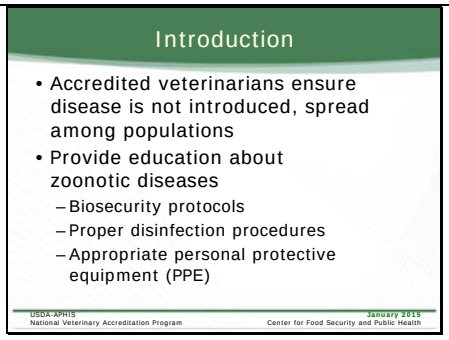
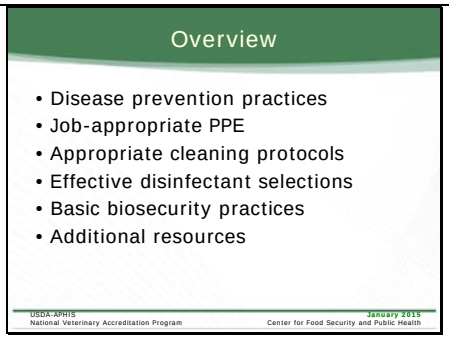
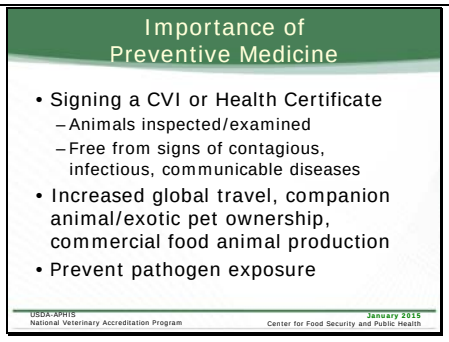
Slide 1	**Module 4: Preventing Disease Introduction and Spread** *USDA-APHIS National Veterinary Accreditation Program (NVAP)* USDA · the Center for Food Security & Public Health, Iowa State University, College of Veterinary Medicine	**Welcome to Module 4: Preventing Disease Introduction and Spread.** This module was developed as supplemental training for the USDA-APHIS National Veterinary Accreditation Program (NVAP) by the Center for Food Security and Public Health at the College of Veterinary Medicine, Iowa State University. The content for this module was finalized in October 2011. *Presenters: As designed, slide completion time ranges from 30 to 90 seconds each, such that the entire presentation can be completed in 60 minutes.*
Slide 2	**Supplemental Training** 1. Print clearly on the sign-in sheets. 2. It is critical that we have your current email address for your accreditation renewal. 3. If you do not know your 6 digit National Accreditation Number, please see me at the conclusion of the presentation. 4. You will receive a Certificate of Completion during the presentation. 5. Keep your Certificate of Completion forever- **do not send it to APHIS**. USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	
Slide 3	**Supplemental Training** • All APHIS Approved Supplemental Training (AAST) modules are also available on our Website with interactive features and links to additional Web resources. • Type "NVAP" into your search engine e.g. Bing, Google, Yahoo. USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	
Slide 4	**Supplemental Training** • Familiarize accredited veterinarians with animal health regulatory concepts and activities – Does not supersede the regulations • For the most up-to-date regulations and standards, please refer to: – Code of Federal Regulations – Assistant District Director (ADD) USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	This informational presentation is intended to familiarize accredited veterinarians with animal health regulatory concepts and activities. Information presented here does not supersede the regulations. For the most up-to-date regulations and standards, please refer to the Code of Federal Regulations and your local Assistant District Director (ADD).

Slide 5		**Introduction:** As an accredited veterinarian, one of your many roles and responsibilities is to ensure disease is not introduced or spread among animal populations. Providing education about zoonotic diseases is another important responsibility. This can include instituting biosecurity protocols, proper disinfection procedures, and wearing appropriate personal protective equipment (PPE) when working with animals. This module will review concepts that are essential to prevent and control the spread of infectious disease agents.
Slide 6		As an **overview,** this presentation will present disease prevention practices that limit exposure to animals and humans, describe job-appropriate PPE to minimize zoonotic disease exposure and fomite spread, outline appropriate cleaning protocols and selecting effective disinfectants, define basic biosecurity practices for veterinary clinics, animal shelters, and livestock facilities, and provide additional resources for infection control practices including appropriate PPE selection.
Slide 7		**Preventive medicine** is extremely **important.** Accredited veterinarians are charged with the responsibility of safeguarding and protecting animal and public health. When an accredited veterinarian signs a Certificate of Veterinary Inspection (CVI) or Health Certificate, they are certifying that when they inspected or examined the animals they were not showing signs of contagious, infectious, or communicable diseases. **Inspect, inspection:** Visual study of the physical appearance, physical condition, and behavior of animals (singly or in groups) that enables an accredited veterinarian to determine whether any abnormality in physical condition or bodily function is evident. **Examine, examination:** Physical study of an individual animal that enables an accredited veterinarian to determine if any abnormality in physical condition or bodily function is suggestive of clinical signs of communicable disease. **Contagious**: capable of being transmitted from animal to animal. **Infectious**: caused by the entrance of organisms (bacteria, viruses, fungi, protozoa) into an animal which subsequently grows and/or multiples; infective. **Communicable**: can pass or be carried from one animal to another directly or indirectly (via fomites or vectors). Increases in global travel, companion animal and exotic pet ownership, and the commercial production of food animals to feed our nation and the world have further necessitated the accredited veterinarian's role in preventive medicine. Preventing the exposure to pathogens is the cornerstone to disease prevention and enhanced animal health.

Slide 8	**Importance of Preventive Medicine (cont'd)** • Biosecurity – Management practices to prevent disease introduction • Infection control – Standard precautions to minimize transmission • Promote disease prevention, control strategies • Critical control points  USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	**Preventive medicine:** Two terms are often used to describe disease prevention measures: Biosecurity and infection control. Biosecurity refers to the management practices designed to prevent the introduction of disease agents onto an animal facility. Infection control refers to the standard precautions designed to minimize transmission of zoonotic pathogens from animals to people. Through implementation of well-designed biosecurity measures, we can help prevent or minimize exposure of animals to disease threats. Infection control measures can help protect ourselves, our staff, and our clients from zoonotic disease risks. Accredited veterinarians can promote appropriate disease prevention and control strategies for their clients, their employees, and others involved in the animal health industry. Critical control points for preventing disease entry and spread in the clinic, in shelters, and on livestock operations will be covered in this presentation.
Slide 9	**Preventing Disease Exposure** • Disease etiology – Triad: Agent, host, environment • Disease agent 'leave' animal – Route of transmission • Agent 'enters' susceptible animal – Exposure route • Focus efforts on limiting exposure USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	**Preventing disease exposure** involves several actions that should be taken. The first step in disease prevention is an understanding of disease etiology. In order for disease to occur, the triad of agent, host, and environment is necessary. For a disease agent to be transmitted from one animal to another it must first 'leave' the animal (route of transmission) and then it needs to 'enter' a susceptible animal (exposure route). For some diseases, the route of transmission and the exposure route are identical (shed by aerosol and the susceptible animal is exposed via inhalation). For others, they are different (transmitted via feces and exposed via ingestion). Since it is impossible to control all possible shedding (transmission) of disease agents, focusing efforts on limiting exposure wherever possible can help prevent disease.
Slide 10	**Preventing Disease Exposure (cont'd)** • Five common exposure routes • Diseases may have multiple routes of transmission • Design prevention practices for these routes instead of individual organisms  USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	The common **disease exposure** routes for animals and humans include aerosol/inhalation, direct contact, fomite, oral/ingestion, and vector-borne. Keep in mind that diseases may have multiple exposure routes and may be different for animals versus humans. Designing prevention practices aimed at minimizing exposure through these five routes, rather than aimed specifically at hundreds of individual organisms, is the approach that will be reviewed in this module.

