and syringes to avoid needle stick injuries. Do not recap needles. Needles and syringes present a substantial risk for occupationally acquired infection in inoculating or drawing blood from laboratory animals (Miller and others 1987). Appropriate restraint or sedation of animals during procedures entailing the use of sharps decreases the risk of sharps injury to workers. Consult Radford University's Exposure Control Plan for additional information on sharps handling.

III. Flammable Materials

The National Fire Protection Association (NFPA) has classified fires into four types according to the character of the flammable or combustible materials. Class A, B, and C fires involve general combustible materials (such as wood, paper, and cloth), flammable gases and liquids (such as oil and paint), and electric equipment, respectively. Class D fires involve such combustible metals as magnesium, sodium, and potassium. Class A, B, and C materials are found in all animal care facilities. Common combustible materials in Class A fires found in animal care facilities include animal bedding, paper gowns, plastic animal cages, paper towels, and laboratory wipes. Class B flammable solvents might be used in painting animal care rooms, cleaning floors and surfaces, sterilizing equipment, administering anesthesia, and performing laboratory analyses of tissues. Common Class C materials include lighting, wet vacuums, steam-cleaning units, automatic cage-washers, and many types of laboratory equipment. Explosive materials are not commonly used, however, crystallized picric acid and previously opened and expired cans of ether are common potential explosion hazards. Class D materials are not common in animal care facilities but might exist in some laboratories.

Class B liquids are classified according to their flash point, the lowest temperature at which a liquid will produce vapor sufficient to propagate a flame. Flammable liquids have flash points less than 100°F. Combustible liquids have flash points greater than 100°F but less than 200°F. The flash points of combustible liquids are higher, so they are more difficult than are flammable liquids to ignite at room temperature. Knowledge of flash points of materials can be helpful in selecting a less-flammable material for a particular use so as to lower the related fire hazard. Safety Data Sheets for chemicals include information on flash points. OSHA provides very strict regulations for the storage and use of flammable and combustible liquids (29 CFR 1910.106).

IV. Pressure Vessels

Compressed-gas cylinders, air receivers, high-pressure washing equipment, hydraulic lift lines, and steam generators house high-pressure air lines (over 30 psi), and autoclaves contain steam and contents under high pressure. These vessels present a substantial hazard to workers if uncontrolled or improper release of the pressure occurs. Compressed-gas cylinders should be secured at all times.

V. Lighting

One characteristic of animal care facilities that is not seen in many other operations is a fixed light-dark cycle. In animal care rooms, light cycles can vary, and most animals receive only artificial light. Animals can be kept on light-dark cycles that do not match the natural daily cycles. Or animals might be kept in rooms with single-color lights (usually red) or very low light. For humans, poor lighting can cause visual fatigue or create safety hazards that cause trips, slips, or falls. They might bump into corners of cages or other objects because they cannot see them easily in low light. Humans need an adjustment period for their eyes to become accustomed to the color or light levels in the room. Waiting for this adjustment will make work in the room easier and safer.

VI. Electricity

Electric hazards can be present whenever electric current is flowing. Electric hazards are ubiquitous in animal care. Most of the hazards are obvious, such as the absence of a plate on a wall socket, an open electric panel, or an ungrounded plug. Less obvious hazards are present on cage-changing tables, biological safety cabinets, and wet vacuum systems. The electric hazards associated with those and other kinds of equipment can be minimized or eliminated through such engineering controls as ground-fault interrupters, such operational procedures as the use of lockout and tagout procedures to control energy sources during repair and maintenance of equipment (CFR 1919.147), and vigilance. Equipment that has frayed or exposed wires or that is designed to be connected to an ungrounded receptacle (as with a two-pronged plug) should not be used.

Wet conditions may be present during room and hallway cleaning and in cage-wash areas. The presence of electrical devices in those areas could pose a risk of electric shock. Areas where fish tanks or aquaria are maintained pose similar hazards. Extension cords must not be used as a long-term solution in place of permanent wiring; they can also create other hazards such as tripping. A qualified electrician must make electrical repairs.

VII. Ultraviolet Radiation

Exposure to ultraviolet (UV) radiation can occur in some operations involved in the care and use of laboratory animals. For example, UV germicidal lamps are used to sterilize clean surfaces in some work areas, and UV radiation is used in sterilizing water and in the diagnosis of fungal diseases. The most important exposures to UV radiation might be those of workers who perform outside work. UV radiation is divided into three classes:

UV Classification	Wavelengths (nm)	Effects	Sources
UV–A (black-light region)	320–400	Pigmentation of skin	Sunlight, black light
UV–B (erythemal region)	280–320	Photokeratitis, cataracts, erythema	Sunlight, artificial sources
UV–C (germicidal region)	100-280	Germicidal effects	Germicidal lamps

Sources: Adapted from National Safety Council 1988, pp. 227–232, and from the American Conference of Governmental Industrial Hygienists (ACGIH), 1994, p. 100.

UV radiation reacts with the vapors of chlorinated solvents—such as trichloroethylene, trichloroethane, and chlorofluorocarbons—to produce phosgene, a potent lung irritant. Those solvents should not be used in areas where UV-B or UV-C radiation is present.

If employees must work in the presence of UV radiation, their eyes and skin should be protected against UV exposure. Interlocking devices can be used to turn off UV sources before exposed areas are entered. Window glass is very effective at filtering out wavelengths less than 320 nm except for very intense sources.

UV lamps in biological safety cabinets (BSC) are not recommended for disinfection, but if there is one in your BSC, make sure it is turned off when people are in the lab. Turn off UV light before beginning work in a BSC. Specialized Eye Protection - Some protective eyewear protects against specific chemical vapors, fumes and dusts, while others protect against intense light sources (e.g., lasers, ultraviolet light (UV), welding).

VIII. Lasers

Laser is an acronym for light amplification by the stimulated emission of radiation. Laser emissions are produced by solid-state, gaseous, and semiconductor lasers. Radford University, in accordance with state and federal regulations, requires that certain types of lasers are to be registered. Consult the Radford University Laser Safety Program for additional information. The American National Standards Institute (ANSI Z–136.1 1986) has classified lasers on the basis of their power level and hazard potential as follows:

Class I. Lasers that under normal operating conditions do not emit a hazardous level of radiation.

Class II. Low-power lasers that do not have enough power to injure someone accidentally but do have enough power to cause injury if the beam is viewed for extended periods.

Class III. Class IIIa higher-power lasers that can cause injury if the beam is concentrated with a viewing device, such as binoculars; Class IIIb lasers that can produce injury if viewed directly. The beam reflected off a mirror-like surface is also hazardous.

Class IV. Lasers that, in addition to the conditions in Class III, can present a fire hazard.

The major hazard associated with lasers is related to the beam. The beam can cause burns, eye damage, lacerations, or fires, depending on its power. In animal care operations, lasers might be used to perform surgery or to provide medical treatment.

Personnel who work with or around lasers should be trained in the hazards and the means to protect themselves. In the case of higher-power lasers, enclosing or shielding the beam (if possible) and providing interlocks on doors where a laser will be used are effective ways to reduce exposure to the beam. Laser surgery can also produce substantial aerosols, fumes, and toxic gases. These hazards should be controlled to prevent harmful exposures of employees.

All lasers use electric power, some in large quantities, so the risk of electric shock should be considered and reduced. The National Safety Council (NSC 1988) has produced a list of possible steps for reducing the risk of electric shock associated with lasers.

IX. Ionizing Radiation

Ionizing radiation is ubiquitous in our daily lives. We are exposed to cosmic radiation, radon gas, natural background radiation, medical x-rays, and even internal radiation from sources including potassium-40. To be classified as ionizing, radiation must have enough energy to remove electrons from atoms and so create ions. The ionization can cause chemical changes that can be harmful to a living organism. Ionizing radiation can be classified as particulate and non-particulate. Particulate radiation is composed of particles that are of atomic origin. Alpha particles are charged particles that each contain two neutrons and two protons. Beta particles are electrons that are emitted with very high energy from many radioisotopes. Positively charged counterparts of beta particles are called positrons. Alpha particles do not travel more than 0.5 in (1.3 cm) in air and cannot penetrate the dead layer of skin. The distance that beta particles can travel depends on their source: in air, some of the more energetic beta particles, such as those from phosphorus-32, can travel up to 30 ft (9 m), but beta particles from tritium (hydrogen-3) travel only 0.02 ft (0.6 cm). Beta particles are usually stopped by the skin but can cause serious damage to skin and eyes.

Non-particulate radiation includes x-rays and gamma rays. X-rays and gamma rays are electromagnetic radiation with very short wavelengths. They are photons of energy and can penetrate matter. Photons are relatively difficult to shield. Gamma rays arise from nuclear decay; x-rays arise from electron dislocation. When a radionuclide decays, it might produce alpha particles, gamma rays, beta particles, neutrons, or combinations of these. Irradiators and diagnostic x-ray machines are commonly used in research settings. Appropriate training of personnel and personal protection should be provided. Preventive maintenance of equipment is also critical to safe operations.

Radiation can present a hazard through inhalation, ingestion, skin contact, or proximity. The biological effect of ionizing radiation depends on the type of radiation, its energy, and the type of tissue that absorbs it. Two types of hazard must be considered: external and internal. A radionuclide that presents a radiation hazard when it is outside the body constitutes an external hazard; a radionuclide that presents a radiation hazard when it is ingested, inhaled, or absorbed constitutes an internal hazard. Alpha and beta particles do not travel very far in air, so they present mainly internal hazards; they can produce harm by being near tissue. Some of the more energetic beta particles can present an external hazard.

Experimentation involving animals and radioisotopes is common in molecular biology today. Use of radioisotopes in or with animals presents several new hazards that must be dealt with. For example, some isotopes can be concentrated in a specific organ, such as iodine in the thyroid. Tissue that has concentrated a radioactive material might have to be handled or disposed of differently, depending on the isotope and the concentration. Bedding material from experimental animals exposed to radioactive materials should be surveyed to determine its radioactivity and then disposed of according to applicable regulations. If an isotope could be released by exhalation, additional engineering controls might be required. The use of radioisotopes is strictly controlled by the US Nuclear Regulatory Commission (US Congress 1971) and the Virginia Department of Health (VDH). Investigators must be authorized to use radioisotopes by Radford University EHS; authorizations are based in part on state licensure, evidence of training, and established work practices.

X. Housekeeping

Good housekeeping keeps work surfaces clean and clear of obstructions, waste, and other material. If boxes, hoses, or bags of bedding material are not removed from the work area, trip hazards can be created or safe work might be impossible because working conditions are cramped. The act of cleaning itself sometimes creates hazards. For example, during steam cleaning of walls and floors of an animal room, the hoses can cause tripping hazards, high-temperature steam can cause burns, and wet floors can cause slipping hazards. Material left in hallways that are used for emergency egress poses a very serious hazard. Immediate removal of blockages of exits is imperative. Poor housekeeping practices can increase the seriousness of other hazards associated with animal care. For example, sweeping bedding, hair, and dander from floors, rather than using a vacuum cleaner with a filtered exhaust, can result in high concentrations of airborne allergens that can be distributed throughout the animal facility.

XI. Ergonomic Hazards

Physical trauma can occur when workers perform tasks that require repetitive motions and lifting of heavy loads. Injuries that result from repetitive small stresses are often termed cumulative injuries. Cumulative injuries are not associated with a specific exposure incident. Common cumulative injuries include back injuries, carpal-tunnel syndrome, tennis elbow, and bursitis. Activities in animal care operations that contribute to back injuries include lifting heavy bags of feed, lifting heavy animals, lifting small weights incorrectly, moving or lifting cages, or clipping animals' fur manually. Adjusting control knobs, using a screwdriver, using pliers, opening and closing cage doors, moving small animals from cage to cage, operating video display terminals

for extended periods, and mopping floors can also lead to repetitive-stress injuries. To reduce hazards due to repetitive motion, vary tasks to lessen the number of repetitions, re-engineer tasks, or redesign equipment or tools to require fewer repetitions with less strain.

