

Veterinary Guide to Personal Protective Equipment

Compiled by the Rocky Mountain Regional Center of Excellence for
Biodefense and Emerging Infectious Diseases

Specialized Biodefense Training Group



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Note: This document is designed to provide an introductory overview of personal protective equipment for veterinary professionals and is not meant to be a source of official information on regulatory compliance or policy. Veterinary professionals should base compliance efforts on OSHA regulations which are referenced in this guide. In addition, other federal or state agencies may provide additional PPE guidelines or policies related to management of animal disease emergencies.

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1. Introduction:

Personal protective equipment (PPE) includes apparel and devices that protect the user from various hazards, including mechanical hazards hazardous materials, and biological hazards. In the environment of veterinary practice, this may include mechanical hazards related to equipment, facilities, animal-related injury (such as bites) as well as hazardous materials, and biological (zoonotic disease) agents. This document, however, will focus on PPE designed to protect the user from hazardous materials, particularly biological hazards.

Highly pathogenic avian influenza (HPAI) is a global issue of great immediate concern, particularly the current outbreak of H5N1 HPAI. While many PPE issues discussed herein may be applicable to HPAI, the goal is to provide a much broader view of PPE issue and provide insight into these issues for veterinary practitioners and state veterinary medical reserve corps programs. Creating the skills to effectively use PPE for a generic biological hazard should greatly improve the capacity to use PPE within the parameters established for a specific disease risk in an emergency event.

The use of PPE within a veterinary practice should be one component of an overall infection control and biosecurity program. The RMRCE has developed a sample infection control plan for veterinary practices and animal shelters. That sample plan can be accessed on the RMRCE Web site at www.cvmb.colostate.edu/mip.rmrce.

2. Risk Assessment

An appropriate risk assessment is an essential component of appropriate PPE selection. For events involving chemical or radiological hazards, many regions now have equipment to rapidly identify the hazard and allow for appropriate PPE for the situation. For veterinary professionals, however, biological risks are perhaps the most likely hazard for which they will be asked to don personal protective equipment. Biological agents may take hours to days to identify accurately and clinical signs and epidemiological information must be used to project an initial risk assessment.

Examples:

A cat is presented with bilateral sub-mandibular abscesses, fever, depression, and respiratory signs. Confirmation of plague may take several days, but pneumonic plague must be considered in the differential diagnosis and those staff members handling the case must be trained and fit tested to don the appropriate PPE while the risk is more accurately established.

A veterinary medical officer for the state animal health agency responds to the location of a backyard flock of poultry with rapid onset of 95% mortality. There are a number of possibilities, but HPAI and Exotic Newcastle Disease (END) are potential agents in this situation. Appropriate precautions must be taken to protect the response personnel and prevent infectious agents to leave the premises (except for appropriately secured samples).

A veterinary practitioner arrives at a ranch in the southwest to find vesicular lesions in horses and cattle consistent with Vesicular Stomatitis Virus (VS). While VS is much more likely than Foot and Mouth Disease, steps must be taken by practitioners to protect themselves from contamination and avoid accidental transport of infected materials off the ranch while awaiting laboratory confirmation.

A veterinarian is presented with a case of a dog with severe respiratory signs. There have recently been cases of canine influenza in the area. The dog is very ill, dehydrated and needs to be hospitalized. What PPE precautions are needed to ensure that the staff does not transmit the infectious agent to other animals within the facility?

For veterinary professionals, each case or farm visit must include active risk assessment. In addition, veterinary professionals must have on hand PPE adequate for any predictable infectious hazards that might they may encounter. In addition, all staff members that may be asked to don PPE must be trained in the use of that PPE. When respiratory protection is needed, additional requirements exist for medical evaluation and fit testing (see section 4)

3. Personal Hygiene:

While PPE provides a substantial amount of protection for the wearer, there is no substitute for effective personal hygiene while working around biological hazards. Hand washing in particular should be incorporated as a key element in infection control and personal protection. Hand washing should be done frequently, using antiseptic soap and warm water. When not possible and if hands are not grossly soiled, alcohol-based hand sanitizers have been shown to be effective in dramatically reducing microorganisms carried on the hands.

The recommended technique for hand washing is:

- *Wet hands and forearms with warm water*
- *Add at least 3-5 mls (1-2 full pumps) of soap or disinfecting soap*
- *Lather up and vigorously scrub each side of the hands beyond the wrist for 10-30 seconds, cleaning under rings and cleaning dirty fingernails.*
- *Rinse under warm water until no soap residue remains*
- *Dry hands with paper towel or hot air dryer.*
- *If it is not possible to wash your hands immediately wet wipes with alcohol or hand sanitizers can be used until you have access to warm water and soap.*
- *Hand sanitizers work better when hands are not grossly soiled.*

Recommended method for using a hand sanitizer:

- *Apply a thumbnail-sized amount to the palm.*
- *Work sanitizer into fingertips of opposite hand, then onto the rest of hand.*
- *Repeat with opposite hand.*
- *Rub briskly until dry and do not rinse.*

4. Barrier Protection:

Barrier protection includes items that shield the body parts of the user from contamination by blood, body fluids, and other substances. Examples of barrier protection include gloves, gowns, smocks, coveralls, aprons, head covers, glasses, goggles, face shields, and foot wear.

Barrier protections increase safety and biosecurity, but may also reduce dexterity and magnify the stresses of heat and humidity. Whenever PPE is used, care must be taken to manage the risk of dehydration, heat stress and/or heat stroke.