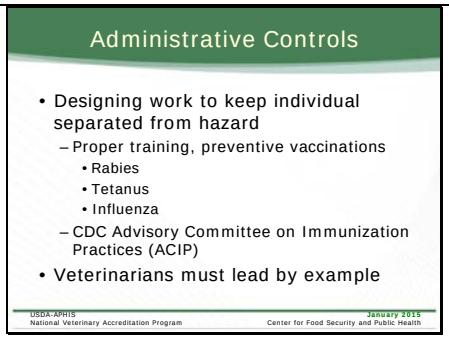
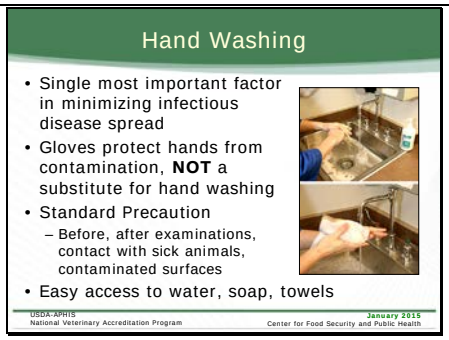
Slide 11	**Routes of Disease Transmission and Exposure**	Next we will discuss the various **routes of disease transmission and exposure** in more detail.
Slide 12	**Aerosol** • Disease agents contained in droplets – Pass through air • Most agents not stable in droplets – Close proximity required – Infected and susceptible animals • Appropriate ventilation, humidity control  USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	Pathogenic agents contained in **aerosol** droplets may be passed from one animal to another or between animals and humans. Most pathogenic agents do not survive for extended periods of time within the aerosol droplets and close proximity of infected and susceptible animals is required for exposure. Appropriate ventilation and humidity control are management practices that can help limit aerosol exposure.
Slide 13	**Aerosol Exposure Examples** • Canine distemper – Dogs • Feline leukopenia – Cats • Infectious bovine rhinotracheitis – Cattle • Pseudorabies – Pigs, cattle, sheep, goats, dogs, cats • Influenza virus – Birds, pigs, dogs, cats, horses, humans • Sheep and goat pox* – Sheep, goats *FAD USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	A few **aerosol exposure** disease **examples** include canine distemper in dogs; feline panleukopenia in cats; infectious bovine rhinotracheitis in cattle; influenza virus in birds, pigs, dogs, cats, horses, and humans; pseudorabies in pigs, cattle, sheep, goats, dogs, and cats; and sheep and goat pox in small ruminants. Sheep and goat pox is also a foreign animal disease (FAD). Keep in mind that these diseases may be transmitted by more than one route.
Slide 14	**Direct Contact** • Disease agent in animal, human or environment • Isolate, prevent contact • Reproductive  USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	**Direct contact:** A susceptible animal or human becomes exposed through physical contact when the agent from an infected animal, human, or the environment enters open wounds, mucous membranes, or the skin through blood, saliva, nose-to-nose contact, rubbing, or biting another animal. Some disease agents can spread between animals of different species, as well as to humans. Isolating sick animals and preventing contact with susceptible animals will help limit direct contact exposure. Reproductive is a type of direct contact exposure, specifically through venereal contact and in-utero. Ensuring the animals are test negative for disease(s) before breeding will help limit reproductive disease spread.

Slide 15	**Direct Contact Exposure Examples** • Brucellosis – Cattle, dogs, horses, pigs, sheep, humans • Glanders* – Horses, dogs, cats, sheep, humans • Monkeypox* – Rodents, non-human primates, humans • Parvovirus – Dogs • Q fever – Cattle, cats, dogs, sheep, goats, humans • Rabies – All warm blooded animals, humans *FADs USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	A few **direct contact exposure** disease **examples** include brucellosis in cattle, dogs, horses, pigs, sheep, and humans; glanders in horses, dogs, cats, sheep, and humans; parvovirus in dogs; monkeypox in rodents, non-human primates, and humans; Q fever in cattle, cats, dogs, sheep, goats, and humans; and rabies in all warm blooded animals including humans. Glanders and monkeypox are also foreign animal diseases (FAD). Keep in mind that these diseases may be transmitted by more than one route.
Slide 16	**Fomite** • Contaminated inanimate object – Feed, needles, bowls/buckets, kennels, chutes, muzzles • Secondary route – Direct contact, oral • Cleaning, sanitizing or disinfection procedures • Traffic – Vehicles, trailers, humans  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	A contaminated inanimate object (**fomite**) can transmit a disease agent from one susceptible animal to another animal or human. Fomites require a secondary exposure route (direct contact or oral) for the pathogen to enter the host. Examples include contaminated feed, needles, bowls/buckets, kennels, chutes, muzzles, and halters. Preventing fomite exposure relies heavily on proper cleaning and sanitizing/disinfection procedures for items used with animals. Traffic is a type of fomite. A vehicle, trailer, or a human can carry organic material containing a pathogenic agent on tires, wheel wells, undercarriage, clothing, or shoes/boots to another location with susceptible species.
Slide 17	**Fomite Exposure Examples** • Bovine leukosis virus – Cattle • Caprine arthritis – Sheep, goats • Cryptosporidiosis – Cattle, dogs, goats, cervids, horses, cats, sheep, pigs, rodents, humans • Equine infectious anemia – All equids • Nipah* – Pigs, horses, dogs, cats • Ringworm – Cattle, horses, sheep, goats, cats, dogs, humans *FAD USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	A few **fomite exposure** disease **examples** include bovine leukosis virus in cattle; caprine arthritis and encephalitis in goats and sheep; Nipah virus in pigs, horses, dogs, and cats; cryptosporidiosis in cattle, dogs, goats, cervids, horses, cats, sheep, pigs, rodents, and humans; equine infectious anemia in all equids; and ringworm in cattle, horses, sheep, goats, cats, dogs, and humans. Nipah virus is a foreign animal disease (FAD). Keep in mind that these diseases may be transmitted by more than one route.
Slide 18	**Oral** • Ingestion of contaminated feed, water • Licking/chewing contaminated objects • Isolating sick animals from susceptible animals, clean feed, water, equipment  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	**Oral:** Ingestion of pathogenic agents in contaminated feed, water, or licking/chewing on contaminated environmental objects can result in disease. Feed and water contaminated with feces or urine from other animals, including rodents and birds, are frequently the cause of oral exposure of disease agents. Contaminated objects (fomites) could include equipment, feed bunks, water troughs, fencing, salt and mineral blocks, and other items an animal may lick or chew. Preventing oral exposure involves isolating sick animals from susceptible animals, keeping feed and water clean by minimizing fecal and urine contamination, and keeping equipment clean.