Lifting heavy loads that exceed permissible-load recommendations of the National Institute for Occupational Safety and Health (NIOSH 1991) is unsafe and presents a substantial risk of acute injury. Anyone lifting heavy loads should be physically fit, should avoid sudden movements, and should use a two-handed lifting technique. Animal care operations that involve a potential for substantial physical stress include moving and restraining large animals, lifting and moving cages, lifting large feed bags, and moving high-pressure wet-vacuum systems. Engineering controls—such as the use of lifting equipment, automation of the lifting operation, or splitting of the load—can reduce the risk.

Once a hazard is recognized, employee education and engineering controls can be applied to reduce the potential for these types of injuries. Training should be updated if new tools are used in an operation and updated periodically to remind employees of proper work techniques. Employee involvement should be part of each solution.

XII. Machinery

Conveyor belts, sanders, floor polishers, cage washers, room washing equipment, and other machinery have potential to cause injury. The common types of hazards presented by machinery are in-running nip points, crush points, and pinch points. In-running nip points are places on a roller or similar moving surface where a body part of an exposed worker could be pulled into the machinery. Crush points and pinch points are areas of a machine where two surfaces could come together to crush or pinch part of the body. These all occur in machinery that has exposed moving parts. Each machine should be evaluated to determine whether a worker's hand or arm could be placed in an area where it could be injured. If a hazardous area is identified, guarding should be installed to eliminate the hazard. Guarding is important even when workers know that they are not to place their hands in a dangerous area. Slips, falls, and loss of awareness of the hazard can cause injury if guarding is not in place. In large equipment that requires operators or repair mechanics to work in the operating chamber, such as cage washers, an internal release mechanism should be available to allow emergency escape if the equipment is inadvertently started. Supervisors must train all personnel who use facility equipment in the proper operation, use, and maintenance of the equipment. Employees are expected to follow established Standard Operating Procedures (SOPs) which include information about safe use and accident prevention. PPEs such as steel-toed shoes or boots may be required in certain work areas.

XIII. Thermal Burns

Cage-wash and autoclave equipment generate high temperatures which could result in thermal burns in personnel who touch hot surfaces or processed materials that have not yet cooled. Supervisors must train all personnel who use heat-generating equipment to follow established SOPs for handling equipment and processed materials. Personnel must use appropriate PPEs (e.g., thermal mitts) when handling hot materials.

XIV. Noise

Exposure to intense noise can result in loss of hearing. Chronic noise-induced hearing loss is a permanent condition and cannot be treated medically. This type of hearing loss is usually characterized by declining sensitivity to frequencies above 2,000 Hz. Exposure to an intense noise for a short period can cause temporary or permanent loss of hearing. OSHA limits employee exposure to noise to 90 decibels measured on the A scale of a standard sound-level meter at slow response (dBA) averaged over an 8-h workshift (29 CFR 1910.95). The time-weighted average must be lower than 90 dBA if the workshift is longer than 8 h (29 CFR 1910.95). Where levels exceed 85dBA, the exposed employees need to participate in a hearing-conservation program that includes monitoring, audio-metric testing, hearing protection, training, and record-keeping (29 CFR 1910.95 c though o). Hearing loss is not the only adverse effect of exposure to noise. Noise can make speech difficult, cause loss of concentration, distract workers, and increase fatigue (NSC 1988).

In an animal care facility, noise can result from animals, particularly pigs and dogs, and from equipment, such as cage washers, high pressure air cleaning equipment, and wet vacuum systems operated in a confined space. A useful way of assessing whether a noise exposure might be excessive is to visit the area and attempt to converse with another person or attempt to talk on the telephone. The noise is probably excessive if normal speech or talking on the telephone is difficult or impossible. When this condition is observed, the noise levels should be assessed by a person knowledgeable about noise, noise-measurement techniques, and data interpretation. Most often, such a person will be an industrial hygienist or an acoustical engineer. OSHA requires that engineering controls be applied first to control the hazard. Engineering controls include shielding, quieter equipment, and installation of sound-deadening materials on the walls and ceilings. If acceptable noise levels are not achieved that way, administrative controls or personal protective equipment will be necessary. Administrative controls include limiting the time that an employee works in the noise-hazard area. It is prudent to provide workers who are exposed to a noise hazard earplugs, earmuffs, or other protective equipment during the noise-evaluation period.

Ultrasonography is used in laboratories and animal care facilities for imaging internal structures. If the frequency is below 20 kHz, it is covered by the OSHA noise standard. Even if it is above 20 kHz, noise exposure is possible because of subharmonics at these higher frequencies (Strickoff and Walters 1990). *Please consult Radford University's Hearing Conservation Program for additional information.*

Appendix G – Chemical Hazards

CHEMICAL HAZARDS

Most employees engaged in the care and use of research animals are familiar with the hazards of chemicals used in animal care and laboratory environments. Employee knowledge of chemical hazards and of relevant protective measures has been focused and increased in recent years through employers' responses to two important health and safety standards promulgated by OSHA: the Hazard Communication Standard (29 CFR 1910.1200) and the Occupational Exposure to Hazardous Chemicals in Laboratories (29 CFR 1910.1450), which is known as the laboratory standard. The recognition and control of chemical hazards in research institutions have also been aided by Prudent Practices for Handling Hazardous Chemicals in Laboratories (NRC 1981). That volume was extensively revised and updated in 1995, Prudent Practices in the Laboratory: Handling and Disposal of Chemicals (NRC 1995), and then again in 2011: Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards (NRC 2011) which provides practical guidance for evaluating chemical hazards and for working safely with chemicals in the research setting. It extensively discusses sources of hazard information and principles for evaluating and elucidating toxic effects of chemicals. It constitutes a relevant and comprehensive reference document on the recognition and control of chemical hazards, and it should be consulted by all who have responsibility for the planning, conduct, and support of safe research.

Flammability, corrosiveness, reactivity, and explosivity are hazardous properties of chemicals that are usually well understood. Toxicity is the least-predictable hazardous property of chemicals. Exposure to toxic chemicals can cause acute or chronic health effects. General classes of toxic chemicals that might be handled in a research environment are carcinogens, allergens, asphyxiants, corrosives, hepatotoxicants, irritants, mutagens, nephrotoxicants, neurotoxicants, and teratogens. Health risks associated with toxicants depend on both the inherent toxicity of the chemicals and the nature and extent of exposure to them. Animal care activities can seriously influence the potential for employee exposure. Thus, animal care practices that might contribute to employee exposures need to be carefully assessed so that toxic hazards of chemicals associated with the care and use of research animals can be recognized and controlled. A comprehensive review of chemical-hazard assessment and control is provided in Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards (NRC 2011).

Typical sources of chemical exposure in the care and use of research animals involve the use of disinfectants, pesticides, anesthetic gases, and chemicals for preserving tissues. Sources can include animals that have been intentionally exposed to highly toxic chemicals. Another important source is the disposal of bedding and other waste materials from experimental procedures.

Disinfectants and detergents include soaps, cleaning chemicals, acid-containing chemicals, alcohols (most commonly ethanol and isopropanol), aldehydes (including formaldehyde and gluteraldehyde), and halogenated materials (such as chlorinated and iodinated bleaches). Some

phenolic compounds (including potassium o-phenylphenate and potassium o-benzyl-p-chlorophenate) and quaternary ammonium compounds are also used as disinfectants. Various pesticides can be used within animal facilities, but most animal facilities restrict the use of pesticides because of their potential effects on the animals. The primary chemical used as a preservative is formalin as a 10% neutral-buffered solution, but other materials are used from time to time.

Several occupational diseases—including cancer, spontaneous abortion, and liver disease—have been associated with exposure to waste anesthetic gases. Monitoring exposures to waste anesthetic gases in animal operating rooms is an important part of the health and safety program because of the difficulty in matching anesthetic-delivery equipment to the animals.

Burns and irritation of the skin are the most common chemical injuries associated with animal care and use. Some chemicals, such as formaldehyde and gluteraldehyde used for preserving tissue, can cause an allergic response in sensitized people. The risk of injury and illness associated with chemical use can be minimized by practices that reduce or prevent exposure.

When selecting specific safeguards for animal experimentation with hazardous agents, careful attention should be given to procedures for animal care and housing, storage and distribution of the agents, dose preparation and administration, body fluid and tissue handling, waste and carcass disposal, items that might be used temporarily and removed from the site (e.g., written records, experimental devices, sample vials), and personal protection.

Institutions should have written policies and procedures governing experimentation with hazardous biologic, chemical, and physical agents. An oversight process (such as the use of a safety committee) should be developed to involve persons who are knowledgeable in the evaluation and safe use of hazardous materials or procedures and should include review of the procedures and facilities to be used for specific safety concerns. Formal safety programs should be established to assess hazards, determine the safeguards needed for their control, and ensure that staff have the necessary training and skills and that facilities are adequate for the safe conduct of the research. Technical support should be provided to monitor and ensure compliance with institutional safety policies. A collaborative approach involving the investigator and research team, attending veterinarian, animal care technician, and occupational health and safety professionals may enhance compliance.

The BMBL (DHHS 2009) and NRC (1997) recommend practices and procedures, safety equipment, and facility requirements for working with hazardous biologic agents and materials. Facilities that handle agents of unknown risk should consult with appropriate CDC personnel about hazard control and medical surveillance. The use of highly pathogenic “select agents and toxins” in research requires that institutions develop a program and procedures for procuring, maintaining, and disposing of these agents (CFR 1998, 2002a,b; NRC 2004; PL 107-56; PL 107-188; Richmond et al. 2003). The use of immunodeficient or genetically modified animals (GMAs) susceptible to or shedding human pathogens, the use of human tissues and cell lines, or

any infectious disease model can lead to an increased risk to the health and safety of personnel working with the animals (Lassnig et al. 2005; NIH 2002).

Hazardous agents should be contained in the study environment, for example through the use of airflow control during the handling and administering of hazardous agents, necropsies on contaminated animals (CDC and NIH 2000), and work with chemical hazards (Thomann 2003). Waste anesthetic gases should be scavenged to limit exposure.

Appendix H – Experiment Related Injuries and/or Illnesses

HAZARDS ASSOCIATED WITH EXPERIMENTAL PROTOCOLS

A fundamental principle in the conduct of research is the need to determine the potential hazards associated with an experiment before beginning it. That is extremely important in planning experiments that involve research animals, because investigators might be unfamiliar with the intrinsic hazards presented by the animal species of choice or tissues derived from them, and managers and their employees who care for the research animals should be informed of the hazards presented by the experimental protocol. Consideration of both animal-related hazards and protocol-related hazards would benefit from a collaborative assessment in which the investigator, the institutional veterinarian, the animal care supervisor, and a health and safety professional participate. A collaborative assessment is strongly encouraged if the animal experimentation involves either the testing of chemicals for their toxic properties or research with experimentally or naturally infected animals. Whether or not a collaborative initiative is pursued, investigators have an obligation to identify hazards associated with their research and to select the safeguards that are necessary to protect employees involved in the care and use of their research animals.

Hazards associated with experimental protocols are influenced by two principal factors: the dangerous qualities of the experimental agents and the complexity or type of the experimental operations. For example, toxicity, reactivity, flammability, and explosivity should be considered when an experimental protocol involving chemical agents is being planned, and virulence, pathogenicity, and communicability are possible hazardous qualities of biological agents.

The complexity and type of an experimental operation have a direct impact on the extent of potential exposure that an employee receives while carrying out or participating in an experimental protocol. For example, during incorporation of a test chemical into feed for ingestion studies, a contaminated dust created during milling and mixing and during transfer of the diet could result in respiratory and dermal exposures. Test material applied to the skin of experimental animals might be disseminated by handling of animals, clipping of hair, changing of bedding, and sweeping of the animal room floor. Vapors are potential sources of exposure during the application of test material to the skin. Exposing an animal to an agent by injection will create a risk of accidental self-inoculation. Inhalation challenges are particularly hazardous and should be conducted only by investigators who have appropriate experience and containment equipment.

