WPI Occupational Health and Safety Program in the Care and Use of Research Animals

1. Program Goal

The primary goal of the occupational health and safety program is to prevent occupational injury and illness to everyone who comes into contact with research animals by controlling hazards and reducing risks. The secondary goal is to comply with the regulatory requirements of the local, state and federal government.

1.1. Applicability

The program applies to everyone in the WPI community who comes into contact, or who has the potential to come into contact, with research animals. This includes principal investigators, clinicians, animal-care technicians, laboratory technicians, students, maintenance and custodial personnel, and security personnel.

1.2. Accountability and Responsibility

Administrative responsibility of the program resides in the Environmental and Occupational Safety Office (EOS) of WPI. EOS will coordinate this effort with the Institutional Animal Care and Use Committee (IACUC) and the Biomedical Engineering Department.

Every person who comes into contact with, or has the potential to come into contact with, research animals, must work so as to protect themselves and others and incorporate safety into day-today activities. They must comply with the rules, follow established procedures, report injuries and be active in demonstrating safe work practices.

2. Hazard Identification

Hazards associated with laboratory research animals are physical, chemical or protocol-specific. It is the responsibility of everyone to identify potential hazards in the workplace and to report them to their supervisor.

2.1. Physical Hazards

2.1.1. 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.

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. 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.

Inappropriate handling can induce discomfort, pain, and distress, provoking an animal to inflict injury to its handler. Personnel should review educational materials pertinent to safe animal-handling techniques and should have supervised instruction before undertaking new animal-handling procedures.

Knowledge of animal behavior is important in reducing risks.

2.1.2. Sharps

Sharps such as needles, broken glass, syringes, pipettes, and scalpels are commonly used in animal research facilities. These items must be used carefully and disposed of, so they do not injure custodial staff. They must be disposed of in puncture-resistant containers.

2.1.3. Pressure Vessels

Compressed gas cylinders, high-pressure washing equipment and steam generators 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.

2.1.4. Lighting

One characteristic of animal care facilities that is not seen in many other operations is a fixed light/dark cycle. In animal care facilities, 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, or very low light. For humans, poor lighting can cause visual fatigue, or create safety hazards that cause trips, slips or falls. Humans need an adjustment period for their eyes to become accustomed to the color or light level in the room. Waiting for this adjustment will make work in the room easier and safer.

2.1.5. Electricity

Electrical hazards can be present whenever electric current is flowing. 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. 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.

2.1.6. Ultraviolet Radiation

Exposure to ultraviolet (UV) radiation can occur in some operations in the care and use of 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 disease. If employees work in the presence of UV radiation, their eyes and skin should be protected against UV exposure.

2.1.7. Housekeeping

Good housekeeping keeps work surfaces clean and clear of obstructions. 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.

2.1.8. Ergonomic Hazards

Physical trauma can occur when workers perform tasks that require repetitive motions and lifting 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, or lifting or moving cages. Practicing safe lifting techniques will reduce the risk of injury. To reduce the risk of injury due to repetitive motion, vary tasks to reduce the number of repetitions, re-engineer tasks, or redesign equipment or tools to require fewer repetitions with less strain.

2.1.9. Machinery

Conveyor belts, sanders, cage washing equipment, and other machinery have potential to cause injury. The common types of hazards presented by machinery are crush points and pinch points. These are areas of a machine where two surfaces could come together to crush or pinch part of the body. These all occur in machinery having moving parts. If a hazardous area is identified, guarding should be installed to eliminate the hazard.

2.1.10. 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. In an animal care facility, noise can result from animals and from equipment, such as cage washers, high pressure air cleaning systems and wet vacuum systems operated in a confined space.

2.2. Chemical Hazards

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, corrosives, irritants, neurotoxins 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.

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 tissue. 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, aldehydes, and halogenated materials. Some phenolic compounds and quarternary ammoniun compounds are also used as disinfectants. The primary chemical used as a preservative is Formalin, a 10% neutral-buffered solution, but other materials are used from time to time.

Burns and irritations of the skin are the most common chemical injuries associated with animal care and use. Some chemicals, such as formaldehyde and glutaraldehyde 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.

2.2.1. Material Safety Data Sheets (MSDS) and other safety resources

MSDS's are available on-line in the Environmental and Occupational Safety home page. It can be accessed at: http://www.wpi.edu/Admin/Safety. This page also contains the WPI Chemical Hygiene Plan, a comprehensive plan which is the baseline safety plan for any WPI facility that uses hazardous materials.