Slide 19	**Orally Exposure Examples** • Anthrax – Cattle, sheep, goats, horses, pigs, dogs, cats, humans • Johne's disease – Cattle • *E. coli* – Cattle, horses, pigs, dogs, cats, humans • *Campylobacter jejuni* – Cattle, sheep, chickens, turkeys, dogs, cats, ferrets, non-human primates, humans • Foot-and-mouth* – Cattle, pigs, sheep, goats, cervids *FAD USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	A few **oral exposure** disease **examples** include anthrax in cattle, sheep, goats, horses, pigs, dogs, cats, and humans; Johne's disease (*Mycobacterium avium* ss. *paratuberculosis*) in cattle; *Escherichia coli* in cattle, horses, pigs, dogs, cats, and humans; *Campylobacter jejuni* in cattle, sheep, chickens, turkeys, dogs, cats, ferrets, non-human primates, and humans; and foot-and-mouth disease in cattle, pigs, sheep, goats, and cervids. Foot-and-mouth disease is a foreign animal disease (FAD). Keep in mind that these diseases may be transmitted by more than one route.
Slide 20	**Vector-Borne** • Insect (arthropod) – Acquires pathogen – Transmits to animal/human – Mechanically, biologically • Disturbing source – Egg laying areas, larvicides • Environmental controls, topical products for animals  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	An insect, usually an arthropod, acquires a pathogen from one animal and transmits it to another animal or human either mechanically or biologically. **Vector** control efforts focused on disturbing the source (egg laying areas, the use of larvicides) is often more effective than treating adults. Environmental controls (sprayers/misters, fly strips, insect bait) and topical products approved for animals are options to control some adult vectors.
Slide 21	**Vector-Borne (cont'd)** • Mechanical transmission (flies) – Pinkeye – *Moraxella bovis* (Cattle) – Screwworm myiasis* (All warm blooded animals including humans) *FAD • Biological transmission (fleas, ticks, mosquitoes) – Vector takes up agent, replicates/develops it – Injects into susceptible animal/human USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	During mechanical transmission, the disease agent does not replicate or develop in/on the **vector**; it is simply transported by the vector from one animal to another (e.g., flies). A few mechanical transmission disease examples include pinkeye (*Moraxella bovis*) in cattle and screwworm myiasis in all warm blooded animals including humans. Screwworm myiasis is a foreign animal disease (FAD). During biological transmission, the vector takes up the agent, usually through a blood meal from an infected animal, replicates and/or develops it, and then regurgitates the pathogen onto or injects it into a susceptible animal or human (e.g., fleas, ticks, mosquitoes).
Slide 22	**Vector-Borne Exposure Examples** • Biological transmission – West Nile virus (Mosquitoes) • Horses, dogs, cats, humans – Plague (Fleas) • Cats, dogs, rabbits, rodents, humans – Rift Valley fever* (Mosquitoes) • Cattle, sheep, goats, dogs, cats, humans – Tularemia (Ticks) • Sheep, cats, dogs, pigs, horses, rabbits, humans USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	A few biological transmission (**vector-borne**) disease **examples** include West Nile virus in horses, dogs, cats and humans (transmitted by mosquitoes); Plague (*Yersinia pestis*) in cats, dogs, rabbits, rodents, and humans (transmitted by fleas); Rift Valley fever in cattle, sheep, goats, dogs, cats, and humans (transmitted by mosquitoes); and Tularemia in sheep, cats, dogs, pigs, horses, rabbits, and humans (transmitted by ticks). Rift Valley fever is a foreign animal disease. Keep in mind that these diseases may be transmitted by more than one route.

Slide 23	**Minimizing Zoonotic Disease Risks**	Next we will focus on ways to **minimize zoonotic disease risks** in veterinary personnel. Accredited veterinarians do not always know what 'awaits' them on the other side of the examination door or on the farm, so standard precautions to protect themselves, colleagues, staff, clients, and their animals are fundamental in minimizing exposure or spreading disease.
Slide 24	**Minimizing Zoonotic Disease Risks** • Transmitted between animals and humans under natural conditions • Exposure: 5 routes • Elimination of all risks not feasible • Job-appropriate PPE limits, prevents exposure, helps prevent reverse zoonosis (2009 pH1N1)  USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	**Minimizing zoonotic disease risks:** Zoonotic diseases are those transmitted between animals and humans under natural conditions. Human exposure occurs through one of the previously listed five main routes of transmission (aerosol, direct contact, fomite, oral, and vector-borne). The elimination of all risks associated with zoonotic pathogens, especially in the veterinary profession, is not feasible. Wearing job-appropriate personal protective equipment (PPE) is designed to limit or prevent exposure to infectious agents and could include one or more of the following: gowns, coveralls, laboratory coats, gloves, face shield, goggles, masks, and protective footwear. In some cases, PPE can help prevent reverse zoonosis, such as the wearing of masks to prevent aerosol exposure of respiratory disease agents to susceptible animals (e.g., 2009 pandemic H1N1).
Slide 25	**Minimizing Zoonotic Disease Risks (cont'd)** • 2008: National Association of State Public Health Veterinarians (NASPHV) • "Compendium of Veterinary Standard Precautions for Zoonotic Disease Prevention in Veterinary Personnel" – Guidelines for infection control practices – Model Infection Control Plan • Adapt, implement • Updated in 2010 USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	**Minimizing zoonotic disease risks:** In 2008, the National Association of State Public Health Veterinarians (NASPHV) published the "Compendium of Veterinary Standard Precautions for Zoonotic Disease Prevention in Veterinary Personnel." The Compendium of Veterinary Standard Precautions provides guidelines for common sense infection control practices and also included a Model Infection Control Plan for veterinary practices to adapt and implement. The Compendium was updated in 2010.
Slide 26	**Veterinary Standard Precautions** • Raise awareness of scope of zoonotic disease risk in veterinary medicine – Science-based infection control guidance • Gloves, facial protection, protective outerwear – Used whenever exposure to potentially infectious materials may occur  USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	One of the main objectives of the Compendium of **Veterinary Standard Precautions** is to raise awareness of the scope of zoonotic disease risk in veterinary medicine. It addresses infection control issues and provides science-based infection control guidance. The Veterinary Standard Precautions (i.e., use of gloves, facial protection and protective outerwear) are intended to be used whenever exposure to potentially infectious materials, including feces, body fluids, vomitus, exudates, and non-intact skin, may occur. The Compendium of Veterinary Standard Precautions is a free resource and available here: *http://www.nasphv.org/Documents/VeterinaryPrecautions.pdf*

Slide 27	**Personal Protective Equipment (PPE)** **See also: Module 10** • Well, sick, injured, immunocompromised • Unexpected zoonotic disease situations • Infection control measure • Some disease agents can be harbored in human nasal passages  USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	The nature of veterinary practice includes well animal exams on a variety of species as well as treating sick, injured or immunocompromised patients. Zoonotic infectious disease situations may present themselves at the most unexpected time, so wearing some form of barrier protection for certain situations is warranted. Barrier protection, also called **Personal Protective Equipment (PPE)**, includes items worn to protect the skin, mucous membranes, and respiratory system of personnel. PPE is an infection control measure that can protect veterinarians, staff, and clients from zoonotic disease exposure. It can also help reduce transfer of microorganisms from humans (hands, clothing) to susceptible animals and thereby minimize the spread of pathogens in a clinic, between patients, or between livestock premises (biosecurity). Some disease agents (influenza virus, foot-and-mouth disease virus) can be harbored in the nasal passages of humans; to prevent spread to susceptible animals, avoiding contact is recommended until the agents are no longer viable (differs by organism). For a detailed review of PPE, please see *NVAP Module 10: Personal Protective Equipment for Veterinarians*.
Slide 28	**Engineering and Administrative Controls**	While PPE is often thought of as the first level of protection from disease agents or injury, there are other controls that should be put in place whenever possible. These **controls** include **engineering and administrative.**
Slide 29	**Engineering Controls** • Measures that contain/remove hazards, expedite compliance with safety procedures – Hand washing facilities near animal handling areas – Sharps containers placed where needles, scalpels used – Isolation areas for sick animals USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	**Engineering controls** are measures that contain or remove hazards, or expedite compliance with safety procedures. Examples include providing hand washing facilities near animal handling areas, placing sharps containers near areas where needles and scalpels are used, and having isolation areas for sick animals.

Slide 30		**Administrative controls** include designing the work to keep the individual separated from the hazard. An example is to prevent workers without proper training (animal restraint, medication administration) or preventive vaccinations (rabies, tetanus, influenza) from participating in certain situations. Rabies vaccinations are recommended for veterinary personnel. Rabies titers should be assessed every two years and a booster rabies vaccine given when the titer is less than 1:5 per the rapid fluorescent foci inhibition test. Tetanus vaccinations are recommended every 10 years. Influenza vaccines are encouraged for personnel working with poultry, swine, or ferrets to prevent human-to-animal transmission. See the CDC Advisory Committee on Immunization Practices (ACIP) for more information. The Compendium of Veterinary Standard Precautions is an excellent starting point to learn more as well as *NVAP Module 10: PPE for Veterinarians*. Administrative controls also include proper training so that everyone can identify the hazards (disease agent or pending injury) and are aware of safety policies to protect their own health and that of others. Veterinarians should lead by example in promoting safe work habits.
Slide 31		**Hand washing** is the single most important thing you can do to minimize the risk of infectious disease spread. Gloves can help protect hands from becoming contaminated but they are **not** a substitute for hand washing. Hand washing is a Standard Precaution that should always be done before and after all animal examinations and especially after contact with sick animals and contaminated surfaces. Given the nature of veterinary work, easy access to a source of running water, a soap dispenser, and paper towels will enhance hand hygiene which decreases disease exposure. Without access to running water, disposable wipes can be used to remove organic material from hands (it may take several). For a review of diseases caused by viruses and bacteria, see the Virus Family Table and Bacterial Group Review Table resources. *Source: Center for Food Security and Public Health, Iowa State University. Presenter: These handouts can be found at the end of the speaker notes PDF provided. If you printed a hard copy, hold them up for demonstration purposes.*