I. Protocols Involving Chemicals of Unknown Hazard

A comprehensive, rigidly followed plan is necessary for testing chemicals of unknown hazard for their toxic properties. It should be presumed that a chemical is hazardous to humans, and the plan should describe specific procedures for handling the chemical from receipt through disposal of animal waste and processing of tissues for histopathological or biochemical examination. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards (NRC

2011) provides an excellent general model for planning experiments that involve hazardous chemicals. It was specifically structured to follow the sequence of stages that should be considered in planning a safe experiment: evaluating hazards and assessing risks in the laboratory, management of chemicals, working with chemicals, working with equipment, the disposal of chemicals, laboratory facilities, and government regulation of laboratories. It is important not to underestimate the risk presented by experimental chemicals. But most references on chemical safety provide little guidance that is directly applicable to the care and use of research animals. Therefore, developing plans for a specific research protocol that involves research animals and chemicals of unknown hazard will require ingenuity, a quality best derived from a collaborative planning process.

II. Protocols Involving Infectious Agents

Experiments involving experimentally or naturally infected research animals present recognized risks of occupationally acquired infections. In the largest survey of laboratory-acquired infections conducted to date, research animals or their ectoparasites were associated with about 17% of the reported infections (Pike 1976). In the few cases (under 3%) in which infections were attributed to a recognized accident, the primary source was a bite or scratch from an infected animal. That survey and others (Sullivan and others 1978) have shown that trained scientific personnel and technicians were most likely to be infected, although animal care providers and janitorial and maintenance workers have been proved to be at risk for occupationally acquired infection. Most of the zoonotic infections cited in these surveys were associated with research activities involving experimentally infected animals. Transmission of zoonotic disease in an animal facility that is not involved with infectious disease research is rare. CDC and NIH have identified 17 infectious agents or genera other than arboviruses as proven hazards for personnel who use and care for experimentally or naturally infected research animals (CDC-NIH 2009). The agents and genera are summarized in Table 3-2. Arboviruses—most notably Venezuelan equine encephalomyelitis virus, yellow fever virus, Rift Valley virus, and Chikungunya virus—have also been responsible for laboratory animal-associated infections (Hanson and others 1950). The Subcommittee on Arbovirus Laboratory Safety (SALS) of the American Committee on Arthropod-Borne Viruses reported 818 occupationally acquired infections caused by 62 different arboviruses or related viruses (SALS 1980). A total of 19 of these infections, which were associated with 10 viruses—Semliki Forest, Venezuelan equine encephalitis, Western equine encephalitis, yellow fever, Hypr, Rift Valley fever, Congo-Crimean hemorrhagic fever, Junin, Lassa, and Machupo—resulted in death.

Investigators who are planning research activities involving experimentally or naturally infected vertebrate animals should carefully review Biosafety in Microbiological and Biomedical Laboratories (BMBL) (CDC-NIH 2009). It defines four levels of control that are appropriate for animal research with infectious agents that present occupational risks ranging from no risk of disease for healthy people to high individual risk of life-threatening disease, and it recommends guidelines for specific agents. The four levels of control, referred to as animal biosafety levels 1-4, each have appropriate microbiological practices, safety equipment, and features of animal

facilities. The selection of an animal biosafety level is influenced by several characteristics of the infectious agent, the most important of which are the severity of the disease, the documented mode of transmission of the infectious agent, the availability of protective immunization or effective therapy, and the relative risk of exposure created by manipulation in handling the agent and caring for infected animals.

Animal biosafety level 1 is the basic level of protection appropriate for well-characterized agents that are not known to cause disease in healthy humans. Animal biosafety level 2 is appropriate for handling a broad spectrum of moderate-risk agents that cause human disease by ingestion or through percutaneous or mucous-membrane exposure. Extreme precautions with needles or sharp instruments are emphasized at this level. Animal biosafety level 3 is appropriate for agents that present risks of respiratory transmission and that can cause serious and potentially lethal infections. Emphasis is placed on the control of aerosols by containing all manipulations and housing infected animals in isolators or ventilated cages. At this level, the animal facility is designed to control access to areas where animals are kept and includes a specialized ventilation system that is designed to maintain directional airflow. Exotic agents that pose a high individual risk of life-threatening disease by the aerosol route and for which no treatment is available are restricted to animal biosafety level 4 high-containment facilities. Worker protection in these facilities is provided by the use of physically sealed glove boxes or fully enclosed barrier suits that supply breathing air. Most research involving experimentally and naturally infected vertebrate animals will be conducted at animal biosafety level 2 or 3.

Most-helpful practices to prevent occupationally acquired infections associated with the care and use of research animals are the following:

- Avoid the use of sharps whenever possible. Take extreme care when using a needle and syringe for inoculating research animals or when using sharps during necropsy procedures.
- Keep hands away from mouth, nose, and eyes.
- Wear protective gloves and a laboratory coat or gown in areas where research animals are kept.
- Remove gloves and wash hands after handling animals or tissues derived from them and before leaving areas where animals are kept.
- Use mechanical pipetting devices.
- Never eat, drink, smoke, handle contact lenses, apply cosmetics, or take or apply medicine in areas where research animals are kept.
- Perform procedures carefully to reduce the possibility of creating splashes or aerosols.
- Contain operations that generate hazardous aerosols in biological safety cabinets or other ventilated enclosures.
- Wear eye protection.
- Keep doors closed to rooms where research animals are kept.

- Promptly decontaminate work surfaces after spills of viable materials and when procedures are completed.
- Decontaminate infectious waste before disposal.
- Use secondary leak-proof containers to store or transfer cultures, tissues, or specimens of body fluids.

Appendix I – Allergens

ALLERGENS

Allergic reactions to animals are among the most common conditions that adversely affect the health of workers involved in the care and use of animals in research. One survey (Lutsky 1987) demonstrated that three-fourths of all institutions with laboratory animals had animal-care workers with allergic symptoms. The estimated prevalence of allergic symptoms in the general population of regularly exposed animal-care workers ranges from 10% to 44% (Hollander and others 1996, Knysak 1989). An estimated 10% of laboratory workers eventually develop occupation-related asthma.

Attempts have been made to determine whether persons with allergic conditions, such as allergic rhinitis (hay fever), are at higher risk than normal persons of developing animal-dander sensitivity when working with laboratory animals. On the basis of current estimates, up to 73% of persons with pre-existing allergic disease eventually develop allergy to laboratory animals (Agrup and others 1986, Platts-Mills and others 1986, Venables and others 1988). Allergy is most often manifested by nasal symptoms, itchy eyes, and rashes.

Symptoms usually evolve over a period of exposure of 1-2 years. Occupation-related asthma, a more serious disorder, might develop in about 10% of persons with allergic disease who work with laboratory animals (Hunskaar and Fosse 1993). Occupation-related asthma not only can cause symptoms of cough, wheezing, and shortness of breath while the worker is exposed to laboratory animals, but also can lead to chronic symptoms (persisting for months to years) even after exposure ceases.

Workers exposed to laboratory animals can be categorized into several risk groups. Except in a few situations, a dose-response relationship that defines sensitization, induction of disease, and production of symptoms in association with specific allergen concentrations has not been established.

Contact urticaria ("hives") is typically due to the application of an allergen (usually a protein or glycoprotein) directly onto the skin. A common example is the development of wheal and flare reactions that produce welts when a person's skin and the tail of a mouse or rat come into contact. Scratches by cats and dogs can produce similar responses. Latex in rubber gloves is another cause of contact urticaria.

Although symptoms of asthma in laboratory-animal workers are most obvious in the work environment, they can also occur at night and awaken sufferers. In almost all asthmatic people with laboratory-animal allergy, nasal and eye symptoms preceded the development of asthma (Bland and others 1987). Before working with animals, individuals should read the NIOSH pamphlet "Preventing Asthma in Animal Handlers"; a web-based version of this pamphlet may be found at http://www.cdc.gov/niosh/docs/97-116/. Animal handlers should understand the risk

of developing asthma and allergies from working with animals and follow the precautions described in the NIOSH Alert.

In rare instances, a person who has become sensitized to an animal protein in the saliva of the animal experiences a generalized allergic reaction termed anaphylaxis when bitten by an animal (Teasdale and others 1993). People working in entomology laboratories can be exposed to stinging insects, such as bees, wasps and ants, which can cause similar reactions. Anaphylaxis can be evident as diffuse itching, hives, and swelling of the face, lips, and tongue. Some people experience difficulty in breathing because of laryngeal edema; others develop asthma with wheezing. In some instances, shock can lead to loss of conscious-ness. Anaphylactic reactions vary from mild generalized urticarial reactions to profound life-threatening reactions.

I. Mechanisms of Allergic Reactions

The allergic reactions described above are examples of classic immunoglobulin E-mediated reactions. Such reactions are the consequence of a series of immunological and biochemical events. First, a person is exposed to the allergen, which is usually a protein or glycoprotein. The allergen is processed by the macrophages or B lymphocytes and presented to T lymphocytes. Helper T lymphocytes stimulate B lymphocytes to produce antibodies of the immunoglobulin E (IgE) class specific for the allergen. Allergic disorders observed include contact urticaria, Allergic conjunctivitis, Allergic rhinitis, Asthma, and Anaphylaxis.

IgE is found in the circulation in low concentrations and binds to mast cells and basophils. Mast cells are abundant in the respiratory tract, gastrointestinal tract, and skin, the main sites of allergic reactions. When a person so "sensitized" is re-exposed to the same allergen, the allergen binds to IgE molecules and causes the release of histamine and other chemical mediators stored in the mast cells and basophils. The mediators, on contact with the relevant tissues, can produce hives, nasal congestion, sneezing, nasal drainage, coughing, wheezing, and shortness of breath.

All those reactions are termed "immediate hypersensitivity" responses be-cause they are noted within 10-15 min of exposure to the allergen. However, it is now recognized that such reactions not only can occur immediately but also have a late component; that is, the symptoms can recur 4-6 h after exposure without further allergen stimulation.
Virtually all human beings are capable of developing allergic reactions; however, some individuals are more susceptible. These people (atopics) are more likely to develop IgE antibodies to allergens owing to an inherited tendency. This is an autosomal dominant trait with variable expression that has been linked to genetic markers on chromosome 5 (Blumenthal and Blumenthal 1996, Marsh and others 1994). Persons with atopy often develop allergic diseases, such as allergic rhinitis, asthma, and atopic dermatitis (eczema) when chronically exposed to allergens.

II. Specific Animals that can Provoke Allergic Reactions

Rats

Rats are among the most commonly used laboratory animals and are responsible for symptoms in a large portion of people who have laboratory-animal allergy. The major sources of rat-allergen exposure appear to be urine and saliva of the animal. A major rat-urine allergen with two isoforms has been identified: Rat n 1A, a pre-albumin, and Rat n 1B (α2-euglobulin) (Eggleston and others 1989, Longbottom 1980). These two proteins have some cross-reactivity, al-though they differ in molecular weight and isoelectric point. Their amino acid composition is similar, but their carbohydrate concentration differs. The amino acid sequence of Rat n 1B has been obtained (Laperche and others 1983).
Sampling methods have been developed to measure the amount of airborne allergen and the size of the airborne particles that contain rat allergen (Eggleston and others 1989; Platts-Mills and others 1986). Particles that contain rat allergen found in air samples from a rat vivarium vary from <0.5 to >20 µm in aerodynamic equivalent diameter. Disturbance of rat litter leaves a substantial proportion of the smaller particles airborne for 15-35 min (Platts-Mills and others 1986); most of these particles are easily respirable.

In a preliminary study of 335 workers exposed to rats, the risk of respiratory or skin symptoms was related to the duration of exposure to rat urinary protein concentrations of at least 1 µg/m3 of air sampled (Tee and others 1993), the concentrations most likely to be encountered by animal-care technicians. Allergic symptoms due to exposure to rats were more likely to develop in atopic subjects (those with pre-existing sensitivity to nonanimal allergens) than in nonatopic subjects.

Exposure concentrations are clearly task-related. Cage-cleaning resulted in a mean airborne Rat n 1 concentration of 21 ng/m^3 (range, 8.1-69 ng/m^3); handling rats for weighing, shaving, injections, and collection of blood and urine samples yielded a mean of 13 ng/m^3 (range, undetectable to 45 ng/m^3); and surgery on anesthetized animals or euthanasia of unconscious animals yielded a mean of 3 ng/m^3 (range, undetectable to 12 ng/m^3) (Eggleston and others 1989). It should be noted that these levels are an order of magnitude lower than reported by Tee and others (1993). This difference might be accounted for by the fact that Eggleston and co-workers measured for the specific allergen Rat n 1, whereas Tee and colleagues measured total airborne rat allergenic activity.