Barrier protection summaries:

- **Gowns, smocks and aprons:** Various types and styles provide limited protection from contaminants where zoonotic potential is limited. In some situations, such as some laboratory or in-hospital situations, such barriers may be adequate. Where liquid contaminants are of concern, the user should choose water resistant barrier materials.
- **Coveralls:** Coveralls provide a much broader level of barrier protection. Several types of coveralls include:

- **Fabric coveralls (washable):** Commonly used in normal clinical situations, clean coveralls should be donned whenever entering each new animal premises. Cloth coveralls are generally cooler than Tyvek or Tychem.
- **Tyvek coveralls:** Tyvek is composed of spun bound olefin fibers that result in a highly tear resistant product that resists contamination by particulate materials. Tyvek is neither splash resistant nor waterproof. While Tyvek may breathe, it may still subject the wearer to additional environmental stress. Tyvek can be taped to other barrier protections (gloves, footwear) with duct tape. Tyvek is typically a one-use disposable product. Tyvek may be hooded or plain and typically costs about \$7 per suit.
- **TyChem coveralls:** TyChem provides the protection of Tyvek and provides additional protection against liquids, including most solvents. TyChem must be taped to other barriers using special TyChem tape as duct tape will degrade the integrity of the material. TyChem does not breathe and can easily contribute to overheating. TyChem may cost \$21 per set and the tape may cost \$27 per roll.
- **Level A, B, or C protection:** Various models of heavy duty chemical resistant coveralls and body suits are available for hazmat responders needing level A, B, or C level protection. The average veterinary professional will not use these in a clinical environment. Consult your local fire department or state emergency management agency for additional information. Additional training on advanced PPE is available at the Agricultural Emergency Response Training program at the Noble Training Center in Anniston, Alabama. Contact your USDA Area Veterinarian in Charge or state emergency management agency about this course.
- **Gloves:**
 - **Exam gloves:** provide a splash resistant barrier, but many brands are easily subject to tearing. Latex allergies make latex varieties a problem for use by a significant percentage of people, with nitrile (blue) and vinyl gloves used as an alternate. Some brands may have extended cuffs and textured fingers (increased dexterity). Various sizes (S, M, L, and XL) should be stocked to accommodate hand sizes. Exam gloves typically cost \$8-15 per box of 50 pairs.
 - **Heavy duty gloves:** heavy duty rubber, butyl, nitrile or neoprene gloves are available where exam gloves to not provide sufficient mechanical or chemical protection. Costs range from \$2 per pair and up.
 - **Work gloves:** heavy work gloves may include leather, cloth or rubberized or textured materials. Typically, these gloves are used for mechanical protection and should be worn over a glove providing barrier protection. Costs are highly variable.
- **Footwear**

- **Shoe covers:** These may include Tyvek, vinyl or other disposable foot coverings. Shoe covers should be adequately sized to conveniently fit over footwear. Tyvek is not water resistant. In laboratory or indoor clinical environments, shoe covers may be adequate, but in outdoor, agricultural environments, they can easily be punctured or wear through in a short period of time. Shoe covers may increase slippage hazards.
- **Overshoes:** These are generally rubber or synthetic boots made to slip over existing shoes or boots. May be decontaminated after use or disposed of in very hazardous situations.
- **Boots:** Rubber or synthetic boots may be the ideal footwear for agricultural premises. Typically boots can be cleaned and disinfected if made of appropriate water resistant materials. In some circumstances, chemical resistant boots may be needed when working around chemical hazards such as some disinfectants.

- **Eyewear**
 - **Safety glasses and direct vented goggles:** Safety glasses and direct vented goggles may be appropriate PPE where mechanical injury is the primary concern. These items do not provide adequate biological protection where there is significant zoonotic disease risk.
 - **Indirect vented Goggles:** Indirect vented goggles provide substantial protection from dust, particulates and liquid splashes. Unvented goggles generally fog easily and may be difficult to use effectively. Many brands and styles are available with highly variable costs. Goggles may impact the fit of respirators and vice-versa. If using goggles and respirators together in a strenuous environment, the fit of both products may easily be compromised.
 - **Face shields:** Face shields are often used in clinical or laboratory settings for splash protection. Face shields do not provide protection from dust and particulates and are not an effective form of PPE in the typical agricultural setting.
 - **Full face plate respirators:** Full face plate respirators provide excellent eye protection. In some circumstances, personalized prescription vision inserts may be needed, which adds considerably to the costs. See the section on respirators for more information.

- **Headwear**
 - **Bouffant caps:** Bouffant (chef) type caps provide limited protection from particulates, but do not provide complete skin protection or splash protection. Bouffant caps are generally disposable.
 - **Hooded coveralls:** Tyvek and TyChem coveralls can be purchased in a hooded model, providing additional coverall of the head and neck. Hooded coveralls may add to environmental stresses for the wearer.
 - **Hard hats:** In some cases, mechanical hazards may dictate the wearing of hard hats. Typically hard hats are worn either on top of hoods or underneath a chemical resistant level A, B, or C barrier suit.