2.2.2. Hazardous Waste Management and Disposal

The EOS website contains the WPI Hazardous Waste Management Plan. The plan contains all of the components necessary to comply with the state and federal regulations. It should be consulted for guidance, whenever hazardous waste is generated in the animal care facility.

2.3. 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. Investigators have an obligation to identify hazards associated with their research and to select the safeguards 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. 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.

2.3.1. Protocols Involving Chemicals of Unknown Hazard

A comprehensive 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 histological or biochemical examination.

2.3.2. Protocols Involving Infectious Agents

Experiments involving experimentally or naturally infected research animals present recognized risks of occupationally acquired infections. Investigators who are planning research activities involving experimentally or naturally infected vertebrate animals should carefully review Biosafety in Micobiological and Biomedical Laboratories (CDC-NIH 1993). 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 give appropriate microbiological practices, safety equipment, and features of animal facilities.

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 or potentially lethal infections. Emphasis is placed on the control of aerosols by containing all manipulations and housing infected animals in isolators and ventilated cages. Exotic agents that pose a high 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.

2.3.3. Practices to Reduce Occupational Risk to Infectious Agents

- Keep hands away from mouth, nose and ears.
- Avoid the use of sharps whenever possible. Take extreme care when using a needle and syringe for inoculating research animals.
- Wear protective gloves and a laboratory coat or gown where laboratory animals are kept.
- Remove gloves and wash hands after handling animals, and before leaving areas where animals are kept.
- Use mechanical pipetting devices.
- Never eat, drink, smoke, handle contact lenses, apply cosmetics, or take 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 and when procedures are completed.
- Decontaminate infectious waste before disposal.
- Uses secondary leak-proof containers to store or transfer cultures, tissues, or specimens of body fluids.

3. 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. Virtually all human beings are capable of developing allergic reactions; however, some individuals are more susceptible. Allergy is most often manifested by nasal symptoms, itchy eyes, and rashes. Symptoms usually evolve over a period of exposure of 1-2 years.

3.1. 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.

Exposure concentrations are clearly task-related. Tasks that can elevate risk are cage cleaning, handling rats for weighing, shaving, injections and collection of blood and urine samples, and surgery on anesthetized animals.

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.

3.2. Mice

Mice are another important source of allergen exposure of laboratory workers. The major mouse allergen is a urinary protein.

3.3. Preventive Measures

Measures to minimize exposure to animal allergens must be undertaken. These measures include screening programs, facility design, work practices, and personal protective equipment.

3.3.1. Screening Programs

Pre-placement screening evaluations can be helpful in identifying and alerting persons who might be at risk of developing laboratory animal allergy or asthma and educating them to take protective measures. At a minimum, a simple

questionnaire that asks for a personal and family history of allergy and specific allergy to laboratory animals should be completed. The presence of pre-existing allergic conditions in a person might increase the likelihood of developing asthma in an occupational setting where there is exposure to laboratory animals.

3.3.2. Facility Design

Attention to facility design can be helpful in reducing the incidence of laboratory animal allergy. The airborne-allergen load in an animal room depends on the rate of production, which is a function of the number of animals present, and the rate of removal, which is a function of ventilation. Airborne concentrations of rat allergens also depend on the relative humidity of the environment. Cage-emptying where loose bedding is used results in particularly high levels of allergen exposure. Use of ventilated hoods or work stations for cage-emptying and cage-cleaning with filtered, re-circulated air can reduce exposure.

3.3.3. Work Practices

Several work practices can reduce the potential development of laboratory animal allergy and perhaps alter its severity. Workers should be made aware of the risks and be instructed in proper measures to control and avoid exposure as much as possible.

Job assignment on entry into the laboratory animal work environment should be assessed. People with known risks are best assigned to tasks that minimize exposure. Some tasks – such as feeding and washing – produce low levels of exposure, whereas cage-cleaning can lead to high levels of exposure. Selection of job assignment is the first step to minimize exposure of people who have become sensitized or have developed symptoms.

3.3.4. Personal Protective Equipment

The use of protective equipment and clothing can minimize the chance of sensitization. The use of gloves, laboratory coats, shoe covers, and other kinds of protective clothing that are worn only in the animal rooms should be encouraged. Frequent hand washing is important and showering after work is of value.

3.4. Evaluation of the Allergic Worker

When people develop allergic symptoms (sneezing, nasal congestion, itchy eyes, cough, wheezing, chest tightness, shortness of breath, or hives) related to laboratory animal exposures, consultation with appropriate physicians (allergists, pulmonologists, or occupational medicine specialist) is necessary so that an accurate diagnosis and effective management can be achieved.