The importance of these exposures has been demonstrated in environmental challenge studies in which workers are exposed in rooms containing animals. Eggleston and co-workers (1990) measured airborne Rat n 1 in a rat vivarium over the course of 1 h. The allergen concentration ranged from less than 1.5 to 310 ng/m3 and was much higher during cage-cleaning than during quiet activity. Of 12 rat-allergic volunteers working in this environment, all had nasal symptoms and evidence of histamine release in their nasal secretions during the period of exposure, and five had decreases in pulmonary function greater than 10%. This experiment demonstrated that

occupational exposure was directly correlated with the development of nasal symptoms and asthma in the sensitized volunteers.

Airborne allergen concentrations depend on the balance between the rate of allergen production and the rate of removal. And the magnitude of exposure to rat allergens is directly proportional to the number of animals in the area. Urine is a major source of allergen, and contact with contaminated litter seems to be a major source of exposure (Gordon and others 1992). Ventilation might be an effective means to lower exposure when production of allergen is low, because of either a small number of animals or little disturbance of litter, but it might be ineffective when production is high. For example, Swanson and others (1990) found that it might take up to 127 air changes per hour to reduce exposures sufficiently to make symptoms unlikely when many rats were present in the sampling area.

Mice

Mice are another important source of allergen exposure of laboratory workers. The major mouse allergen is a urinary protein, Mus m 1. Mus m 1 has been molecularly cloned and its amino acid sequence deduced. It is analogous in many ways to Rat n 1B in that it is produced in the liver and saliva, is secreted in the urine, and has 80% amino acid sequence homology with Rat n 1B (Clark and others 1984). Urine samples contain Mus m 1 at a concentration 100 times that in serum, and male mice excrete 4 times as much of it as female mice (Lorusso and others 1986).

Air-sampling techniques have been developed to monitor concentrations of major mouse urinary proteins in the environment (Twiggs and others 1982). Airborne allergen concentrations range from 1.8 to 825 ng/m^3, depending on the number of animals and the type of activity in the environment. The particles that contain most of the allergen vary from 6 to 18 µm in diameter (Price and Longbottom 1988). Sakaguchi and others (1989a) found that most of the airborne allergen in undisturbed air in a room containing 350 mice was trapped by a filter with a retention size greater than 7 µm. In disturbed air (in which cage-cleaning was conducted), allergen concentration increased by up to 5 times and the proportion of small particles (1.1 µm and smaller) increased by 3 times. Airborne concentrations are related to the number of mice present in the sampling area and the degree of work activity (Twiggs and others 1982).

Guinea Pigs

Immunochemical studies have identified allergenic components in the dander, fur, saliva, and urine of guinea pigs (Walls and others 1985); urine appears to be the major source of allergen. Most guinea pig allergen activity is associated with particles greater than 5 µm, but about 10% is found on particles smaller than 0.8 µm, which are small enough to penetrate into the lower respiratory tract (Swanson and others 1984).

Gerbils

Gerbils are occasionally used as laboratory animals, and allergic sensitivity to them has been reported (Gutman and Bush 1993). The allergens involved have not been identified.

Rabbits

Rabbits are used widely as laboratory animals and are a recognized cause of allergic symptoms in many workers. A major glycoprotein allergen has been described that appears to occur in the fur of the animals, and minor allergenic components found in rabbit saliva and urine have been identified (Warner and Longbottom 1991). Allergenic activity is associated with particles less than 2 µm in diameter (Price and Longbottom 1988).

Cats

Domestic cats are kept as pets by many people, and sensitization can occur outside the laboratory environment. Furthermore, allergy to cats might predispose workers to the development of allergy to laboratory animals, such as mice and rats (Hollander and others 1996). There is a close link between immunological sensitization and development of asthma in people sensitive to cats (Desjardins and others 1993). Those with pre-existing sensitivity might encounter worsening of their symptoms and possibly develop asthma during the course of their work exposure.

The major cat allergen is the protein Fel d 1 (Kleine-Tebbe and others 1993). Fel d 1 was first described by Ohman and colleagues (1974). It is produced in the sebaceous glands of the skin and coats the hair shafts (Woodfolk and others 1992). It is also produced in the saliva (Anderson and others 1985). Fel d 1 has been molecularly cloned, its amino acid sequenced, and its allergenic structure analyzed (Morgenstern and others 1991). Fel d 1 is found in all cats, and cross reactivity occurs throughout all species of cats. However, individual cats shed different amounts of the allergen (Wentz and others 1990), and male cats might shed more than female cats. A few people can become sensitized to cat albumin.

The size of particles that contain cat allergen varies, but many are less than 0.25 µm in diameter (Findlay and others 1983) and are easily carried deeply into the lung. Exposure to two cats that produced allergen at a concentration of 1.1-128 ng/m^3 was sufficient to cause symptoms of rhinitis and asthma in 10 persons with cat sensitivity (VanMetre and others 1986). Cumulative doses of 80-98 ng of Fel d 1 inhaled over 2 min can cause a sufficient decrease in pulmonary function to produce an asthma attack. Placing one cat in a room with a volume of 33 m^3 increases the concentration of Fel d 1 from nondetectable to 30-90 ng/m^3, which would be sufficient to cause an asthma attack within 25 min in a sensitized person (VanMetre and others 1986).

Airborne Fel d 1 remains suspended for long periods because of its small particles (Luczynska and others 1990). The allergen appears to be highly electrostatically charged and therefore sticks

to surfaces, such as walls and laboratory benches (Wood and others 1992). It can be transferred from those materials to hands, or the materials can act as reservoirs and can hold large quantities of allergen in the absence of cats.

Decreasing the airborne concentrations of cat allergen can be attempted by washing the animal (Middleton 1991; Ohman and others 1983). Using a filtered vacuum cleaner, removing carpeting, running a high-efficiency air cleaner, and washing the cat(s) can decrease concentrations in the air (deBlay and others 1991). Simply increasing ventilation rates from eight to 40 air changes per hour in a room containing two female cats did not reduce the clearance of airborne cat allergen (Wood and others 1993). After removal of cats from the environment, he time for concentrations to reach those seen in areas where there has been no cat can be 20 weeks or more (Wood and others 1989).
In addition to cats themselves, it is now recognized that cat fleas can produce allergic symptoms in some people (Baldo 1993).

Dogs

Like exposure to cats, exposure to domestic dogs outside the work environment can lead to sensitization and is also a risk factor for laboratory animal allergy (Hollander and others 1996). The major allergens of dogs are not as well studied as cat allergens, but an important allergen, Can f 1, has been identified (deGroot and others 1991; Schou and others 1991b). Collections of dust samples from homes with a dog in residence showed a Can f 1 concentration of 120 µg/g of dust, compared with 3 µg/g where there was no dog (Schou and others 1991a). There is some question about cross reactivity among breeds of dogs, but the relevant information is not complete. Sources of exposure to dog allergens appear to be saliva, hair, and skin (Spitzauer and others 1993). Dog albumin has also been shown to be an important allergen (Spitzauer and others 1994). About 35%of people who are allergic to dogs have IgG antibody to albumin. The allergen has been molecularly cloned and shares amino acid sequence homology with other albumins.

Primates

Sensitization to primates is unusual. Despite widespread exposure to primates in research settings, few cases of sensitivity to primate allergens have been documented. Cases of sensitivity to lesser bushbaby (galago) and cottontop tamarin have been identified (Petry and others 1985). Allergenic activity was found in the dander of the latter. Whether other sources, such as saliva, are important is not clear.

Pigs

Asthma and other respiratory symptoms have been attributed to pig exposures, particularly in farm operations. In general, the symptoms do not appear to be allergic but more often are related to exposure to high nitrogen concentrations, especially in confinement operations (Matson and

others 1983; Zhou and others 1991). Occupational asthma was described in a person who apparently had allergic sensitivity to a urinary protein from pigs (Harries and Cromwell 1982).

Cattle

Sensitivity to cattle has been reported in 15-20% of dairy farmers. The allergens have not been completely described, but components of dander and urine have been identified as allergenic (Ylönen and others 1992). A purified allergen with a molecular weight of 20-25 kilodaltons (kD) and an isoelectric point of 4.1 has been described (Ylönen and others 1994). Airborne cow-dander allergen concentrations in animal sheds range from 137 to 19,800 ng/m^3.

Horses

Horses constitute a highly potent source of allergens. The nature of the allergens has not been established, but a 27-kD allergen from horse dander, skin scrapings, and albumin are important (Fjeldsgaard and Paulsen 1993). They appear to be shed by the skin and are highly sensitizing in some people. Formerly, the use of horse antiserum in treatment of infectious diseases led to serious reactions in sensitized persons, but the risk has been substantially reduced in recent years since the advent of human antisera.

Sheep

Little information is available regarding sensitivity to sheep. Major allergens have not been identified. Contact dermatitis, possibly due to lanolin in the wool, can occur (Slavin 1993).

Deer

Some people have been shown to be sensitized to deer proteins. There is evidence of cross sensitivity between deer and horse allergens (Huwyler and Wüthrich 1992). Airborne reindeer epithelial allergens have been detected at 0.1-3.9 $\mu g/m^3$ (Reijula and others 1992).

Birds

Exposure to birds can cause rhinitis and asthma symptoms. Birds are also a potential source of hypersensitivity pneumonitis, a lung condition in which a pneumonia-like illness develops after repeated exposure to the antigen. These allergic and hypersensitivity reactions are not mediated by IgE antibody. The symptoms and signs usually occur several hours after exposure and consist of cough, fever, chills, myalgia, and shortness of breath. People with hypersensitivity pneumonitis often have precipitating IgG antibodies to the protein in question. Various bird proteins have been identified as sources of antigens involved in both allergic reactions and hypersensitivity pneumonitis. These proteins are found in pigeon serum and droppings that contain serum.

Reptiles

Human sensitivity to reptiles and amphibians is rare. Cases of occupational asthma caused by frog proteins have been described (Chang-Yeung and Malo 1994), but otherwise the information is sparse.

Fish

Fish proteins are a source of problems for people sensitized through inhalation. In the fish- and crab-processing industry and through the use of fish as a source of animal feed, some people have developed allergic rhinitis and asthma symptoms (Malo and Cartier 1993). Crustaceans and mollusks also pose problems in some laboratory workers. There is evidence that sensitization to airborne allergens from these sources can result in asthma (Malo and Cartier 1993).

Insects

Entomologists are at risk for developing sensitivity to insect proteins. People working in laboratories can be exposed to scales of moths, caterpillars, and other insects that result in sensitization. Beetles, mealworms, cockroaches, and other insects have been described as causing contact urticaria, rhinitis, and possibly asthma symptoms in laboratory workers (Gutman and Bush 1993).

Appendix J – Zoonoses

ZOONOSES

The transmission of zoonotic disease in the laboratory-animal environment is uncommon, despite the number of animal pathogens that have the capacity to cause disease in humans. That is largely the result of the collaborating interactions and work of two groups. The laboratory-animal industry has had much success in providing high-quality laboratory animals of defined health status for use in research. And research institutions have developed comprehensive and responsive programs of veterinary care that have fostered the investigation of new disease findings and helped to ensure the continuing health of research-animal populations. Quality veterinary care itself, however, is insufficient to prevent the transmission of zoonoses in a research institution. The repeated occurrences of laboratory-acquired Q fever and lymphocytic choriomeningitis and the emergence of newly recognized zoonoses point to a need for investigators to become more involved in their institutions' efforts to prevent occupationally acquired zoonotic disease. The occupational-medicine services might be first to observe the symptoms of zoonotic infection, but it is also important that the institutions' medical professionals become knowledgeable in methods for detecting and managing zoonoses for which workers at the institutions are at risk. All workers share the responsibility for protecting their own health. Personal hygiene affords a critical barrier to the transmission of zoonoses and should be reinforced routinely in an institution's educational efforts and materials, in group and laboratory meetings of involved personnel, and in messages that emphasize appropriate practices for the care and use of research animals.