5. Respiratory Protection

Respirators: There are many kinds of respirators, each ideally suited for different hazardous situations. For most veterinary professionals in private practice settings, disposable filter respirators are the most commonly used. The following chart illustrates the degree of respiratory protection provided by each kind of respirator:

Respirator Type #	Exposure reduction percentage
N-95 Filter mask	75%
N-100 Filter mask	90%
Half-face air purifying respirator	90%
Full face purifying respirator	98%
Loose fitting hooded PAPR*	96%
Full face PAPR	98%
Self-Contained Breathing Apparatus (SCBA)	99%+
* PAPR= Powered Air Purifying Respirator	

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It is important to note that respirators, particularly filter masks do not eliminate exposure, but substantially reduce exposure. The more dangerous the biological agent, the more respiratory protection needed. Exposure may also be increased unless the respirator is properly fitted and maintained.

Respirator overview:

Surgical masks (single strap dust masks): Surgical masks are designed to help protect patients from droplets that might be produced by a surgeon and are helpful in reducing the spread of droplets and aerosolized infectious particles generated by the person wearing the mask. They are not considered by OSHA to be effective respiratory protective equipment and should never be issued to staff members to protect them from respiratory hazards! Surgical masks do provide some splash protection and keep the wearer from touching the nose and mouth while wearing the mask. For this reason, surgical masks should be considered barrier protection, not respiratory protection.

Approved filtering face masks: Disposable filter masks are classified as N-95 or N-100 depending on the standard of protection they provide. Filtering face masks are probably the most likely type of respiratory protection that would be used in a veterinary clinical setting by veterinarians and technicians. Filtering face masks may be inadequate for very dangerous agents or environments that are exceedingly dusty and dirty. Some models have exhalation valves that make working in warm environments somewhat less heat strenuous. There are numerous models and sizes of N-95 and N-100 masks and no one



model or size will fit every person. Goggles can interfere with the correct fitting of the mask.

Half-face air purifying respirators: Half-face APRs are a reusable rubbery mask that covers just the mouth and nose. Replaceable filter cartridges color coded for purpose (particulates, organic vapors, etc.) are attached to the mask. Air flow is accomplished by passive filtration of air inhaled by the user. These respirators are often used with eye protection such as goggles, but goggles may interfere with maintaining appropriate fitting of the mask.



Full-face air purifying respirators: Full-face APRs use the same cartridge filtration system, but are designed to fit over the entire face, including the eyes. A tighter fit can often be maintained with a full-face APR.



Powered air purifying respirators (PAPR): PAPRs use a battery powered fan to pull air through filter cartridges and blow the air into the mask or hood of the wearer. PAPRs have advantages in cooling, and less resistance to breathing by the wearer. Disadvantages are cost, decreased filter cartridge life, weight and dependence on batteries. Hooded (loose fitting) PAPRs blow air into a hood worn by the user. Unfortunately, in challenging agricultural work environments, there is a definite possibility of contaminants entering under the edge of the hood.



Self-contained breathing apparatus (SCBA): SCBA allows entry to low oxygen environments or situations where chemical vapors cannot be filtered out. All air breathed by the user is provided from a compressed air container carried on the back. Most veterinary personnel will never need to use SCBA for respiratory protection, but almost all fire departments have SCBA equipment and training.



Medical clearance and fit testing: In order to comply with OSHA regulations, respiratory PPE, including filter masks except as provided in the voluntary use regulations) use must be preceded by three basic requirements.

1. All personnel using respirators on the job will undergo a medical screening. This consists of a standardized medical history questionnaire that is filled out by the employee. A physician must review the application. If the physician determines that the employee does not have any elevated risk factors, then they will receive medical clearance. If elevated risk factors are found, then

the employee will be asked to undergo an occupational physical to determine if the employee can use the respirator safely and if there will be restrictions on their use of the respirator. This medical clearance is generally repeated every two years.

2. Once clearance is obtained, the user must be trained in the use of the respirator.
3. Lastly, the user must be fit-tested for the respirator.
 - a.
 - b. Qualitative fit testing (generally for filter mask respirators) tests the ability of the respirator to block the taste/smell of volatile agents. The employee dons the respirator, is placed under a large hood, and agents are introduced and the wearer is asked to try to detect the agent while doing several types of breathing and body movements. **Qualitative fit testing is only valid for the exact brand, model, and size of the filter face mask. Each person has a slightly different facial shape and no single filter mask will adequately fit every person. For that reason, you may have to stock several models and sizes of filter mask in order to accommodate all users.** Each user must use the exact make, model and size filter mask for which they were successfully fitted. There are not exceptions to this requirement. Beards may have to be shaved or the user may need to use a full-face respirator.
 - c. Quantitative fit testing measure the seal of the respirator to the person's face with specialized measuring equipment. Quantitative fit testing is valid for the individual mask assigned and fitted to the user.
 - d. Fit testing must be repeated annually.
 - e. Most veterinary practices will only have a need for qualitative fit testing. Qualitative fit testing resources may be available through an industrial hygienist affiliated with a local hospital. Quantitative fit testing may be available through negotiations with local fire departments.
 - f. Personnel doing fit testing must have gone through training programs to qualify for either qualitative or quantitative fit testing. Your state public health agency, local hospital or fire department may be able to direct you to such training programs in your state.
4. **Exception for voluntary use of respirators:** The exception to fit-testing is for voluntary use of respirators. If a respirator is not required, but the employee elects to use the respirator (i.e. not required by risk and not required by employer) then medical screening and fit testing are not required. There is considerable ambiguity about

Heat stress and user safety: While PPE protects the user from specific hazards, it may also create some additional hazards that need to be addressed.