Slide 32	**Needlestick Injuries** • Frequent in veterinary workplace – Puncture: Skin broken, no injection – Inadvertent injection • Adjuvants, carriers irritating, may require prompt medical attention • Bottle/product insert to expedite treatment, avoid fasciitis or loss of appendage • Adverse effects – Local irritation, systemic reaction, zoonosis • Wash immediately with soap, water USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	Some of the most frequent **injuries** in the veterinary workplace are due to **needlesticks**. These include puncture injuries and inadvertent injection with vaccines, antimicrobials, or anesthetic agents. Puncture injuries occur when the skin is broken with an uncontaminated needle and no injection occurs. Inadvertent injection with vaccine adjuvants or product carriers in medications can be very irritating and depending on the body location of the puncture, may require prompt medical attention. Human medical professionals may not be familiar with the products used in veterinary medicine, so ensure the injured person or first responder takes the bottle or product insert with them. This will expedite the most appropriate treatment to hopefully avoid fasciitis or loss of an appendage. The adverse effects range from local irritation to a serious systemic reaction. If a needlestick injury occurs during venipuncture or fine needle aspiration on an animal, there is risk of direct exposure to zoonotic pathogens. All needlestick injuries should be immediately washed with soap and water.
Slide 33	**Cleaning and Disinfection**	Proper **cleaning and disinfection** is another important infection control step to minimize disease spread. Protocols and chemical selection may vary depending on the needs of the facility. No single disinfectant is adequate for all situations. Consideration of the microorganism being targeted, the specific disinfectant characteristics, and the environmental conditions are important aspects of an effective disinfection protocol. Some disinfectants can be harmful to humans and animals, so safety is always an essential consideration. We will address all of these topics on the next few slides.
Slide 34	**Cleaning** • Cleaning alone can remove over 90% of microorganisms • Should be conducted prior to application of disinfectants • Effective cleaning involves 4 steps: 1. Dry Clean 2. Wash 3. Rinse 4. Dry  USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	**Cleaning** alone can remove over 90% of microorganisms when done properly. Cleaning measures should be conducted prior to the application of all disinfectants. Effective cleaning involves a 4-step process: Dry clean, wash, rinse, and dry and each will be discussed next in more detail.

Slide 35	**Dry Clean and Wash** • Step 1: Dry Clean – Remove manure, bedding, gross debris, organic material • Eliminates most microorganisms – Allows disinfectants to work properly • Step 2: Wash – Soak with water, detergent – Wipe, scrub, spray • Use caution with high pressure spraying – Floor drains, corners special attention USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	Step 1: **Dry clean**. Remove manure, bedding, gross debris, and other organic material. This is a crucial step. When performed correctly, this eliminates a large number of microorganisms present. It also allows disinfectants to work properly, since most disinfectants have reduced effectiveness in the presence of organic material. Step 2: **Wash**. Soak the area with water (hot, if available) and detergent, then wash by wiping, scrubbing, or spraying. Caution should be used with high pressure spraying; this method may further aerosolize microorganisms and contribute to disease spread. Pay special attention to washing floor drains and corners; these areas can serve as reservoirs for pathogens and should be cleaned last and disinfected last.
Slide 36	**Rinse and Dry** • Step 3: Rinse – Rinse areas thoroughly – Disinfectants can be inactivated by residual soaps, detergents • Step 4: Dry – Allow area to dry before applying a disinfectant – Reduce dilution effect USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	Step 3: **Rinse**. Rinse all washed areas thoroughly. Many disinfectants can be inactivated by residual soaps and detergents. Step 4: **Dry**. Allow the area to dry before applying a disinfectant to reduce the dilution effect.
Slide 37	**Cleaning and Disinfection Definitions**	There are many terms used to describe products used for **cleaning and disinfection** (C&D). It is important to understand the benefits and limitations of the types of products to ensure effective products are used. The following slides include some of the more common terms and their **definitions**.
Slide 38	**Detergents** • Disperse, remove soil, organic material • Reduce surface tension, increase penetrating ability of water • Improve disinfectant's ability to reach, destroy microorganisms within/beneath dirt  USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Detergents** are chemical products used to disperse and remove soil and organic material from surfaces by reducing surface tension and increasing the penetrating ability of water. This can improve a disinfectant's ability to reach and destroy microorganisms within or beneath the dirt.

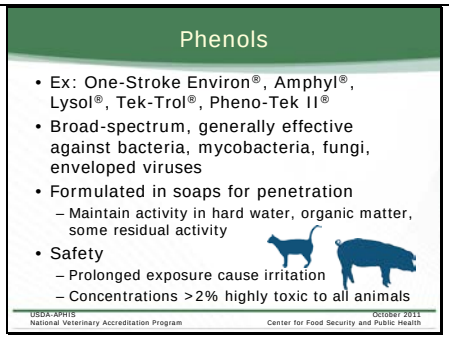
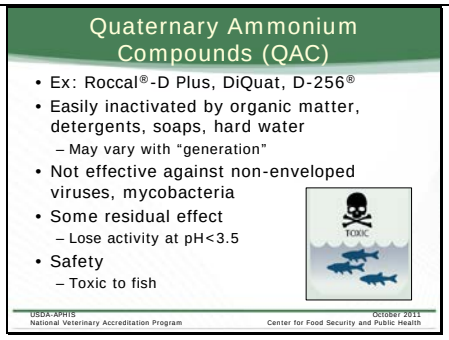
Slide 39	**Soaps, Sanitizers, Antiseptics** • Soaps – Anionic detergents – Made by treating fat with salt (Na, K) – Can be excessively foamy, creating residue • Sanitizers – Reduce bacterial population in inanimate environment by significant numbers – Do **NOT** destroy/eliminate them all • Antiseptics – Kill/inhibit growth of microorganisms on tissue – Regulated as drugs by FDA USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Soaps** are anionic detergents, made by treating a fat with a salt (sodium or potassium). As a cleaning/washing agent, they can become excessively foamy, creating a residue. **Sanitizers** reduce the bacterial population in the inanimate environment by significant numbers but do not destroy or eliminate them all. **Antiseptics** reduce the risk of infection by killing or inhibiting the growth of microorganisms on the tissue. Because these products are used in or on humans or animals, they are considered drugs and are approved and regulated by the U.S. Food and Drug Administration (FDA).
Slide 40	**Disinfectants** • Destroy or eliminate specific species of microorganism on inanimate surfaces – Not usually effective against bacterial spores • Registered as "antimicrobial pesticides" • Regulated by EPA • Some have detergent properties – Quaternary ammonium compounds • Also by physical means – Heat, ultraviolet radiation  USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Disinfectants** are substances used on inanimate surfaces that **destroy or eliminate a specific species** of microorganism, but are not usually effective against bacterial spores. Disinfectants are registered as "antimicrobial pesticides" and regulated by the U.S. Environmental Protection Agency (EPA). Some disinfectants (i.e., quaternary ammonium compounds - QACs) have detergent properties. Disinfection can also be achieved by physical means (e.g., heat, ultraviolet radiation). Graphic: Heat, sunshine, and a bottle of an example disinfectant.
Slide 41	**Sterilants** • Destroy/eliminate all forms of microbial life in inanimate environment – Vegetative bacteria, bacterial spores, fungi, fungal spores, viruses • Also achieved by physical means – Heat, ultraviolet radiation USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Sterilants** are substances that **destroy or eliminate all forms of microbial life** in the inanimate environment, including vegetative bacteria, bacterial spores, fungi, fungal spores, and viruses. Sterilization can also be achieved by physical means (e.g., heat, ultraviolet radiation).
Slide 42	**Selecting an Appropriate Disinfectant** • Begins with identification of target microorganism – Not always possible – Broad-spectrum approach should be utilized • Microorganisms vary in degree of susceptibility • "Antimicrobial Spectrum of Disinfectants" handout shows susceptibility  USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Selection of a disinfectant** begins with the **identification of the target microorganism**. It is easier to select a product or protocol for a single microorganism, although this is not always possible in everyday practice. If the organism has not been identified, or a disinfectant is needed for a wide range of organisms, a broad-spectrum approach should be utilized. Microorganisms vary in their degree of susceptibility to disinfectants. The "Antimicrobial Spectrum of Disinfectants" handout, pictured here, shows the susceptibility of microorganism classes to various chemical disinfectants.