The following discussion covers most of the zoonotic diseases important to laboratory animal personnel. The emphasis is on likely occurrence and potential or severity. Some uncommon zoonoses are covered only briefly even though they could have devastating effects if imported into the laboratory environment. In this regard, institutions should investigate situations that are peculiar to pro-posed research and instructional programs and that might pose special zoonotic hazards, e.g., the use of wild-caught birds or mammals or their fresh carcasses with their associated flora and fauna before embarking on full-scale programs. That might occasionally necessitate the use of an integrated team from within the institution or of outside specialists or consultants to ensure that the research-animal facilities and personnel expertise are conducive to safety.

The information on zoonotic diseases is organized by agent category. Major sections on viral diseases, rickettsial diseases, bacterial diseases, protozoal diseases, and fungal diseases are included. Material relevant to each zoonotic dis-ease is presented under four headings: reservoir and incidence; mode of transmission; clinical signs, susceptibility, and resistance; and diagnosis and prevention. The discussion on reservoir and incidence addresses the natural infection in the animal host species. The three other headings deal specifically with the potential for and occurrence of occupationally acquired infection of persons involved in the care and use of animals in research.

Various source materials provide detailed information on zoonoses associated with laboratory animals (Fox and Lipman 1991, Fox and others 1984). Readers should find the Centers for Disease Control and Prevention (CDC) Morbidity and Mortality Weekly Report indispensable for reviewing contemporary issues pertaining to zoonotic outbreaks.

Although the subject of xenograft transplantation is beyond the scope of this report, vigilance for zoonoses should be an important aspect of all xenograft transplantations. An important consideration should be the potential for exchange of infectious agents between natural and foreign hosts. Xenograft transplantation can inadvertently introduce animal viruses into a new susceptible host. Infection in a new host might not always be apparent. Long-term management of the xenograft recipient is a necessary and prudent practice for maintaining vigilance because new, previously unidentified, pathogens can be anticipated to arise.

I. VIRAL DISEASES

Common viral diseases include Hantavirus, Measles (Rubeola), Newcastle Disease, Hepatitis A, Hepatitis B, C, D, and E, Rabies, Influenza, and Arboviral Infection.

Hantavirus Infection (Hemorrhagic Fever with Renal Syndrome and Nephropathia Endemica)

Reservoir and Incidence. Hantavirus is one of several genera in the family Bunyaviridae that can cause severe hemorrhagic disease. The hantaviruses are widely distributed in nature among wild-rodent reservoirs, and the severity of the disease produced depends on the virulence of the strain involved (Gajdusek 1982; LeDuc 1987). Strains producing hemorrhagic fever with renal syndrome are prevalent in southeastern Asia and Japan and focally throughout Eurasia. Strains producing a less-severe form of the disease known as nephropathia endemica occur throughout Scandinavia, Europe, and western portions of the former Soviet Union. Outbreaks of hantavirus infection characterized by a severe pulmonary syndrome resulting in numerous deaths were recently recognized in the south-western United States (CDC 1993a,b; CDC 1995, CDC 1996). Rodents in numerous genera (Apodemus, Clethrionomys, Mus, Rattus, Pitimys, and Microtus) have been implicated in foreign outbreaks of the disease. In the United States, serological surveys have detected evidence of hantavirus infection in urban and rural areas involving the following rodents: Rattus norvegicus, Peromyscus spp., Microtus californicus, Tamias spp., and Neotoma spp. (CDC 1993a,b; Tsai and others 1985). Numerous cases of hantavirus infection have occurred in laboratory animal facility people from exposure to infected rats (Rattus), including outbreaks in Korea, Japan, Belgium, France, and England (LeDuc 1987). There is also epidemiologic evidence that cats can become infected through rodent contact and potentially serve as a reservoir (Xu and others 1987).

Mode of Transmission. The transmission of hantavirus infection is through the inhalation of infectious aerosols, and extremely brief exposure times (5 min) have resulted in human infection. Rodents shed the virus in their respiratory secretions, saliva, urine, and feces for many months

(Tsai 1987). Transmission of the infection also can occur by animal bite or when dried materials contaminated with rodent excreta are disturbed, allowing wound contamination, conjunctival exposure, or ingestion to occur (CDC 1993a,b). The recent cases that have occurred in the laboratory-animal environment have involved infected laboratory rats. In such an environment, the possibility of transmitting the infection from animal to animal by the transplantation of cells or tissues also should be considered (Kawamata and others 1987). Person-to-person transmission apparently is not a feature of hantavirus infection.

Clinical Signs, Susceptibility, and Resistance. The clinical signs are related to the strain of hantavirus involved. The form of the disease known as nephropathia endemica is characterized by fever, back pain, and a nephritis that causes only moderate renal dysfunction, from which the patient recovers; in the recent cases in the United States, patients had fever, myalgia, headache, and cough followed by rapid respiratory failure (CDC 1993a,b). The form of the disease that has been noted after laboratory-animal exposure fits the classical pattern of hemorrhagic fever with renal syndrome; the infection is characterized by fever, headache, myalgia, and petechiae and other hemorrhagic manifestations, including anemia, gastrointestinal bleeding, oliguria, hematuria, severe electrolyte abnormalities, and shock (Lee and Johnson 1982).

Diagnosis and Prevention. Human hantavirus infections associated with the care and use of laboratory animals should be prevented through the isolation or elimination of infected rodents and rodent tissues before they can be introduced into resident laboratory-animal populations. Serodiagnostic tests are available for both animals and humans. Additional information about serological testing is available through the Special Pathogens Branch, Division of Viral and Rickettsial Diseases, National Center for Infectious Diseases, CDC. Rodent tumors and cell lines can be tested for hantavirus contamination with a modified rat-antibody production test. People suspected of having the infection might benefit from intravenous ribavirin therapy initiated early in the course of the disease (Morrison and Rathbun 1995). Hemodynamic maintenance and respiratory support are critical for these people after infection. Animal Biosafety Level 2 is recommended for working with experimentally infected rodent species known not to excrete the virus. All work involving inoculation of the virus into P. maniculatus or other permissive species should be conducted at Animal Biosafety Level 4 (CDC 1994b).

Measles (Rubeola)

Reservoir and Incidence. Humans are the reservoir for measles. Nonhuman primates become infected through contact with human populations with endemic measles (Fox and others 1984). Both Old World and New World nonhuman primates are susceptible to infection (Fox and others 1984). The disease spreads rapidly through infected nonhuman-primate colonies; wild-caught nonhuman-primate populations often attain a 100% seroconversion rate within several weeks of capture. However, with the current emphasis on and success of domestic nonhuman-primate production, institutions could develop large populations of susceptible nonhuman primates.

Mode of Transmission. Measles, a highly communicable disease, is transmitted via infectious aerosols, contact with nasal or throat secretions, or contact with fomites freshly contaminated with infectious secretions.

Clinical Signs, Susceptibility, and Resistance. The clinical signs of measles are similar in nonhuman primates and humans. In humans, fever develops after an incubation period of about 10 d and is followed by conjunctivitis, coryza, cough, and Koplik's spots inside the mouth. Later, a characteristic exanthematous rash develops, beginning on the face, becoming generalized over the body, and ending sometimes in flaky desquamation. Complications of viral replication or secondary bacterial infection can result in pneumonia, otitis media, diarrhea, or, rarely, encephalitis (Benenson 1995b).

Diagnosis and Prevention. Characteristic clinical signs generally make diagnostic methods unnecessary, but serology, immunofluorescent-antibody screening for virus in clinical specimens, or viral isolation can be used. Vaccination of all nonhuman-primate handlers against measles should be ensured, and vaccination of nonhuman-primate populations also should be considered.

Newcastle Disease

Reservoir and Incidence. Newcastle disease is caused by a paramyxovirus. It is seen among wild, pet, and domestic birds, and wild birds transmit the infection to domestic-bird populations (Bryant 1984). The zoonotic potential of the agent in the laboratory environment has been realized on numerous occasions (Barkley and Richardson 1984).

Mode of Transmission. Aerosol transmission is the important means of spread, but contaminated food, water, and equipment also transmit infection within bird populations.

Clinical Signs, Susceptibility, and Resistance. The severity of the disease in birds depends on the pathogenicity of the infecting strain. Highly pathogenic strains have been largely excluded from flocks within the United States. Moderately pathogenic strains produce anorexia and respiratory disease in adult birds and neurological signs in young birds. The disease in humans is characterized by follicular conjunctivitis, mild fever, and respiratory involvement ranging from cough to bronchiolitis and pneumonia.

Diagnosis and Prevention. In the laboratory environment, the disease can be prevented by immunizing susceptible birds against it or obtaining birds from flocks known to be free of the agent. Good personal-hygiene practices also should be in place.

Hepatitis A

Reservoir and Incidence. Humans are the primary reservoir for hepatitis A virus (HAV), and nonhuman-primate infections result from contact with infected humans. However, more than 200 cases of HAV infection in humans have been associated with nonhuman primates (Barkley and Richardson 1984), and many nonhuman-primate species are susceptible, including chimpanzees and other great apes, marmosets, owl monkeys, cynomolgus monkeys, and patas monkeys (Fox and Lipman 1991; Hollinger and Glombicki 1990). A recent outbreak of HAV infection in young, domestically reared rhesus monkeys has renewed the concern for potential zoonotic transmission (Lankas and Jensen 1987).

Mode of Transmission. HAV is transmitted by the fecal-oral route, and some outbreaks can be related to contaminated food and water.

Clinical Signs, Susceptibility, and Resistance. The disease in nonhuman primates is much less severe than the disease in humans and is often subclinical. Some species of nonhuman primates develop malaise, vomiting, jaundice, and increased serum concentrations of hepatic enzymes.

The disease in humans varies from a mild illness lasting 1-2 wk to a severely debilitating illness lasting several months. After an incubation period of about a month, patients experience an abrupt onset of fever, malaise, anorexia, nausea, and abdominal discomfort, followed within a few days by jaundice. Children often have mild disease without jaundice, whereas HAV infections in older patients can be fulminant and protracted with prolonged convalescence.

Diagnosis and Prevention. Enzyme immunoassay and radioimmunoassay are available for the demonstration of immunoglobulin M-specific anti-HAV in the serum or plasma. Alternatively, fecal samples can be tested for virus particles or viral antigen.

An approved vaccine is now available for the control of HAV infection in humans. Passive immunization with immune serum globulin has also been used at intervals of 4-6 mo for personnel in contact with recently imported chimpan-zees (Fox and Lipman 1991). The use of protective clothing, good personal hygiene, and appropriate practices of sanitation of equipment and facilities also will minimize the potential for zoonotic transmission.

Hepatitis B, C, D, and E

Humans are considered the natural host for hepatitis B, C, D, and E viruses (Benenson 1995b). Various nonhuman primates, particularly chimpanzees, can be infected experimentally, but only one case of natural infection has been re-ported (Kornegay and others 1985). Viral hepatitis B has been suggested in recently imported cynomolgus monkeys by the demonstration of hepatitis B sur-face antigen in hepatic cells (Kornegay and others 1985), but it was not associated with zoonotic disease transmission; these animals developed mild clinical disease characterized by anorexia, increased hepatic enzyme concentrations, and hyperbilirubinemia. Although natural infections of nonhuman primates with hepatitis B, C, D, and E viruses are extremely rare, personnel should adhere to appropriate precautions when handling nonhuman primates.

Animal Biosafety Level 2 practices, containment equipment, and facilities are recommended for activities using naturally or experimentally infected chimpanzees or other nonhuman primates. Licensed recombinant vaccines against hepatitis B are available and highly recommended for personnel involved in studies with hepatitis B virus (CDC-NIH 2009).