- Work capacity and dexterity is reduced markedly while wearing PPE. As an example, coveralls, boots, gloves and a full-face APR can reduce work capacity by 30% or more.
- Hot environments, humidity, individual physical factors, and work being done can contribute to heat stress or heat stroke. Individuals may need to be

limited to 30 minutes or less of work prior to doffing PPE and resting and rehydrating in some environments.

- Hydration must be maintained, but personnel will not be able to take in fluids while wearing a respirator. Persons should be hydrated prior to donning PPE and a respirator. Over-hydration and caffeine, however, can lead to increased need to urinate, which may be challenging in environments requiring PPE.
- Individuals using respirators and working in barrier protection should work with a team of personnel. Each team should have a plan on providing first aid and summoning emergency services in the event of a medical emergency.

6. Regulatory issues (OSHA compliance)

The central mission of OSHA is to ensure safe workplaces. From the OSHA Web site:

[Section 5\(a\)\(1\)](#) of the OSH Act, often referred to as the General Duty Clause, requires employers to "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees". [Section 5\(a\)\(2\)](#) requires employers to "comply with occupational safety and health standards promulgated under this Act".

In other words, employers must take steps to protect employees from recognized hazards, including zoonotic biological agents. Even if OSHA has not published specific standards for a specific disease agent in a veterinary practice environment, the employer is still responsible for the protection of their employees.

Regulatory issues for use of respirators: The Occupational Safety and Health Administration (OSHA) requires the use of appropriate PPE for hazardous situations. A veterinary practice could be subject to fines and other penalties for failure to provide a safe work environment. In addition, veterinary practices could be subject to civil suits from employees who were not properly protected. To ensure maximal compliance:

1. Be sure you understand the OSHA requirements for PPE and respiratory equipment (see Web references in the Appendix)
2. Find out if you may be subject to additional state requirements regarding PPE and animal disease issues (check with your state's animal health and public health agencies)
3. Premises owners or agricultural producers are also subject to many OSHA requirements regarding hazardous materials or conditions. Veterinary professionals could be cautious if asked by farm owners to provide PPE (particularly respirators) for farm/ranch personnel. Not following established OSHA protocols could result in farm personnel donning PPE without proper medical clearance or training, resulting in unsafe work environments.
4. Farm and ranch personnel/management should be made aware of these issues by veterinarians and can potentially be assisted in developing an on-

farm compliance program for the use of appropriate PPE by their workers both for worker protection and infection control programs. (eg: cleaning and disinfection procedures for premises known to have a salmonella or Q fever problem.)

More on voluntary use of respirators by employees:

- Voluntary use can be thought of as conditions where:
 - The employee elects to use a filter mask respirator (dust mask)
 - The conditions/risks do not necessitate a respirator
 - There is no company requirement to use a respirator
 - A supervisor has not required or recommended that the employee to use a respirator
- If a substantial respiratory biological hazard exists and the employee is not required to use a respirator, this could be construed to be an OSHA violation and/or expose the employer to civil liability.

Information on OSHA regulations can be found at:

OSHA Respiratory protection standards

- [Hhttp://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=STANDARD_SH](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=STANDARD_SH)

OSHA Small Entity Compliance Guide for Respiratory Protection

- [Hhttp://www.osha.gov/Publications/SECG_RPS/secgrev-current.pdf](http://www.osha.gov/Publications/SECG_RPS/secgrev-current.pdf)H

OSHA Medical Questionnaire for Respiratory Protection:

- [Hhttp://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9783](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9783)

OSHA Quick Card for Respirators

- [Hhttp://www.osha.gov/OshDoc/data_Hurricane_Facts/respirators.pdf](http://www.osha.gov/OshDoc/data_Hurricane_Facts/respirators.pdf)H

OSHA hazardous biological agents Web page:

- [Hhttp://www.osha.gov/SLTC/biologicalagents/index.html](http://www.osha.gov/SLTC/biologicalagents/index.html)

OSHA avian influenza Web page:

- [Hhttp://www.osha.gov/dsg/guidance/avian-flu.html](http://www.osha.gov/dsg/guidance/avian-flu.html)

7. General biosecurity issues

PPE is designed both to protect the user from hazards and to facilitate entry into and exit from a location in such a way as to minimize any potential for accidentally introducing an infectious agent or the transportation of an infectious agent out of the area. The RMRCE has prepared a video of approximately 20 minutes on basic premises entry/exit and PPE use for veterinary professionals in a moderately high biological risk situation.

Additional information on general biological risk management practices is available online through the Center for Food Security and Public Health at Iowa State University. Visit <http://www.cfsph.iastate.edu/BRM/> for more information.

General considerations for veterinary practitioner visits to all agricultural premises for general visits and visits during times of high biological risk:

1. Keep the interior of your vehicle clean and wash your vehicle frequently. Be prepared to disinfect your vehicles with a pump-type garden sprayer and appropriate disinfectant if necessary.
2. While it is ideal from a biosecurity perspective to park your vehicle on the public road just outside the facility, circumstances for routine visits often require parking within the premises. Vehicles, however, should not be parked directly within animal areas and **when biological risk factors are elevated, park as far from animal areas as practical.**
3. Maintain "clean" and "dirty or contaminated" areas of your vehicle. Put soiled/contaminated items in the dirty area after use.
4. Use clean coveralls and clean/disinfected footwear for each call.
5. Clean and disinfect boots upon exiting any premises.
6. When possible, leave trash onsite for disposal. Any hazardous biological waste should be double bagged for appropriate off-site disposal.
7. Veterinarians should be equipped with appropriate PPE and decontamination resources on all farm visits both for routine work and in case the practitioner discovers unexpected high biological risk factors during the visit, such as a potential foreign animal disease.
8. Be prepared to clearly communicate risks and recommendations concerning infectious animal and zoonotic diseases that are diagnosed or suspected on a farm visit.
9. Samples of highly infectious materials should be collected carefully and placed within appropriate sealed containers/plastic bags. The external surface of that bag/container should be disinfected appropriately and placed within a clean plastic bag and packaged for transportation to the laboratory.
10. When visiting locations where significant infectious disease problems exist, only essential personnel should enter the premises and all personnel should wear appropriate apparel/PPE.