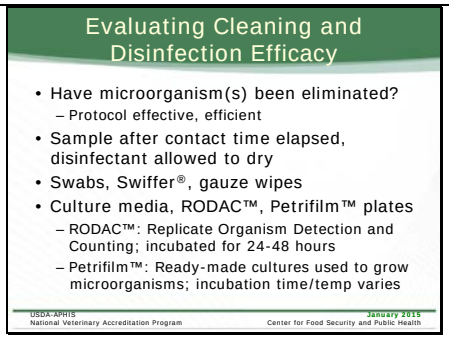
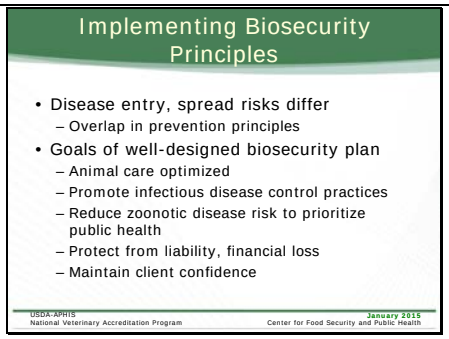
Slide 43	**Disinfectant Product Label** • Microbial spectrum, efficacy, uses, dilution, contact times, safety issues vary • Always read product label before use • Violation of federal law to use product in manner inconsistent with labeling • Sample disinfectant label – Handout  USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	Understanding the information on a **disinfectant product label** is essential for developing an effective disinfection protocol. Factors such as microbial spectrum and efficacy, product uses, proper dilutions, contact times, and safety issues will vary among products. Always **read** the product label before use! It is a violation of federal law to use a product in a manner inconsistent with its labeling. Text from a sample disinfectant product label will be used in this module to demonstrate information provided on a product's label to help in decision making. For a complete review, please consult the Disinfectant Product Label document. *Presenter: This handout can be found at the end of the speaker notes PDF provided. If you printed a hard copy, hold it up for demonstration purposes.*
Slide 44	**Environmental Considerations** • Heavy soiling/organic load – Soil, manure, blood, bedding – Neutralize disinfectants, protect microorganisms from disinfectant contact • Surface topography – Porous, cracked, pitted surfaces (wood, concrete, earthen floors) difficult to disinfect, harbor organisms • Temperature – Best above 68° F (20° C)  USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Environmental** factors must also be **considered** when selecting a proper disinfectant. These include heavy soiling or organic load: Organic material such as soil, manure, blood, or bedding can neutralize many disinfectants and protect microorganisms from contact with disinfectants. Surface topography: Porous, cracked, or pitted surfaces such as wood, rough concrete, or earthen floors are difficult to disinfect and can harbor microorganisms. Temperature: Most disinfectants work best at temperatures above 68°F (20°C).
Slide 45	**Environmental Considerations (cont'd)** • Water hardness – Calcium, magnesium ions inactivate/reduce effectiveness of disinfectants (quaternary ammonium compounds, phenols) • Effect on equipment – Can be highly corrosive, damage equipment • Presence of other chemicals – Other chemicals (soaps, detergents), structural compositions (metals, rubber) affect efficacy • Activity also affected by pH, sunlight (UV radiation), humidity, other factors USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	Other **environmental considerations** include water hardness: The presence of calcium or magnesium ions in "hard" water can inactivate or reduce the effectiveness of certain disinfectants (quaternary ammonium compounds, phenols). Effect on equipment: Some disinfectants can be highly corrosive and will damage equipment. Presence of other chemicals: Interactions with other chemicals (e.g., soaps, detergents) or structural compositions (e.g., metals, rubber) can also affect a disinfectant's efficacy. The activity of some disinfectants is also affected by pH, sunlight (ultraviolet radiation), relative humidity, and other factors.

Slide 46	**Other Disinfectant Considerations** • Application method • Expense – Per gallon of use/dilution, not cost of concentrate • Contact time – Minimum on product label – Affected by organic matter, temperature, pH, water hardness, concentration • EPA registers, approves • Know local/state regulations  USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Other considerations** when selecting a **disinfectant** include application method: Disinfectants can be applied in a variety of ways including wiping, brushing, spraying, misting, soaking, fumigating, etc. Expense: Calculate on a per gallon of use/dilution rather than the cost of concentrate. Contact time: The minimum contact time is normally stated on the product label; however, it is affected by the presence of organic matter, temperature, pH, water hardness, and disinfectant concentration. Government regulations: While the EPA registers products and approves them for use, it is important to be familiar with your local or state regulations for other restrictions. Contact your local or state environmental agency for more information. Factors such as disinfectant concentration, stability and storage, and instructions for use must also be evaluated and understood to ensure safety for the user and efficacy against the organisms of concern. For more information, please refer to the Characteristics of Selected Disinfectants handout. *Presenter: This handout can be found at the end of the speaker notes PDF provided. If you printed a hard copy, hold it up for demonstration purposes.*
Slide 47	**Classification of Chemical Disinfectants**	Next we will define different **classes of chemical disinfectants**. There are 9 different classes that will be reviewed. *Disclaimer: The use of trade names in this material does not in any way signify endorsement of a particular product. They are only provided as examples.*
Slide 48	**Acids** • Ex: Hydrochloric, peracetic, acetic, citric • Defined, limited use as disinfectants • Effective against vegetative bacteria – Hydrogen ion bacteriostatic in pH range 3-6, bactericidal when pH<3 • Bacterial spore efficacy variable, limited, – Often requires high concentrations (2.5% HCl) • Safety – Can be caustic, toxic, cause chemical burns – Minimum: Eye protection, rubber gloves USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Acid** examples: Hydrochloric, peracetic, acetic, citric Acids have a defined but limited use as disinfectants. Acids are generally effective against vegetative bacteria; the hydrogen ion is bacteriostatic in the pH range of 3 to 6 and bactericidal when the pH drops below 3. The efficacy of acids against bacterial spores is variable and limited, and often requires high concentrations such as 2.5% hydrochloric acid solution. Concentrated solutions of acids can be caustic, cause chemical burns, and can be toxic at high concentrations in the air. If acidic disinfectants are used, personnel should, at a minimum, wear eye protection and rubber gloves during mixing, application, and rinsing.