Rabies

Reservoir and Incidence. Rabies occurs worldwide except for a few countries that have excluded the disease through animal-importation and animal-control programs and the aid of geographic barriers (Fox and others 1984). Rabies virus infects all mammals, but the main reservoirs are wild and domestic canines, cats, skunks, raccoons, bats, and other biting animals. *In Virginia, the main wildlife vectors for rabies are skunks, racoons, foxes, and bats (https://www.vdh.virginia.gov/content/uploads/sites/13/2018/03/Rabies2016.pdf).* The disease historically has not posed a problem in the laboratory-animal setting. However, the incidence of rabies in wildlife in the United States has been rising in recent years, and the possibility of rabies transmission to dogs or cats with uncertain vaccination histories and originating in an uncontrolled environment must be considered. In addition, rabies-susceptible wildlife introduced into the laboratory for special re-search investigations have the potential to harbor infection.

Mode of Transmission. Rabies virus is most commonly transmitted by the bite of a rabid animal or the introduction of virus-laden saliva into a fresh skin wound or an intact mucous membrane. Airborne transmission probably can occur in caves where rabid bats roost, but this mode of transmission is extremely unlikely in the laboratory (Benenson 1995b). The virus also has been transmitted through corneal transplants from persons with undiagnosed central nervous system disease. Personnel who handle tissue specimens or other materials potentially laden with rabies virus during necropsy or other procedures should be regarded as at risk for infection.

Clinical Signs, Susceptibility, and Resistance. Rabies produces an almost invariably fatal acute viral encephalomyelitis. Patients experience a period of apprehension and develop headache, malaise, fever, and indefinite sensory changes referred to the site of a prior animal-bite wound. Further progression of the disease is marked by paresis or paralysis, inability to swallow and the related hydrophobia, delirium, convulsions, and coma. Death is often due to respiratory paralysis.

Diagnosis and Prevention. Rabies usually is diagnosed with specific immuno-fluorescent antibody staining of brain tissue, corneal smears, mucosal scrapings, or frozen skin-biopsy specimens. Virus isolation also can be used to confirm the diagnosis. The most important factor in preventing human rabies, apart from the immediate and thorough cleaning of bite and scratch wounds, is control of the disease in the domestic-animal population. Stringent vaccination measures and enforced animal-control measures help to reduce the population at risk. When-ever possible, animals brought into the laboratory should have histories that preclude their exposure to rabies or ensure their having been vaccinated for this disease. Pre-exposure immunization should

be available to personnel in high-risk categories, such as veterinarians, people who are working with or involved in the care of infected or inadequately characterized animals, and wildlife-conservation personnel who work in rabies-endemic areas. Animal Biosafety Level 2 practices, containment equipment, and facilities are recommended for activities using naturally or experimentally infected animals (CDC-NIH 2009).

Influenza

Reservoir and Incidence. Humans are considered the reservoir for human-influenza viruses. Influenza-virus infections with different antigenic strains occur naturally in many animals, including avian species, swine, horses, mink, and seals (Benenson 1995b). Animal reservoirs are thought to contribute to the emergence of new human strains of influenza viruses, perhaps by reassortment of animal strains with human strains. In the laboratory, ferrets are highly susceptible to human influenza and often are used as experimental models of influenza (Fox and Lipman 1991).

Mode of Transmission. Transmission is by the airborne route and by direct contact. The transmission of animal-influenza strains from animals to humans is rare (CDC-NIH 2009). However, ferrets housed in the laboratory will develop epizootic infection concomitant with human outbreaks of the disease. Ferret-to-human transmission of the virus also has been documented (Marini and others 1989).

Clinical Signs, Susceptibility, and Resistance. Influenza is an acute disease of the respiratory tract characterized by fever, headache, myalgia, prostration, coryza, sore throat, and cough. Viral pneumonia and gastrointestinal involvement manifested by nausea, vomiting, and diarrhea also can develop.

Diagnosis and Prevention. Personnel should wear appropriate protective clothing and practice good personal hygiene if contact with ferrets suspected of having influenza is unavoidable.

Arboviral Infection

Reservoir and Incidence. The arboviruses (arthropod-borne viruses) are taxonomically diverse, each involving its own web of mammalian or avian hosts (or both) and specific arthropod vectors (Benenson 1995b; Tsai 1991). The presence of arboviral infection among laboratory animals generally would be restricted to situations where these agents are the focus of experimental study, wild-caught animals are brought into the laboratory for study, or nontraditional laboratory animals are housed outdoors, permitting the perpetuation of the natural cycle of arboviral infection.

Mode of Transmission. Natural cycles of infection involve transmission from mosquitoes, ticks, midges, or sandflies (Benenson 1995b; Tsai 1991). In the laboratory setting, transmission can

occur via parenteral inoculation, aerosol exposure, contamination of unprotected broken skin, and possibly animal bites (CDC-NIH 2009).

Clinical Signs, Susceptibility, and Resistance. The clinical manifestations of arboviral infections are diverse, including fever, hemorrhagic fever, rash, arthralgia, arthritis, meningitis, and encephalitis (Benenson 1995b).

Diagnosis and Prevention. Personnel involved in research-animal studies of arboviral infections should observe strictly the biosafety-level practices deemed appropriate for the particular arboviral agent (CDC-NIH 2009, SALS 1980). Institutions sponsoring research programs involving wild-caught animals should ensure that veterinary and occupational-health personnel have performed an ad-equate review of the scientific literature to establish a potential-disease profile for the animal species under study and have implemented corresponding measures for personnel protection.

Other viral diseases include B-Virus Infection (Cercopithecine herpesvirus 1, CHV1), Ebola-Virus Infection, Marburg-Virus Disease, Hantavirus Infection (Hemorrhagic Fever with Renal Syndrome and Nephropathia Endemica), Lymphocytic Choriomeningitis Virus Infection, Poxvirus Diseases of Nonhuman Primates (Monkeypox and Benign Epidermal Monkeypox), Simian Immunodeficiency Virus (SIV) Infection, and Orf Disease (Contagious Ecthyma and Contagious Pustular Dermatitis).

II. RICKETTSIAL DISEASES

Q Fever

Reservoir and Incidence. Q fever is caused by the rickettsial agent Coxiella burnetii. C. burnetii has a worldwide distribution perpetuated in two intersecting cycles of infection—in domestic animals and in wildlife animals and their associated ticks. Infection is widespread within the domestic-animal cycle, which includes sheep, goats, and cattle. Cats, dogs, and domestic fowl also can be infected (Fox and others 1984). The prevalence of the infection among sheep is high throughout the United States, and sheep have been the primary species associated with outbreaks of the disease in laboratory-animal facilities (Bernard and others 1982). However, an outbreak of Q fever with one death in a human cohort exposed to a parturient cat and her litter and cases of the disease associated with exposure to rabbits indicate that other species should not be overlooked as possible sources of the infection in the laboratory environment (Langley and others 1988; Marrie and others 1990).

Mode of Transmission. Humans usually acquire this infection via inhalation of infectious aerosols, although transmission by ingestion has been recorded (Benenson 1995b). The organism is shed in urine, feces, milk, and especially Cat-Scratch Fever birth products of domestic ungulates, which generally are asymptomatic. The placenta of an infected ewe can contain up to 109 organisms per gram of tissue, and milk can contain 105 organisms per gram (CDC-NIH

2009). The organism is resistant to desiccation and persists in the environment for long periods, contributing to the widespread dissemination of infectious aerosols. The risk of infection is high because the infectious dose by inhalation is less than 10 microorganisms (CDC-NIH 2009, Wedum and others 1972). The importance of those factors was evident in outbreaks of the disease associated with the use of pregnant sheep in research facilities in the United States when personnel became infected along the routes of sheep transport and in the vicinity of sheep surgery from contact with soiled linens (Bernard and others 1982).

Clinical Signs, Susceptibility, and Resistance. The disease in humans varies widely in duration and severity, and asymptomatic infection is possible. The disease often has a sudden onset with fever, chills, retrobulbar headache, weak-ness, malaise, and profuse sweating. In some cases, pneumonitis occurs with a nonproductive cough, chest pain, and few other signs. Acute pericarditis and acute or chronic granulomatous hepatitis also have been reported. Endocarditis can occur on native or prosthetic cardiac valves and often extends over a period of months or years and results in relapsing systemic infection. Most cases of Q fever resolve within 2 wk (Benenson 1995b). Persons with valvular heart disease should not work with C. burnetii (CDC-NIH 2009).

Diagnosis and Prevention. Serological methods available for the detection of a rise in specific antibody between acute and convalescent samples include microagglutination, immunofluorescent, complement fixation (CF), and ELISA tests. The organism can be isolated from blood or other tissues, but doing so poses a hazard for laboratory personnel. Recommendations for the control of Q fever in a research facility are avail-able and should be applied rigorously in surgical, laboratory, and housing areas used for sheep (Bernard and others 1982). In brief, the recommendations emphasize the need for the separation of sheep-research activities from other areas. Physical barriers or air-handling systems, the appropriate use and disposal of protective clothing, and the use of disinfectants in the sanitation and waste management programs minimize the risk of exposure. Whenever possible, male or nonpregnant female sheep should be used in research programs. However, many research studies require the use of pregnant sheep. Neither antimicrobial therapy nor serological testing in combination with the culling of infected animals has led to the reliable development of disease-free flocks for use in biomedical research programs (Fox and Lipman 1991). Serological monitoring of sheep for evidence of C. burnetii infection also is unrewarding because serological status is not a useful indicator of organism shedding. Since infected guinea pigs and other rodents may shed the organism in urine and feces, the CDC and NIH recommend maintaining experimentally infected rodents under Animal Biosafety Level 3 (CDC-NIH 2009).

An investigational new Phase 1 Q-fever vaccine is available from the Special Immunizations Program, US Army Medical Research Institute for Infectious Disease (USAMRIID), Fort Detrick, Maryland 21701. The use of this vaccine should be limited to personnel at high risk of exposure who have no demonstrated sensitivity to Q-fever antigen.

Other Rickettsial Diseases

Reservoir and Incidence. Dogs, rodents, and their ticks and fleas are the reservoirs for Rickettsia. R. akari, R. prowazekii, and R. typhi are found in wild rodents and their associated fleas and mites (Fox and others 1984). Ehrlichia canis produces natural infection only in dogs; human infections result from the bites of infected ticks. These rickettsial infections are considered rare in the United States.

Mode of Transmission. Zoonotic transmission of these diseases in the laboratory has involved aerosols, accidental parenteral inoculation, and bites by natural ectoparasitic vectors (CDC-NIH 2009).

Clinical Signs, Susceptibility, and Resistance. These rickettsial diseases are characterized by fever, headache with encephalitis, myalgia, and a rash of varied distribution according to the species involved (Saah 1990). A rash does not develop in E. canis infections. Eschar development at the site of a vector bite is seen in R. rickettsia and R. akari infections. Diagnosis and Prevention. The rickettsial diseases generally are diagnosed serologically with complement-fixation and direct immunofluorescence tests.

Concern for the zoonotic potential of these diseases in the laboratory should focus on situations where wild-caught rodents or other small mammals are brought into the laboratory for study or where feral-rodent infestation has occurred. Ectoparasite control in such populations is essential, particularly the elimination of Ornithonyssus bacoti, a free-living mite capable of transmitting some of the rickettsial agents (Fox and others 1984). Personnel who are conducting studies with wild-caught animals also should be instructed to practice good laboratory safety and personal hygiene.

III. BACTERIAL DISEASES

Tuberculosis

Reservoir and Incidence. Tuberculosis of animals and humans is caused by acid-fast bacilli of the genus Mycobacterium. Laboratory animals are potential reservoirs of several mycobacterial species, including M. tuberculosis, M. avium-intracellulare, M. bovis, M. kansasii, M. simiae, M. marinum, and M. chelonae (Des Prez and Heim 1990; Saunders and Horowitz 1990). In addition to cattle, birds, and humans that serve as the main reservoirs for these mycobacteria, many laboratory animals—including nonhuman primates, swine, sheep, goats, rabbits, cats, dogs, and ferrets—are susceptible to infection and contribute to spread of the diseases (Fox and Lipman 1991). However, nonhuman primates are of primary importance in the consideration of these diseases in the laboratory-animal environment.