8. Guidelines for the Veterinary Practitioner Conducting an Initial Disease Investigation at a Livestock Premise

Goal

Avoid introducing and transmitting potentially harmful biological agents

In the daily routine of a veterinary practitioner it is reasonable to assume that sooner or later he/she will receive a call from a client who has concern about the sudden appearance of an unusual disease situation on his/her premises

Detailed History

Once a call to investigate a disease event on a livestock premise has been received by the veterinarian, a detailed history including the location, address, phone number etc should be obtained before arriving at the premise. This will facilitate the appropriate preparation of PPE, sampling supplies etc. Ideally the veterinarian will have at least a list, but preferably a pre-prepared kit that can be easily and quickly available for use. (*See the suggested list of PPE, supplies etc. in Appendix*)

Suspicion of a potential FAD or zoonotic disease problem

If at this point the veterinarian suspects or is concerned about the potential for a foreign animal disease, zoonotic disease etc., preliminary contact and notification of the State or USAD/APHIS area veterinarian would be appropriate.

Preparation prior to entering the premise

Ideally, the veterinarian should park his/her vehicle in a convenient place before arriving at the premise prepare the necessary PPE, supplies etc

Establish and maintain "clean" and "dirty" areas of your vehicle. Put soiled/contaminated items in the dirty area after use. For example, the driver's side of the vehicle becomes the established "dirty" side where the foot bath container, hand sprayer, plastic tote box with necessary PPE, and other supplies are stored. All potentially contaminated objects stay on the "dirty" side. The passenger side of the vehicle becomes the "clean" side.

Place in the vehicle cab on the clean side Tyvek suits, masks, plastic boots, duct tape etc. in preparation for donning the PPE once on the premise.

Pre-place appropriate length strips of duct tape on the inside of your vehicle door to facilitate taping your coveralls to your boots and gloves.

NB: Use the bathroom facilities before entering the premise and donning PPE

Entering the premise

While it is ideal from a biosecurity perspective to park your vehicle on the public road just outside the facility, circumstances for routine visits often require parking within the premises. Vehicles, however, should not be parked directly within animal areas and when biological risk factors are elevated, park as far

from animal areas as practical. Upwind is a preferable parking location to reduce vehicle contamination.

Once parked, it is critical that the "dirty" and "clean" sides and perimeters around the vehicle be observed throughout

Donning PPE

The type of PPE and the protocols for donning (putting on) and doffing (removing) PPE will vary with the level of PPE appropriate for the risk of the current circumstances. Where a foreign animal disease is suspected, official guidelines will determine the appropriate PPE to be used.

The following is an example of a sequence for donning and doffing Tyvek coveralls, boots and an N-95 filter mask (OSHA level D PPE) for a significant risk situation. The philosophy of PPE use is much like the structured sterile technique used for surgical procedures.

- a. Have the equipment you expect to need organized and ready within a tote or other suitable device for carrying. Ensure that there is sufficient PPE for all entering the premises before setting out. All should have suitable coveralls and footwear.
- b. Everyone should have clean hands and be fully hydrated. Hand sanitizer may be used to further disinfect hands before putting on PPE.
- c. While within the vehicle, put on a Tyvek suit over the coveralls. You may not be able to get the coveralls completely on at this point, but should be over your legs and lower body. (As the booties on the Tyvek suits are not very durable, it is often easier to cut them off before hand, and use heavy duty plastic booties instead)
- d. Put on clean boots or boot covers over your shoes/boots.
- e. Open the door and step out while pulling your coveralls over your shoulders. Zip the coveralls completely.
- f. Put on rubber boots/overshoes. Place duct tape around the coverall-boot junction.
- g. Place the N-95 mask gently in place and secure the two straps behind the head, one above the ear and one below the ear. Gently press the nose forming band toward the face for better seal, but DO NOT pinch the band across the nose as this will compromise the fit! **Only use a filter mask of the make, model and size for which you have been previously fit tested.****
- h. Place gloves on hands. Disposable exam gloves may need to be doubled for adequate protection for light duty tasks. Carefully tape the edges of the gloves to the Tyvek coveralls. Duct tape will be a challenge to handle with exam gloves and can tear the gloves if allowed to adhere to them. For heavy duty tasks heavy rubber gloves or work gloves may need to be added on top of the exam gloves.
- i. Place cell phones and other hard to disinfect items that you must carry onto the premises within a heavy zip lock bag on the "dirty" side. Forms, printed materials and records should be placed in another zip lock bag on the "dirty" side.