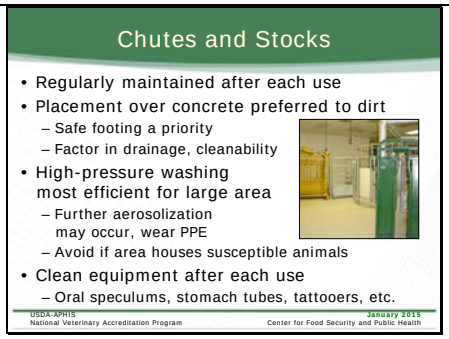
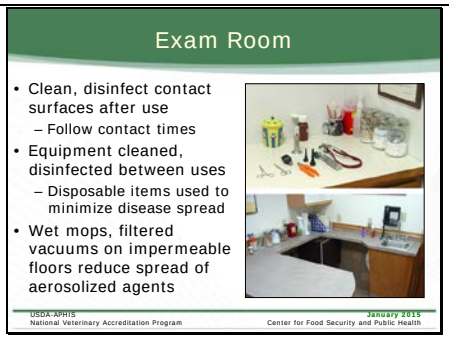
Slide 49	**Alcohols** • Ex: Ethyl, isopropyl • Fast-acting, kill bacteria within 5 minutes – Limited virucidal activity • Water necessary to denature proteins – 60-90% alcohol concentration recommended • Organic matter limits efficacy • Surface disinfection, evaporates rapidly • Safety – Highly flammable – Damage rubber, plastic, irritate skin USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Alcohol** examples: Ethyl, isopropyl Alcohols are considered fast-acting (no residual activity) and capable of killing most bacteria within 5 minutes. They are limited in virucidal activity. The presence of water is necessary for alcohol efficacy to denature proteins. Therefore, concentrations of 60-90% are recommended. The effectiveness of alcohol disinfectants is limited in the presence of organic matter. Alcohols may be used for surface disinfection; however, they evaporate rapidly making extended contact time difficult. Alcohols are highly flammable, can cause damage to rubber and plastic, and can be very irritating to injured skin.
Slide 50	**Aldehydes** • Ex: Formaldehyde, paraformaldehyde, glutaraldehyde – Formalin: 37% formaldehyde in water • Slow-acting, very effective – Optimum efficacy: 70% humidity, 57° F (14° C) • Safety – Safe on metals, rubber, plastic, cement – Highly irritating, toxic to animals – Acutely toxic to humans (potential carcinogen); appropriate PPE at all times USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Aldehyde** examples: Formaldehyde, paraformaldehyde, glutaraldehyde Aldehyde disinfectants are slow-acting but are very effective. They are generally non-corrosive to metals, rubber, plastic and cement. However, they are highly irritating and toxic to animals via contact or inhalation. Efficacy of formaldehyde is dependent on relative humidity and temperature; optimum being humidity close to 70% and a temperature close to 57°F (14°C). Formaldehyde is acutely toxic to humans and has been identified as a potential carcinogen. Appropriate PPE must be worn when using all aldehyde products. Formalin is a 37% solution of formaldehyde in water.
Slide 51	**Alkalis** • Ex: Sodium hydroxide (lye, soda ash), ammonium hydroxide, sodium carbonate • Slow activity – Higher temperature increases activity • Lye disinfects buildings • Safety – Highly caustic, corrosive – PPE essential – **Always** add lye to water, **never** pour water into lye (violent reaction occurs)  USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Alkali** examples: Sodium hydroxide (lye, caustic soda, soda ash), ammonium hydroxide, sodium carbonate Activity is slow but can be increased by raising the temperature of the solution. Alkalis are corrosive agents and PPE is essential when preparing or applying any of these agents. Sodium hydroxide is used to disinfect buildings but is highly caustic and corrosive to metals. Always add lye to water; NEVER pour water into the lye. A very violent reaction will occur, producing heat that can melt plastic containers.
Slide 52	**Biguanides** • Ex: Chlorhexidine, Nolvasan®, Chlorhex®, Virosan®, Hibistat® • Broad antibacterial spectrum – Limited viral efficacy – Not sporicidal, fungicidal mycobacteriocidal • Easily inactivated by soaps, detergents • Safety – Toxic to fish, do not discharge into environment – Skin antiseptic, preoperative skin preparation  USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Biquanide** examples: Chlorhexidine, Nolvasan®, Chlorhex®, Virosan®, Hibistat® Broad antibacterial spectrum, but limited in their effectiveness against viruses and are not sporicidal, mycobacteriocidal, or fungicidal. Function in a limited pH range (5-7) and are easily inactivated by soaps and detergents. Toxic to fish and should not be discharged into the environment. Biguanides are cationic compounds often used as a skin antiseptic and for preoperative skin preparation. *Presenter: This handout can be found at the end of the speaker notes PDF provided. If you printed a hard copy, hold it up for demonstration purposes.*

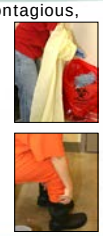
Slide 53	**Halogens** • Ex: Hypochlorites, iodophores – Household bleach, povidone-iodine • Broad-spectrum, often formulated with soaps (relatively safe) • Rapid antimicrobial efficacy – Not affected by water hardness • Sodium hypochlorite (2-500 ppm) active against vegetative bacteria, fungi, viruses • Low cost, easy to use • Iodophores: Inactivated by QACs, organic USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Halogen** examples: Hypochlorites (sodium hypochlorite is household bleach) and iodophores (e.g., povidone-iodine) Broad-spectrum* and often formulated with soaps making them relatively safe. Their antimicrobial efficacy is rapid, and halogens are not affected by water hardness. Sodium hypochlorite at low concentrations (2 to 500 ppm) is active against vegetative bacteria, fungi, and most viruses. Sodium hypochlorite diluted to 5,000-6,000 ppm (1:10 bleach:water ratio) and corrected to pH7 through the addition of acetic acid can be an effective sporicide. They are generally low in cost and relatively easy to use. Halogens are extremely sensitive to organic material, so thorough cleaning must be done prior to application. Iodophores are iodine complexes that have increased solubility and sustained release of iodine. Inactivated by quaternary ammonia compounds (QACs) and organic debris. *Broad-spectrum or general-purpose is a claim of effectiveness against both Gram-positive **and** Gram-negative bacteria. This claim must be supported by efficacy testing against *S. aureus* and *S. choleraesuis.*
Slide 54	**Halogens: Safety** • Lose potency over time, at high temps • **Never** mix with strong acids, ammonia = toxic gas • Highly toxic to aquatic animals – Avoid discharge into waterways • Hypochlorites – High concentrations irritating, damaging to mucous membranes, eyes, skin, footpads • Concentrated iodine – Irritates skin, stain clothes, damage rubber and some metals  USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	Next we will review the **safety** concerns with **halogens**. Halogen products can lose their potency over time or at high temperatures. Halogens, especially chlorine, should NEVER be mixed with strong acids or ammonia as toxic gases (chlorine) can form. They are also highly toxic to aquatic animals, so discharge into watersheds or waterways must be avoided. High concentrations of hypochlorites are irritating to the mucous membranes, eyes, and skin, and can cause damage to the footpads of animals. Concentrated iodine compounds can be irritating to the skin, stain clothes, or damage rubber and some metals.
Slide 55	**Oxidizing Agents** • Ex: Hydrogen peroxide, peracetic acid, Virkon®S, Oxy-Sept® 333 • Broad-spectrum, peroxide-based, relatively safe (diluted) – Concentration 5-20% (home solutions 3%) • Rapid acting, break down quickly • Virkon®S: Efficacy with organic material • Safety – Rinse after appropriate contact time – Irritating, damage clothing USDA-APHIS National Veterinary Accreditation Program · October 2011 Center for Food Security and Public Health	**Oxidizing agent** examples: Hydrogen peroxide, peracetic acid, Virkon® S, Oxy-Sept® 333 Broad-spectrum, peroxide-based compounds and relatively safe in their diluted form. Hydrogen peroxide is rapid acting, however hydrogen peroxide solutions can break down quickly, so fresh solutions should be used. The desired concentration for hydrogen peroxide is (5-20%); home solutions are typically 3%. Virkon® S (potassium peroxymonosulfate and sodium chloride) has some efficacy in the presence of organic material. Rinsing after the appropriate contact time is important before restocking with animals. Concentrated solutions may be irritating and damage clothing.