It is also important to note that mycobacterial infections are an important bacterial disease of aquarium fish. A diverse variety of tropical fish species have been reported infected with the disease. In addition, fish infected with these organisms are an important potential source of

zoonotic mycobacterial infections in aquarium owners. Mycobacteria infecting fishes also include zoonotic pathogens that can cause protracted illness, especially in immunocompromised individuals (e.g. Mycobacterium ulcerans, Mycobacterium fortuitum, and Mycobacterium marinum). Therefore, monitoring for mycobacteriosis in tropical fish is strongly recommended. Human infections acquired from fish are most often characterized by skin lesions of varying severity, which occasionally spread to underlying joints and tendons. Some lesions may be difficult to cure, especially in those who are immunocompromised.

Contact with nonhuman primates infected with Mycobacterium spp. is a recognized risk factor in the development of a positive tuberculin skin reaction (Kaufman and others 1972). Nonhuman primates generally develop tuberculosis from humans during capture and exportation from parts of the world where the prevalence of the disease in humans and animals is high. However, the resurgence of human tuberculosis in the United States and the recognition of nosocomial outbreaks of multiple-drug-resistant tuberculosis (CDC 1994a) should serve as reminders that nonhuman primates can continue to be at risk for contracting tuberculosis from humans after introduction into established research colonies. The close confinement of these animals in holding facilities and in shipment crates creates an environment conducive to the spread of infection. The incidence of infection in a population varies with the species and the source of the primates. A recent survey of tuberculosis in 22,913 imported nonhuman primates in the United States yielded an incidence of 0.4% (CDC 1993c). Although macaques are considered to be particularly sensitive to infection with M. tuberculosis, surveillance programs for tuberculosis should be extended to all species of non-human primates (Bennett and others 1995; CDC 1993c; NRC 1980).

Mode of Transmission. M. tuberculosis is transmitted via aerosols from infected animals or tissues, and this mode of transmission also applies to most of the other mycobacterial species that might be encountered in laboratory-animal contact. Laboratory personnel involved in the care, use, or necropsy of infected animals are especially at risk for tuberculosis. Humans can contract the disease in the laboratory through exposure to infectious aerosols generated by the handling of dirty bedding, the use of high-pressure water sanitizers, or the coughing of animals with respiratory involvement. Other potential sources of exposure include fecal shedding by animals with enteric infection and skin exudates resulting from scrofuloderma or suppurative fistulated lymph nodes. Mycobacterial disease also can be spread by entry of the bacilli into the body by ingestion or wound contamination.

Clinical Signs, Susceptibility, and Resistance. The most common form of tuberculosis reflects the involvement of the pulmonary system and is characterized by cough, sputum production, and eventually hemoptysis. The incubation period for the development of a demonstrable primary lesion or a substantial secondary skin reaction is 4-12 wk. After that, the risk of progressive pulmonary or extrapulmonary disease remains highest during the next 1-2 yr, but recrudescence of a latent infection persists for the rest of a person's life. Extrapulmonary forms of the disease can involve any tissue or organ system and include disseminated (miliary) infections of multiple organs due to the hematogenous spread of the organism, regional lymphadenitis, tuberculous meningitis, and disease of the pericardium, pleura, skeleton, intestines, peritoneum, kidneys, and

skin. General symptoms as the disease progresses include weight loss, fatigue, lassitude, fever, chills, and cachexia.

Diagnosis and Prevention. The diagnosis of tuberculosis in humans and nonhuman primates relies primarily on the use of the intradermal tuberculin test, chest radiography, and the demonstration of acid-fast bacilli in sputum smears. Definitive diagnosis can be obtained by isolating organisms in body fluids or biopsy specimens and identifying them with biochemical techniques or DNA probes. Additional information can be found in guidelines established for the diagnosis and control of tuberculosis in humans (American Thoracic Society 1992; CDC 1994a); revisions have been proposed recently.
The prevention and control of tuberculosis in a biomedical-research facility require personnel education, periodic surveillance for infection in nonhuman primates and their handlers, isolation and quarantine of any suspect animals and prompt euthanasia, necropsy, and microbiological and histopathological analysis of animals confirmed as positive. For extremely valuable animals, chemoprophylaxis with effective antituberculosis agents may be elected (Wolf and others 1988).

The CDC and NIH recommend Animal Biosafety Level 3 for animal studies using nonhuman primates experimentally or naturally infected with M. tuberculosis or M. bovis. Experimentally infected guinea pigs and mice pose a lesser risk to personnel because droplet nuclei are not produced by coughing in these species; however it is prudent to use Animal Biosafety Level 3 for these infected laboratory animals because contaminated litter can be a source of infectious aerosols (CDC-NIH 2009).

The vaccination of nonhuman primates with the bacillus Calmette Guérin (BCG) strain of M. bovis also can be considered. However, the use of BCG does not prevent infection but only suppresses proliferation of the organism to prevent the development of clinical disease (Sutherland and Lindgren 1979). Further-more, this vaccination complicates the use of the tuberculin test for surveillance because those vaccinated become skin-test-positive. Institutions should consider the implications of BCG vaccination as related to disease monitoring and management in nonhuman primates and the assignment of personnel to the care of these species. Personnel who convert to a positive tuberculin skin reaction should be evaluated further. Institutions should recognize the risk that such personnel pose for nonhuman-primate populations; it might warrant their reassignment to work with other animals. Consistent institutional policies should be developed to address this issue.

Psittacosis (Ornithosis, Parrot Fever, Chlamydiosis)

Reservoir and Incidence. The genus Chlamydia contains three species: C. psittaci, C. trachomatis, and C. pneumoniae. Only C. psittaci is widely distributed among animals and is recognized as a zoonotic pathogen. C. psittaci is distributed widely among birds and mammals worldwide and occurs naturally among many laboratory species, including birds, mice, guinea pigs, rabbits, ruminants, swine, cats, ferrets, muskrats, and frogs (Fox and others 1984; Storz 1971).

Mode of Transmission. C. psittaci produces a diverse spectrum of conditions in animals, including conjunctivitis, pneumonitis, air sacculitis, pericarditis, hepatitis, enteritis, arthritis, meningoencephalitis, urethritis, endometritis, and abortion. Latency is a common characteristic of the infections and is especially important in the epizootology of the disease in birds; stress can reactivate enteric shedding of the organism and clinical signs. The organism is spread to humans from infectious material in exudates, secretions, or desiccated fecal material via direct contact or the aerosol route.

Clinical Signs, Susceptibility, and Resistance. In general, the C. psittaci strains associated with mammalian infections are less pathogenic for humans than the avian strains of the organism (Schachter and Dawson 1978). Human conjunctivitis has been observed in people involved in the care of cats with chlamydial conjunctivitis and pneumonitis (Schachter and others 1969). Human abortion resulting from infection with a C. psittaci strain that is associated with abortions in sheep also has been recorded (Hadley and others 1992).

The progression of disease in humans related to infection with avian strains of C. psittaci includes fever, headache, myalgia, chills, and upper or lower respiratory tract disease. More serious manifestations of disease also can occur, such as extensive pneumonia, hepatitis, myocarditis, thrombophlebitis, and encephalitis. Relapses occur in untreated infections (Benenson 1995b).

Diagnosis and Prevention. Psittacosis can be diagnosed with serological tests for specific antibody or isolation of the organism.

Psittacosis can be prevented by permitting birds only from disease-free flocks to be introduced into an animal facility. If wild-caught birds or birds of unknown disease status are brought into a facility, chlortetracycline chemoprophylaxis should be instituted in these birds. Cases of chlamydiosis in other animals should be treated promptly to prevent the spread of infection to personnel who work with them.

Animal Biosafety Level 2 practices, containment equipment and facilities, and respiratory protection are recommended for personnel working with naturally or experimentally infected caged birds (CDC-NIH 2009).

Rat-Bite Fever

Reservoir and Incidence. Rat-bite fever is caused by either Streptobacillus moniliformis or Spirillum minor, two microorganisms that are present in the upper respiratory tracts and oral cavities of asymptomatic rodents, especially rats (Anderson and others 1983). These organisms are present worldwide in rodent populations, although efforts by commercial suppliers of laboratory rodents to eliminate Strep. moniliformis from their rodent colonies now appear to have been largely successful. The form of the disease caused by Spir. minor can be differentiated

clinically from the form due to Strep. moniliformis and is generally more common in Asia. Several cases of the disease in laboratory-animal handlers have been reported in recent years (Anderson and others 1983; Taylor and others 1984).

Mode of Transmission. Most human cases result from a bite wound inoculated with nasopharyngeal secretions, but sporadic cases have occurred without a history of rat bite. Infection also has been transmitted via blood of an experimental animal. Persons working or living in rat-infested areas have become infected even without direct contact with rats (Benenson 1995b).

Clinical Signs, Susceptibility, and Resistance. In Strep. moniliformis infections, patients develop chills, fever, malaise, headache, and muscle pain and then a maculopapular or petechial rash most evident on the extremities. Arthritis occurs in 50% of Strep. moniliformis cases but is considered rare in Spir. minor infections. One or more large joints usually become painful and enlarged and contain a serous to purulent effusion. Complications of untreated cases of the disease include focal abscesses, endocarditis, and, less frequently, pneumonia, hepatitis, pyelonephritis, and enteritis.

Diagnosis and Prevention. The disease is diagnosed by isolating the causative organisms, both of which have unusual growth requirements (Fox and others 1984). Strep. moniliformis can be isolated in vitro from joint fluid, but Spir. minor requires animal inoculation and identification of the organism with dark-field microscopy.

Proper animal-handling techniques are critical to the prevention of rat-bite fever.

Leptospirosis

Reservoir and Incidence. Leptospirosis has a worldwide distribution in domestic and wild animals. Rats, mice, field moles, hedgehogs, squirrels, gerbils, hamsters, rabbits, dogs, domestic livestock, other mammals, amphibians, and reptiles are among the animals that are considered reservoir hosts (Benenson 1995b; Hanson 1982). Pathogenic leptospires belong to the species Leptospirosis interrogans and are divided into serovars according to serological reactivity. In the United States, the predominant serovars are L. icterohaemorrhagia (in rats and dogs), L. pomona (in swine), L. hardjo (in cattle), L. canicola (in dogs), L. autumnalis (in raccoons), and L. bratislava (in swine). Rats and mice are common hosts of L. ballum, which also has been found in other wildlife, including skunks, rabbits, opossums, and wild cats (Fox and others 1984). The possibility of zoonotic transmission of leptospirosis from most animal species maintained in the laboratory would have to be considered. Several recent outbreaks of the disease in laboratory animals emphasize the continued importance of this zoonosis in the laboratory-animal facility (Alexander 1984; Barkin and others 1974; Geller 1979).

Mode of Transmission. Leptospires are shed in the urine of reservoir animals, which often remain asymptomatic and carry the organism in their renal tubules for years. Mice infected with L. ballum are believed to harbor the organism for life (Fox and others 1984). Transmission occurs through skin abrasions and mucous membranes and is often related to direct contact with urine or tissues of infected animals. Inhalation of infectious droplet aerosols and ingestion also are effective modes of transmission.

Clinical Signs, Susceptibility, and Resistance. The manifestations of this disease are diverse, ranging from inapparent infection to severe systemic illness (Benenson 1995b). Common features are fever with sudden onset, headache, chills, myalgia, and conjunctival suffusion. Other manifestations of the disease are orchitis, rash, hemorrhage into the skin and mucous membranes, hemolytic anemia, hepatorenal failure and jaundice, mental confusion with encephalitis, and pulmonary involvement.

Diagnosis and Prevention. Leptospirosis is diagnosed by showing rising anti body titers in serological tests, such as the microscopic agglutination test, or by isolating the organism. Efforts to prevent this zoonotic disease in a laboratory-animal facility should focus on effective control of the infection in laboratory-animal populations and use of protective clothing and gloves by personnel.

Reservoir and Incidence. Enteric infection with Salmonella spp. has a worldwide distribution among humans and animals. Among the laboratory-animal species, rodents from many sources are now free from salmonella infection because of successful programs of cesarean rederivation accompanied by rigorous management practices to exclude the recontamination of animal colonies. The pasteurization of feeds also has contributed to the control of salmonellae in laboratory-animal populations. However, despite those efforts to eliminate the organisms in laboratory-animal populations, salmonella carriers continue to occur as a result of infection by contaminated food or other environmental sources of contamination and represent a source of infection for other animals and personnel who work with the animals (Nicklas 1987).