- j. If not already in place, a decontamination station (bucket, disinfectant, brush, waste containers) should be carried to the edge of the premises where people will leave the 'dirty' area. The foot bath with the disinfectant should be placed close to the vehicle at the edge of the determined "clean" and "dirty areas"
- k. Fill the foot bath and hand sprayer with disinfectant.
- l. Collect your gear and enter the premises. Remember, you must take everything you need with you at this time. In complex operations, one or more people may need to remain outside the premises to pass additional materials to those in the work zone.

Collecting and handling of samples

After examining the animals, and having collected an appropriate set of samples, the samples should be bagged in a plastic (zip lock) bag(s). Similarly the history, physical exam forms and other paper work should be placed in a separate zip lock bag. Used syringes, needles etc. should be put in a plastic bag for appropriate disposal.

Exiting the premises

Decontamination and Doffing PPE:

- a. Make sure that all materials that will exit the premises are organized for decontamination. Place all samples in an appropriate zip lock or other container. Place waste in appropriate plastic bags.
- b. Leave the animal area and return to disinfecting area near vehicle
- c. Wash gloved hands and boots. Place any waste in plastic bags. As each bag is filled, it should be sealed, sprayed with disinfectant and placed within a clean bag and resealed.
- d. The foot bath and brush with disinfectant should then be emptied and the outside of the foot bath disinfected before being placed in a plastic bag for further disinfection later.
- e. Spray tires wheel wells and running boards of the vehicle with disinfectant as needed before leaving.
- f. Outer work gloves may be discarded at this point, leaving exam gloves in place.
- g. Disinfect outer part of sample containers with Lysol spray and place entirely within another clean plastic bag.
- h. Spray with Lysol the "dirty" side of the vehicle and all areas inside and outside that have been potentially contaminated.
- i. Spray tires wheel wells and running boards of the vehicle with disinfectant as needed.
- j. Unwrap duct tape from the rubber boots, and remove rubber boots. Spray the rubber boots with disinfectant and then place them in a plastic container for further disinfection later.
- k. N-95 masks should be removed next. Dispose of the mask into the plastic trash bag for proper disposal.
- l. Unzip the Tyvek suit and remove duct tape from sleeves. Then "roll" the suit off the body and arms, turning suit inside out in the process. Continue the process for the legs. Place balled suit in waste bag.

- m. Now clad only in coveralls and plastic booties, open drivers door . Unzip and roll down the coveralls from the inside to the knees and then sit on the driver's seat. Using the remaining pair of gloves pull off the plastic booties, inverting them, and then finally remove the gloves by inverting them over the balled-up booties. Place them in the plastic bag pre-placed in the vehicle cab. The 'street' footwear at this point can be placed on the mat on the floor of the vehicle, thus having never been exposed to the ground on the premise!
- n. Leave the premises!
- o. The vehicle should be taken directly to a car wash and thoroughly pressure washed.

Additional measures after leaving premises:

1. All medical waste should be transferred to a suitable collection receptacle (either on site or at a base of operations).
2. Samples must be delivered to the laboratory collection point.
3. Equipment that needs additional decontamination must be disinfected, repaired as necessary and returned to the PPE kit, ready for the next time it is needed.
4. In an animal health emergency such as a Foot and Mouth disease outbreak, a shower and change into clean clothes is required after visiting infected premises.

9. Emergency events: Entry, Exit, Donning and doffing PPE

The type of PPE and the protocols for donning (putting on) and doffing (removing) PPE will vary with the level of PPE appropriate for the risk of the current circumstances. In a foreign animal disease response, official guidelines will be established that are appropriate for that incident. We have provided here an example of a sequence for donning and doffing Tyvek coveralls, boots and an N-95 filter mask for a significant risk situation such as a "generic" animal health emergency response. The philosophy of PPE use is much like the structured sterile technique used for surgical procedures. For this example, we will consider the vehicle the "clean" zone and the edge of the visited premises as the "dirty" zone.

Donning PPE

- m. Ensure that all personnel have appropriate PPE in hand before setting out for the premises.
- n. Have the equipment you expect to need organized and ready to place within a tote or other suitable disinfectable device for carrying.
- o. Park the vehicle in an appropriate parking area, preferably outside the premises adjacent to the public right-of-way and preferably on a paved area to reduce potential contamination of the vehicle. Upwind is a preferable parking location to reduce vehicle decontamination.
- p. Everyone should have clean hands and be fully hydrated. Hand sanitizer may be used to further disinfect hands before putting on PPE.
- q. Place cell phones and other hard to disinfect items that you must carry onto the premises within a heavy zip lock bag. Forms, printed materials and records should be placed in another zip lock bag.
- r. While within the vehicle, carefully put on Tyvek coveralls over your legs and lower body. You may not be able to get the coveralls completely on at this point.
- s. Put on clean rubber boots or boot covers over your shoes/boots. You may need to use two layers or use a heavier vinyl cover as the second cover as Tyvek shoe covers will not hold up well under heavy use. In some cases heavy rubber boots may be used instead.
- t. Pre-place appropriate length strips of duct tape on the inside of your vehicle door to facilitate taping your coveralls to your boots and gloves.
- u. Open the door and step out while pulling your coveralls over your shoulders. Zip the coveralls completely.
- v. Place duct tape around the coverall-boot junction.
- w. If a hard hat, bouffant cap or other sizeable head covering is used, you will need to place your respirator on first. A respirator will normally be able to be donned with a Tyvek hood already in place.
- x. Put on the N-95 mask by placing each of the two straps behind the head, one above the ear and one below the ear. Gently press the nose forming band toward the face for better seal, but **DO NOT** pinch the band across the nose as this will compromise the fit in other areas and create an opening at the apex of the nose! **Only use a filter mask of the make, model and size for which you have been fit tested.**