Slide 56		**Phenol** examples: One-Stroke Environ®, Amphyl®, Lysol®, Tek-Trol®, Pheno-Tek II® The antimicrobial activity depends on the formulation, but phenolics are broad-spectrum and generally effective against many bacteria, mycobacteria, fungi, and enveloped viruses. Their efficacy against non-enveloped viruses is variable, and they have minimal sporicidal activity. Can be coal-tar derivatives or synthetic formulations and usually have a milky or cloudy appearance when added to water, as well as a strong pine odor (e.g., Pine-Sol®). Typically formulated in soap solutions to increase their penetrative powers. Maintain activity in hard water, organic matter, and have some residual activity. Prolonged exposure to the skin may cause irritation. Concentrations over 2% are highly toxic to all animals, especially cats (e.g., systemic toxicosis) and pigs (e.g., dermal contact lesions).
Slide 57		**Quaternary Ammonia Compounds (QAC)** examples: Roccal®-D Plus, DiQuat, D-256® Easily inactivated by organic matter, detergents, soaps, and hard water (this may vary with the "generation"). Not effective against non-enveloped viruses or mycobacteria. Have some residual effect and lose their activity at pH <3.5. Toxic to fish and should not be discharged into water sources.
Slide 58		There are several **safety issues** associated with disinfectants, and the health and safety of humans and animals should always be a primary consideration when selecting a disinfectant. All disinfectants have some level of hazard associated with their use. Some pose a serious threat to human and animal health (e.g., sodium hydroxide, aldehydes, phenolics) if not handled appropriately. Careful attention should always be paid to the warnings and safety statements printed on a product's label. All chemical disinfectants have a Material Safety Data Sheet (MSDS) listing the stability, hazards, and personal protection needed, as well as first aid information. This information must be kept on site and be available to all personnel handling disinfectants. A 3-ring binder containing this information in one easily accessible location is recommended.

Slide 59		To **evaluate cleaning and disinfection efficacy,** it is important to determine if the disease microorganism(s) has been eliminated, and also if the protocol used was effective and efficient. The best time to sample is immediately after the disinfectant contact time has elapsed or after the disinfectant has dried. Bacteriological samples may be obtained via moistened sterile swabs, Swiffer®, or gauze wipes. The samples can then be submitted for culture using various types of media. RODAC™ or Petrifilm™ plates may also be used. This is especially important while controlling an outbreak or a hard to eliminate organism in a clinic, animal shelter, or on a livestock operation. RODAC™ stands for Replicate Organism Detection And Counting and are commercial plates used to sample the environment for organisms after a cleaning and disinfecting procedure has been implemented. The RODAC™ plate is incubated for 24-48 hours and the number of colonies are counted to determine organism presence in the area. Petrifilm: Petrifilm™ are ready made culture mediums used to grow microorganisms as a test to see how well the cleaning and disinfection procedure was implemented. Time and temperature of incubation varies with the plates and organisms being tested.
Slide 60		**Implementing biosecurity principles:** Disease entry and spread risks to veterinary facilities, animal shelters, and livestock facilities differ in scope, but overlap exists in the prevention principles that can be applied. The goals of a well-designed biosecurity plan include creating an environment where animal care is optimized by reducing the threat of infectious and nosocomial disease, promoting infectious disease control practices among staff members, clients, reducing the risk of zoonotic disease exposure and prioritizing public health among staff and clients, protecting the facility from liability and financial loss, and maintaining client confidence in disease prevention.
Slide 61		Next we will address key **biosecurity** topics for **veterinary clinics** as well as ambulatory and mobile practices.

Slide 62	**Veterinary Clinic Biosecurity** • Assessment of potential risk areas within individual facility – Characterize exposure sources, areas needing improvement • Waiting room, holding facilities, exam rooms, treatment, surgery, isolation, inpatient, boarding • Tailored biosecurity protocols  USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	**Biosecurity** protocols customized for an individual **veterinary clinic** should specifically address potential risk areas within that facility. An assessment of each area within the clinic will help to evaluate and characterize potential sources of exposure and areas needing improvement. Given the breadth of the audience, a mixed animal practice that provides services to small and large animals will be discussed. The areas to be reviewed include waiting room or patient receiving, holding facilities, livestock chutes and stocks, exam rooms, treatment and surgical preparation areas, isolation areas, inpatient facilities, and boarding/shelters. Biosecurity protocols should be tailored for each area to minimize infectious disease transmission. These areas and some potential risks involved with each are discussed next.
Slide 63	**Waiting Room/Receiving Area** • Clean, well ventilated, avoid crowding • Easy to clean and disinfect • Leashes, kennels • Timely cleanup, disinfection – Feces, urine, vomitus • Ill animals immediately escorted to exam room – In vehicle (weather permitting) • Schedule appointments to avoid buildup of patients  USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	The **waiting room/small animal receiving area** should be clean, well ventilated, and large enough to avoid crowding of clients and patients. Walls, furnishings, and flooring (fomites) should be impervious and easy to clean and disinfect. Animals should be required to be on leashes or in kennels to prevent direct contact with other patients in the waiting area. Pathogens, such as parvovirus and leptospirosis, will expose other animals via the oral route with ineffective or untimely cleanup of feces, urine, or vomitus, or inadequate disinfection. Additionally, to prevent disease transmission by any route, animals appearing ill upon arrival should be immediately escorted to an exam room. If this is not possible, the client should keep the animal in their vehicle (weather permitting) until one becomes available. A buildup of patients in the waiting room may increase the potential for direct contact transmission. Appointments should be scheduled so that the capacity of the waiting room is not exceeded, thereby minimizing the potential for spread of infectious disease.
Slide 64	**Holding Facilities** • Promptly isolate diarrhea cases • House respiratory cases away from susceptible animals • Limit housing multiple animals with varying disease signs • Non-porous contact surfaces • Pens cleaned, washed, rinsed, disinfected, allowed to dry between different clients' animals  USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	**Holding facilities** used for large animals brought to a veterinary clinic need to be designed and maintained to reduce the risk of disease transmission. Prompt isolation of patients presenting with diarrhea will help control the spread of pathogens found in feces (reduce risk of oral exposure). Animals exhibiting respiratory signs should be housed so that they are not sharing air space with other susceptible animals. This may be outside, away from others, or in an isolation pen with its own ventilation (reduce risk of aerosol exposure). Ideally, to decrease the risk of a variety of disease exposures, limit situations that lead to housing multiple animals with varying disease signs. Contact surfaces should be non-porous and in good repair to allow thorough cleaning. Wood panels should be coated with a wood sealer to allow easy scrubbing and cleaning between patients. Pens should be cleaned, washed, rinsed, disinfected, and allowed to dry between different client's animals as a way to manage fomites.

Slide 65		**Chutes or stocks** used for large animal patients should be regularly maintained (rust areas sealed) to allow for more effective cleaning and disinfection after each use to prevent the fomite/oral transmission of organisms found in feces such as *Mycobacterium avium* ss. *paratuberculosis* (Johne's disease) or *Salmonella*. Placement over concrete flooring is preferred to dirt since the area can be washed down and disinfected. Safe footing must also be a priority – slippery concrete is a concern if the surface is not adequately grooved or covered with non-slip and porous matting. Non-concrete flooring should factor in drainage and cleanability. The stocks and surrounding area should be stripped of soiled bedding and all organic matter should be removed by soaking, then scrubbing with a brush and detergent. After cleaning, the area should be rinsed, dried, and then disinfected (allowing the appropriate contact time as per the label instructions). High-pressure washing can be the most efficient means to clean a large area. However, further aerosolization of infectious agents may occur and should be avoided if susceptible animals are housed nearby or PPE is unavailable for personnel. Oral speculums, stomach tubes, tattoo and dehorning equipment, grooming supplies, balling guns, endoscopes, ultrasound probes and thermometers should be cleaned after each use to remove all organic material and then disinfected. Consider surface type and material composition when selecting a disinfectant so as not to damage the equipment.
Slide 66		**Exam room** surfaces that directly contact patients should be cleaned and disinfected after each use. Follow the recommended contact times for disinfectants used on surfaces. Too often surfaces are sprayed with the disinfectant in one hand and wiped with the other, not allowing for proper contact time. For patients with an infectious disease, this could lead to exposure of subsequent animals or staff if the pathogen is zoonotic. Equipment such as thermometers, otoscopes, and flea combs used in the exam room should be cleaned and disinfected between uses (reduce risk of fomite exposure). Disposable items can be used to minimize animal-to-animal disease spread if used once and properly disposed (reduce risk of fomite/direct exposure). The use of wet mops or filtered vacuums on impermeable floor coverings can help to reduce the spread of aerosolized agents. Ventilation systems with air inlets near the ceiling and air outlets closer to the floor are best for air flow since fresh air will travel down toward the more heavily contaminated floor region.