This evaluation will be conducted by a medical professional at the Fallon Occupational Medical Department, as arranged by the Environmental and Occupational Safety office.

4. Zoonoses

The transmission of zoonotic diseases in the laboratory-animal environment is uncommon, despite the number of animal pathogens that have the capacity to cause disease in humans. 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.

4.1. Evaluation of zoonotic infection

When people develop an occupationally acquired zoonotic disease or infection related to laboratory animal exposures, consultation with appropriate physicians (occupational medicine specialists) and institutional veterinarian is necessary so that an accurate diagnosis and effective management can be achieved.

This evaluation will be conducted by a medical professional at the Fallon Occupational Medical Department, as arranged by the Environmental and Occupational Safety office.

5. Work Practices to Minimize Exposures to Hazards

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.

5.1. 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.

5.2. 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 protective equipment (gloves, gowns and eye protection).

5.3. Practices to reduce percutaneous exposures:

- Eliminate the use of sharp objects whenever possible.

- Use needles with self-storing sheaths or those designed to protect the user.
- Keep 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.

5.4. 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 animals.
- Keep hands and contaminated items away from mouth.
- Protect mouth from splash and splatter hazards.

5.5. 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.

6. Personal Protective Equipment

The use of Personal Protective Equipment (PPE) is the final measure for controlling exposures to potentially hazardous agents. PPE provides a physical barrier to hazardous materials that might otherwise come into contact with employee's skin, eyes, mucous membranes or clothing.

6.1. Gloves

Gloves are the most commonly used personal protective clothing. Nitrile rubber 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. Gloves should be long enough to cover the area to be protected.

Disposable gloves should not be re-used. Heavy duty rubber gloves will hold up well in cleaning and disinfecting; they are the type commonly used for washing cages.

6.2. Gowns and Laboratory Coats

Gowns and laboratory coats prevent contamination of animal care personnel from animal urine and feces. Such garb should not be worn outside the work area. Protective clothing should be selected so that it provides an adequate barrier against the type and extent of exposure expected.

6.3. Face and Eye Protection

Face protection is advised if the eyes, nose, or mouth might be exposed through splashes or splatters of potentially hazardous materials. Safety glasses should be considered minimal eye protection and worn to prevent injury from projectiles, minor splashes, or contact with contaminated hands with eyes. Goggles or face shields might be needed for tasks involving infectious or hazardous liquids if there is the potential for splashing or spattering. Surgical masks may also provide some protection of the mouth from splashes.

6.4. Respiratory Protection

Respiratory protection might be necessary to control occupational exposures to aerosols. The selection and use of proper respiratory protection equipment should be coordinated through the Environmental and Occupational Safety office.

7. Occupational Health Care Services

7.1. Assessment of Health Risks

Employees who are involved in the care and use of research animals might face health risks for which specific health-care services should be provided. In most cases, effective use of good animal-care and occupational health and safety practices will be sufficient to protect the health of employees. Substantial contact with research animals or their tissues is an important consideration in assessing health risks, although it is inadequate as the sole criterion for assessing risk. Several aspects of a job merit consideration, including exposure intensity, exposure frequency, the hazards associated with the animal being handled, the hazardous properties of the agents that are used in research, the susceptibility of the individual, and the occupational-health history of previous employees. Because WPI maintains a very small animal use program, the determination of risk and the need for health-care services is made on a case-by-case basis.

7.1.1. Identification of Persons at Risk

The institution will identify employees at risk because of animal related research and determine who should be referred for additional screening and testing by medical professionals at the WPI Student Health Services (for students) or the Fallon Occupational Medical Department (for employees), as arranged by the Environmental and Occupational Safety Office.

7.1.2. Medical Evaluations

Every employee who is subject to a potential risk in the animal care and use program should undergo a medical evaluation, both pre-placement and periodically. For students, these services are provided by the WPI Student Health Office. For employees, these services are provided by the Fallon Occupational Medical Department.

7.2. Immunizations and Required Vaccinations

Immunization programs are an accepted method of protecting people from some infectious diseases. The decision to immunize an employee or student should be made because of a clearly defined, recognized risk at the time of preplacement, periodic, or episodic health evaluation. All WPI students and employees shall be immunized in the following manner:

- MMR (meases, mumps, rubella)
- Tatunus / Diptheria
- Hepatitus B
- Tuberculosis