- y. Place head cover such as a Tyvek hood, bouffant cap, hard hat or other suitable PPE.
- z. Place gloves on hands. Two pair of disposable exam gloves should be worn for adequate protection for light duty tasks and to facilitate decontamination when exiting. Carefully tape the edges of the gloves to the Tyvek coveralls. Duct tape will be a challenge to handle with exam gloves and can tear the gloves if allowed to adhere to them. For heavy duty tasks heavy rubber gloves or work gloves may need to be added on top of the exam gloves.
- aa. If not already in place, a decontamination station (bucket, disinfectant, brush, waste containers) should be placed at the juncture of the clean and dirty zones. In a large scale response, a decontamination and hand-washing station may already be established at the edge of the "dirty" zone when your crew arrives (such as during premises decontamination work.)
- bb. Collect your gear and enter the premises. Remember, you must take everything you need with you at this time. In complex operations, one or more people may need to remain outside the premises to pass additional materials to those in the work zone.

Decontamination and Doffing PPE:

- a. Make sure that all materials to be removed from the premises are organized for decontamination. Place all samples in an appropriate zip lock or other container. Approach the decontamination station which should be at the edge of the 'clean and dirty zones' established near the vehicle. Place samples and waste in appropriate plastic bags (trash bags) that were pre-placed before entering the contaminated premise.
- b. Team members should work in sequence to help each other through the decontamination and doffing process.
- c. Wash gloved hands and boots (work gloves may be discarded or placed in containers for full decontamination at this point, leaving exam gloves in place). An outer pair of exam gloves may be removed at this time and placed in the plastic trash bag or container.
- d. Place any waste in plastic bags. As each bag is filled, it should be sealed (taped shut with duct tape), sprayed with disinfectant and placed within a clean bag at the edge of the dirty zone and sealed before taking into the clean zone.
- e. Disinfect outer part of sample containers and place entirely within another clean zip lock bag or appropriate plastic tote box. Hand off samples to someone in the clean zone.
- f. N-95 masks should be removed by bending over so that any particles dislodged from the mask during doffing fall away from the body. While bent over, remove the straps and exhale while allowing the mask to move down away from the face. Dispose of the mask.
- g. Remove and dispose or decontaminate head covering.
- h. At the edge of the contaminated or dirty zone:
 - i. If wearing disposable boot covers, unzip coveralls and "roll" the overalls off the body and arms, turning coveralls and gloves inside out in the process. You will have to remove all or most of duct tape first. If you used a lot of duct tape it may make this process difficult, particularly

- while wearing exam gloves. Repeat the process for the legs and boot covers, rolling the boot covers inside out as well. Place balled coveralls in waste bag and step into the clean zone.
- ii. If wearing non-disposable boots, disinfect boots thoroughly at the edge of the hot zone. Remove boots and place inside a plastic bag for complete decontamination later. Roll off coveralls and place in waste bag. Step into cold zone and put on clean footwear.
 - i. All samples, contaminated equipment, and waste must be bagged, sprayed with disinfectant and bagged again before being transferred to the dirty area of the vehicle (often the trunk or bed).
 - j. Spray tires and wheel wells of the vehicle with disinfectant as needed before leaving.
 - k. Spray the bottoms of your shoes with an appropriate disinfectant (Lysol spray cans, if appropriate, may be convenient for this). Use hand sanitizer prior to entering your vehicle for departure.

Additional measures after leaving premises:

5. You may need to take the vehicle to a car wash.
6. All medical waste should be transferred to a suitable collection receptacle (either on site or at a base of operations).
7. Samples must be delivered to the laboratory collection point.
8. Equipment that needs additional decontamination must be dropped off at the designated collection point.
9. Responders in a high risk animal health emergency such as Foot and Mouth disease will be required to shower and change into clean clothes after visiting infected premises.
10. In many emergency events, responders may be required to wait for several days prior to visiting other premises. In other events, strike teams may be divided into "clean" teams to visit uninfected premises for surveillance and "dirty" teams that visit suspected/known infected premises.

10. Public perception and media issues

Perception is reality for many if not most of us. Care must be taken to ensure that veterinary personnel both follow established protocols and communicate to the farm personnel those procedures and the rationale for such carefully managed protocols. In some animal health emergency events, owners could be intimidated by the situation, frightened, angry, depressed, and might be present taking photographs or video of the events. In some cases, breaks in biosecurity protocols could become focal points in litigation. Diligent and confident implementation of PPE and biosecurity protocols will help get through these difficult situations.

Suggested practices:

- Maintain appropriate flow between clean and dirty zones. Do not break established biosecurity protocols, even if it seems unlikely to create a problem.
- Maintain consistency. Those doing similar work should wear similar PPE. (e.g. if some are wearing N-95 masks, some surgical masks, and some no masks, the owner may be confused and concerned)
- Discuss the protocols with farm personnel and be prepared to answer their questions.

In other cases, media may be in public areas adjacent to the clean zone, documenting the events.

Suggested practices:

- While the media may be free to film the event from a public access point, Incident Command protocols require that only personnel approved by the Public Information Officer will talk directly with the media. Refer the media to the PIO at the Incident Command Post for information and never provide spontaneous interviews.
- Again, follow biosecurity protocols meticulously. Breaks in biosecurity protocols will both be potentially harmful to people or animals and could result in loss of public confidence when highlighted by the media.