Results of recent surveys in dogs and cats have indicated that the prevalence of infection remains about 10% among random-source animals (Fox and Lipman 1991). Salmonellae continue to be recorded frequently among recently imported nonhuman primates (Tribe and Fleming 1983). Infection with salmonellae is nearly ubiquitous among reptiles; during the 1970s, salmonellosis in turtles was a major public-health concern, which was eventually controlled by restricting the sale of viable turtle eggs or live turtles with a carapace length of at least 10.2 cm to institutions with a scientific or educational mission. Avian sources are often implicated in foodborne cases of human salmonellosis, and birds should be considered likely sources of zoonotic transmission in a laboratory-animal facility.

Mode of Transmission. Salmonellae are transmitted by the fecal-oral route via food derived from infected animals or contaminated during preparation, contaminated water, or direct contact with infected animals.

Clinical Signs, Susceptibility, and Resistance. Salmonella infection produces an acute febrile enterocolitis; septicemia and focal infections occur as secondary complications (Benenson 1995b; Hook 1990). Focal infections can be localized in any tissue of the body, so the disease has diverse manifestations. Many host factors have been associated with increased severity of the disease, including infancy, old age, AIDS, neoplasia, immunosuppressive therapy or other debilitating condition, achlorhydria, gastrointestinal surgery, or prior or current broad-spectrum antibiotic therapy.

Diagnosis and Prevention. Organism isolation with standard microbiological techniques is used to diagnose this infection. Concomitant isolation of the same organism as determined with appropriate molecular biology and molecular epidemiology can be used to implicate a suspect animal as a source of zoonotic trans-mission.

Whenever possible, animals known not to harbor salmonellae should be used in laboratory-animal facilities, and the combination of microbiological screening of individual animals or a representative sample of the animal population for the presence of salmonellae and isolation or elimination of carriers can aid in excluding the pathogen from an animal facility. The use of antibiotic treatment of salmonella-infected animals as a means of controlling the organism in a laboratory-animal facility might not be rewarding, because antibiotic treatment can prolong the period of communicability (Benenson 1995b). Personnel should rely on the use of protective clothing, personal hygiene, and sanitation measures to prevent the transmission of the disease.

Animal Biosafety Level 2 is recommended for activities using naturally or experimentally infected animals (CDC-NIH 2009).

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Animal Biosafety Level 2 is recommended for activities using naturally or experimentally infected animals (CDC-NIH 2009).

Other bacterial diseases include Brucellosis, Campylobacteriosis, Enteric Yersiniosis, Plague, and Shigellosis.

IV. PROTOZOAL DISEASES

Vector-borne protozoal diseases generally are not considered a direct threat to personnel in laboratories, because the importation of vectors with hosts is highly improbable. However, accidental inoculation and wound contamination with infected tissue derivatives are conceivable

means of transmitting plasmodal, trypanosomal, and leishmanial infections, and appropriate precautions should be taken by personnel who work with these agents in animals.

Cryptosporidiosis

Reservoir and Incidence. Cryptosporidium spp. have a cosmopolitan distribution and have been found in many animal species, including mammals, birds, reptiles, and fishes (Fayer and Ungar 1986). Cross-infectivity studies have shown a lack of host specificity for many of the organisms (Tzipori 1988). Among the laboratory animals, lambs, calves, pigs, rabbits, guinea pigs, mice, dogs, cats, and nonhuman primates can be infected with the organisms. Cryptosporidiosis is common in young animals, particularly ruminants and piglets.
Mode of Transmission. Cryptosporidiosis is transmitted by the fecal-oral route and can involve contaminated water, food, and possibly air (Soave and Weikel 1990). Many human cases involve human-to-human transmission or possibly the reactivation of subclinical infections. Several outbreaks of the disease have been associated with surface-water contamination; a recent waterborne epidemic in Milwaukee, Wisconsin, was believed to involve more than 370,000 people (Dresezen 1993). Zoonotic transmission of the disease to animal handlers has been recorded, including a recent report of cryptosporidiosis among handlers of infected infant nonhuman primates; this emphasizes the importance of this zoonosis in the laboratory-animal environment (Anderson 1982; Miller and others 1990; Reese and others 1982).

Clinical Signs, Susceptibility, and Resistance. Although cryptosporidiosis has become identified widely with immunosuppressed people, particularly AIDS patients, the ability of the organism to infect immunocompetent people also has been recognized. In humans, the disease is characterized by cramping, abdominal pain, profuse watery diarrhea, anorexia, weight loss, and malaise (Soave and Weikel 1990). Symptoms can wax and wane for up to 30 d, eventually resolving in immunocompetence. However, in AIDS patients, who might have an impaired ability to clear the parasite, the disease can have a prolonged course that contributes to death.

Diagnosis and Prevention. Cryptosporidiosis is diagnosed by finding the organ-ism in stool specimens with immunofluorescent or other special staining techniques (Soave and Weikel 1990). Several samples might be necessary because of intermittent shedding of the organism. Appropriate personal-hygiene practices should be effective in preventing the spread of infection. No pharmacological treatment is effective for this infection.

Other Protozoal diseases include Amebiasis, Balantidiasis, Giardiasis, and Toxoplasmosis.

V. FUNGAL DISEASES

Dermatomycosis

Reservoir and Incidence. The dermatophytes have a cosmopolitan distribution; some dermatophytes have a regional geographic concentration (Benenson 1995b). These organisms

cause ringworm in humans and animals, which continues to be common among dogs, cats, and livestock (Fox and others 1984). In the United States, several dermatophytes of animal origin are involved in the superficial mycoses of humans, including Microsporum canis, Trichophyton mentagro-phytes, and T. verrucosum. M. canis is most prevalent in dogs, cats, and nonhuman primates and in human infections associated with these species, but it can also occur in rodents. T. mentagrophytes has been associated more commonly with ringworm in rodents and rabbits and occurs among laboratory personnel who work with these species and agricultural personnel who work around granaries, barns, and other rodent habitats. T. verrucosum is restricted generally to cases of ringworm in livestock and their agricultural attendants.

Mode of Transmission. The transmission of dermatophyte infection from humans to animals is by direct skin-to-skin contact with infected animals or indirect contact with contaminated equipment or materials. Infected animals can have no, few, or difficult-to-detect skin lesions that result in transmission to unsuspecting persons. Dermatophyte spores can become widely disseminated and persistent in the environment, contaminating bedding, equipment, dust, surfaces, and air and resulting in the infection of personnel who do not have direct animal contact.

Clinical Signs, Susceptibility, and Resistance. The clinical expression of dermatomycosis depends on various host factors and the predilection of the organ-ism. Dermatophytes generally grow in keratinized epithelium, hair, nails, horn, and feathers and are classified according to their optimal substrate as geophilic (soil), zoophilic (animals), or anthropophilic (human). Many of the zoophilic fungi are species-adapted and cause infection without inciting serious inflammatory lesions in their host species; however, in an aberrant host, such as a human, a vesicular or pustular eczematous lesion with intense inflammation and rapid regression can occur. Dermatophytes that are better adapted to humans produce focal, flat, spreading annular lesions that are clear in the center and crusted, scaly, and erythematous in the periphery. Lesions often are on the hands, arms, or other exposed areas, but invasive and systemic infections have been reported in immunocompromised people.

Diagnosis and Prevention. The definitive diagnosis of dermatomycosis is achieved by fungal culture and identification, but lesion appearance and scrapings of active lesions cleared in 10% potassium hydroxide and examined microscopically for fungal filaments can be used for a tentative diagnosis. In addition, about half of M. canis isolates and lesions are fluorescent in Wood's lamp examination.

Animals with suggestive lesions should be screened for dermatomycosis and isolated and treated if positive. The use of protective clothing, disposable gloves, and other appropriate personal-hygiene measures is essential to the reduction of this zoonosis in a laboratory-animal facility.

Animal Biosafety Level 2 practices and facilities are recommended for experimental animal activities with dermatophytes (CDC-NIH 2009).

Sporotrichosis

Reservoir and Incidence. Sporothrix schenckii is a fungal agent reported in all parts of the world and generally associated with agricultural occupations. However, sporotrichosis has been reported in numerous laboratory-animal species, including dogs, cats, swine, cows, goats, rats, and armadillos (Werner and Werner 1993).

Mode of Transmission. Most cases of zoonotic transmission have implicated the direct inoculation of the fungus into bites or skin wounds inflicted by animals, but several people who have developed infections could not recall pre-existing skin lesions or skin injury in conjunction with exposure. Thus, this organism might be capable of penetrating intact skin.

Clinical Signs, Susceptibility, and Resistance. Humans usually develop a solitary nodule on the hand or extremity and nodular extension along the path of the lymphatic vessels. Ulceration and drainage of the lesions can occur. Arthritis, pneumonia, and other deep visceral infections occur as rare complications (Benenson 1995b).

Diagnosis and Prevention. Sporotrichosis is diagnosed by culture and identification of the organism with Sabouraud dextrose agar. Animals with known or suspected sporothrix infections should be isolated and treated, and personnel should practice appropriate personal-hygiene measures when handling these animals.

Animal Biosafety Level 2 practices and facilities are recommended for activities using naturally or experimentally infected animals (CDC-NIH 2009).

VI. HELMINTH INFECTIONS

Despite the large number of helminth parasite infections that either are directly zoonotic or have cycles of infection that encompass animals and humans (see Table 5-1), the transmission of helminthic zoonoses in the laboratory-animal environment should be regarded as unlikely (Fox and others 1984). Many of the organisms have indirect life cycles that are interrupted in the laboratory environment or have ova embryonation periods that are long enough to permit removal of ova during routine sanitation before they become infective for humans (Flynn 1973). In addition to contemporary laboratory-animal management practices that impede zoonotic transmission of helminth parasites, animal-health conditioning practices should be in place to eliminate infections. The use of appropriate personal hygiene practices also must be emphasized to eliminate any possibility of zoonotic infection.

VII. ARTHROPOD INFESTATIONS

Very few ectoparasite infestations of humans are associated with the handling of conventional laboratory animals, but several have been reported (Fox and others 1984). Appropriate attention

needs to be given to the control of this risk; animals are introduced from the wild, animals are used in studies under natural field conditions, or conventional laboratory animals are used in facilities whose vermin-control measures are inadequate to preclude the introduction of these agents on endemically infected wild-animal reservoirs.

Generally, human ectoparasite infestations are manifested as mild allergic dermatitis (see Table 5-2). The more important, albeit rarer, risk associated with these infestations is transmission of zoonotic agents that can produce systemic disease with arthropods as a vector. Every major group of pathogenic organisms including bacteria, rickettsiae, chlamydia, viruses, protozoa, spirochetes, and helminths is represented among the agents transmitted by arthropod vectors, and personnel who work with research animals that potentially harbor these agents or the ectoparasite vectors should be informed of the hazard.

Rigorous ectoparasite control programs should be instituted as part of the veterinary care program, especially for wild-caught species that are brought into a laboratory, animals housed previously under field conditions, and animals with inadequate disease profiles from any source. The control of vermin in an animal facility also is essential; consideration should be given to the ectoparasite and disease evaluation of wild or feral rodents caught in an animal facility.

Appendix K – Vaccination Declination Form

RADFORD UNIVERSITY

ENVIRONMENTAL HEALTH & SAFETY

Tetanus Vaccine

Declination Statement:

I understand that due to my exposure to potentially infectious materials that I may be at risk of acquiring a tetanus infection. I acknowledge that I have been informed of the risks associated with tetanus and the benefits of vaccination, and that it is recommended that I receive this vaccine; however,

Please Check One

☐ I have already received the Tetanus Vaccine but do not have documentation from my healthcare provider or a record of immunization at this time.

☐ I decline tetanus vaccination at this time. I understand that by declining, I continue to be at risk of acquiring infection to a potentially fatal disease. If, in the future, I continue to be exposed to potentially infectious materials, and I want to receive the tetanus vaccine, I can receive this service.

_____ _____

Signature Date

_____ _____

Print Name Employee/ Student ID number