When dealing with publicly accessed establishments for routine surveillance, such as live bird markets, custom slaughter plants, etc., responders should be cognizant of public perception and their impact on businesses. Entering such a premises through back doors, during low traffic hours or after hours, and with a minimal number of personnel will have less of an impact on employee concerns and potential public anxiety generated by the sight of Tyvek cloaked personnel entering their local market.

Appendices:

Web References

Center for Food Security and Public Health, Iowa State University:

- CFSPH provides excellence reference materials on animal diseases as well as biological risk management.
- www.cfsph.iastate.edu
- www.cfsph.iastate.edu/BRM for biological risk management references with multiple tools to help veterinary practices

Occupational Safety and Health Administration

- www.osha.gov

National Institute for Occupational Safety and Health

- <http://www.cdc.gov/niosh/homepage.html>
- High Plains Intermountain Center for Agricultural Health and Safety (HICAHS) <http://www.hicahs.colostate.edu/>

Centers for Disease Control and Prevention:

- www.cdc.gov

USDA, Animal and Plant Health Inspection Service (APHIS)

- <http://www.aphis.usda.gov/>
- <http://www.aphis.usda.gov/vs/> (Veterinary Services)
- <http://www.aphis.usda.gov/vs/ep/> (VS, Emergency Programs)
- <http://www.aphis.usda.gov/vs/birdbiosecurity/> Biosecurity for the Birds site

National Biosecurity Center (Purdue University)

- <http://www.biosecuritycenter.org/>

Kirkwood Community College (Iowa) Foreign Animal Disease Response Training for First Responders:

- <http://www.agterror.org/>

National Association of State Public Health Veterinarians

- <http://www.nasphv.org>

United States Animal Health Association

- <http://usaha.org>

Sample check list for veterinary PPE kit

- Most of the following items can be purchase at you local hardware store.
- With a little pre-organization all these items can be packed into an easy to grab kit.
 - Clean bag for inside the truck
 - 1 gal zip lock – label bag
 - “clean” tote
 - Don’t forget truck floor mat
 - 1 trash bag
 - 1 can Lysol
 - 1 roll duct tape
 - 2 pairs gloves
 - 1 pair inner boots
 - 1 sanitizing hand gel
 - Clean bag for “clean” container
 - 1 gal zip lock - label bag “clean container”
 - 1 sanitizing hand gel
 - 1 hooded Tyvek suit
 - 1 surgical bonnet if Tyvek suit does not have hood
 - 2 pair gloves
 - 1 N95 mask (or surgical)
 - 1 roll duct tape
 - Dirty bag for “dirty” container
 - 1 gal zip lock - label bag “dirty container”
 - 6 trash bags
 - 1 can Lysol
 - 1 roll duct tape
 - 1 sanitizing hand gel
 - Tote and/or box for sampling

Disinfecting supplies

- Sprayer (weed) 1-2 gallon
- 2 cans Lysol
- 3 sanitizing hand gel
- Foot bath (make sure the large totes fit in it!)
- Virkon S disinfectant (you may need to carry powder to create fresh disinfectant. Do not inhale the powder as it is very irritating!)

Containers and containment supplies:

- 2 large tote containers, same size with lids (make sure your sprayer fits!)
- Tote or closed box for samples
- 1 roll heavy duty (1.3ml) trash bags
- 1 box each gallon & pint freezer ziplock bags

Personal protective equipment

- Tyvek suit (hooded preferred)
- Surgical bonnet (if suit not hooded)
- N95 mask (preferred!) or surgical mask
- Inner boots either plastic or rubber
- Outer boots

- Goggles (indirect vented)
- Coveralls
- Disposable gloves
- 3 rolls duct tape

Sampling supplies

- NVSL, Ames Iowa Diagnostic sampling kit
- Miscellaneous sampling supplies are needed from your clinic and should be organized in pint or quart zip lock bags.
 - Red top, purple top and green top vacutainers
 - Vacutainer holder
 - Vacutainer needles
 - Various needles and syringes
 - Medium or large whirlpaks
 - Fecal cups (can use as sharps container)
 - Sterile swabs & cultures
 - Formalin
 - BHI broth (brain heart infusion)
 - TBTB broth (tris buffered tryptose broth)
 - Trash bag to carry supplies out
 - Sharpies and pens for labeling

Office supplies

- Sharpies
- Pens
- Notebook
- Metal Clipboard
- Diagnostic Forms
- Quarantine orders and instruction pack
- Telephone list laminated
- Sample submission guide for zoonoses form (laminated)

Personal items and misc.

- Thermometer and Stethoscope (if not available at farm)
- Hand sanitizer gel
- Flashlight
- Extra cell phone battery
- Electrolyte replacement drinks
- Bottled water (case)
- Power Bars
- First Aid kit with eye wash
- Extra clothing (if cold)
- Silicon spray for boots

Product sources:

- Personal protective equipment (many sources, 2 examples)
 - Grainger: <http://www.grainger.com/Grainger/wwg/start.shtml>
 - Lab Safety Supply: <http://lss.com>
- NVSL, Ames Iowa Diagnostic sampling kit
 - <http://www.aphis.usda.gov/vs/nvsl/>
- Virkon disinfectant (Dupont): <http://www.antecint.co.uk/>