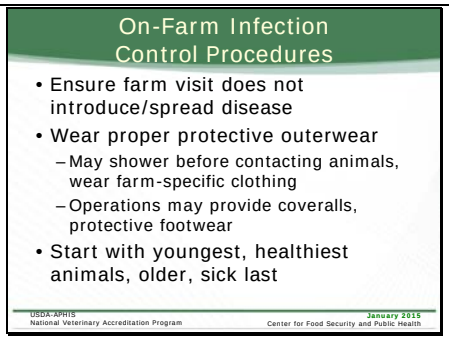
Slide 67	**Exam Room (cont'd)** • Running water, soap dispensers, towels • All people with animal contact – Wash hands between patients • Proper way = signage • Hand sanitizers (60-90% alcohol) after hand washing – Sanitizers do not remove organic material, **not** a substitute for hand washing  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	Each **exam room** should be outfitted with a sink with warm running water, soap dispensers and towels. All people having animal contact should be encouraged to wash their hands thoroughly between patients. There is a proper way to wash hands and a sign is provided as a resource that can be posted near sinks. Hand sanitizers (60-90% alcohol-based) can be used after washing hands if desired. Hand sanitizers do not remove organic material and are not a substitute for hand washing.
Slide 68	**Surgery Room** • Separate, closed, single-purpose room – Aseptic surgical procedures, low traffic area • Uncluttered • Impervious surfaces • Disposable booties, caps, surgical mask, sterile gowns, surgical gloves • Positive pressure ventilation – Controlled, filtered air supply • Separate mops, buckets, cleaning supplies  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	The **surgery room** should be a separate, closed, single-purpose room dedicated to performing aseptic surgical procedures. The area should be uncluttered to minimize environmental contamination. Surfaces should be impervious so they can be thoroughly cleaned and disinfected. This should be a low traffic area, restricted to only the patient, necessary technicians or assistants, and surgeons. Proper attire including disposable booties, caps, surgical mask, sterile gowns, and surgical gloves is recommended to prevent fomite contamination of the patient from clothes and hands. Positive pressure ventilation providing a controlled and filtered air supply will ensure that contaminated air is not drawn in from nearby rooms. The use of separate wet mops, buckets, and cleaning supplies dedicated to the surgical suite can reduce the risk of infectious disease spread from other areas of the clinic (reduce risk of fomite exposure).
Slide 69	**Isolation Area** • Suspect/confirmed infectious, contagious, communicable disease • Essential personnel, flow from "clean" to "dirty" • Running water, soap • Barrier protection, kept in isolation – No items leave without proper cleaning, disinfection or in sealed bags for disposal • Separate airspaces  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	An **isolation area** should be used for animals suspected of having, or already diagnosed with an infectious, contagious, or communicable disease. Foot traffic within the isolation area should be restricted to essential personnel and should flow from "clean" to "dirty" areas. Always provide running water (warm if possible, as it increases compliance) and soap for hand washing. Barrier protection (dedicated gowns, coveralls, or laboratory coats) should be provided and kept in isolation until removed in a sealed bag and immediately laundered. Protective footwear – disposable booties for small animals and disposable or rubber boots for large animals – should also be disposed of or kept in isolation. No items should leave the isolation area without proper cleaning and disinfection, or in sealed bags destined for proper disposal. Separate airspaces are recommended for isolation wards or rooms.

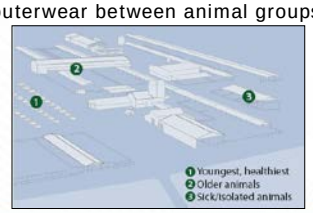
Slide 70	**Isolation Area (cont'd)** • If only single airspace exists: – Limit new patient admissions to isolation – Isolate patient to one end of barn/kennel room near air outlet, empty stalls/ cages around it – Clearly mark area/kennel – Respiratory cases in separate room, prevent recirculation of air with other areas  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	If only a single airspace exists, limit new patient admissions to **isolation,** isolate the animal to one end of the barn or kennel room near the air outlet, and if possible, with empty stalls/cages around it, clearly mark the area or kennel with signage so all personnel recognize this animal is contagious and must be handled appropriately (reduce risk of fomite exposure), and keep respiratory cases in a separate room and prevent recirculation of air with the other areas of the clinic (reduce risk of aerosol exposure).
Slide 71	**Inpatient Facilities** • Clean and Disinfect between patients – Food/water bowls, litter boxes – Equipment – Grooming tools – Instruments – Halters – Waterers/feeders • Clearly written instructions (SOP) for staff  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	**Inpatient facilities:** Small animal kennels should be designed to prevent direct contact between patients and should be easy to clean and disinfect between animal uses to minimize the risk of fomite/oral/direct contact exposure. Food/water bowls and litter boxes should be cleaned and disinfected between animal uses as well (reduce risk of fomite, oral exposure). **Large animal inpatient facilities and equipment**, including grooming tools, instruments, halters, waterers, and feeders, should be thoroughly cleaned and disinfected between patients to minimize the risk of fomite/oral/direct contact exposure. All contaminated bedding from pens/stalls should be removed prior to cleaning (reduce risk of fomite/direct contact/oral exposure). Clearly written instructions (standard operating procedures or SOP) that detail proper cleaning and disinfection steps for inpatient facilities should be provided for staff. Sinks with warm running water and soap for visibly soiled hands should be conveniently located for staff to use before and after patient contact. Hand sanitizers (60-90% alcohol-based) can be used after washing hands if desired but again, they do not remove organic material and are not a substitute for hand washing. Other considerations for inpatient facilities include proper ventilation and vector control to minimize disease transmission.
Slide 72	**Small Animal Boarding/ Animal Shelters** • Adequate ventilation, increase distance of separation – Minimize odors, drafts, ammonia levels, moisture condensation • Cooling when temperature >85˚ F (29.5˚ C)  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	In **small animal boarding facilities** or **animal shelters,** aerosol transmission of infectious agents in a susceptible population is dependent on temperature, relative humidity, ventilation, and animal density. Reducing disease transmission requires providing adequate ventilation systems and increasing the distance of separation between infectious and susceptible animals. Ventilation for dogs and cats should be aimed at minimizing odors, drafts, ammonia levels and moisture condensation. Fans, blowers or air conditioning should be provided when the temperature exceeds 85°F (29.5°C). When the areas are cleaned, the humidity levels often skyrocket. While veterinary clinics and animal shelters are not regulated under the Animal Welfare Act, its regulations provide benchmarks that have the animal's health and well-being at the forefront. Cage design will affect air distribution. Solid side walls, floors and roofs with gated fronts leave only one area for intake and exhaust of air per cage. Work with a heating and cooling expert that can advise on site specific and energy conscious air exchange rates.

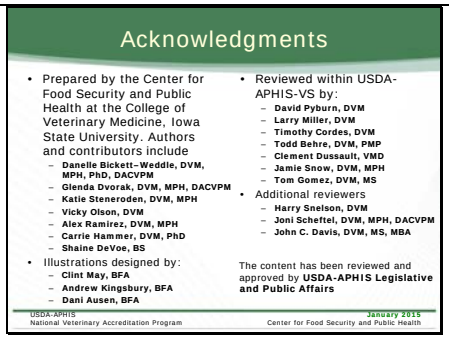
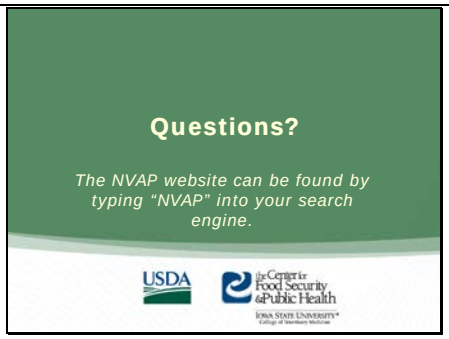
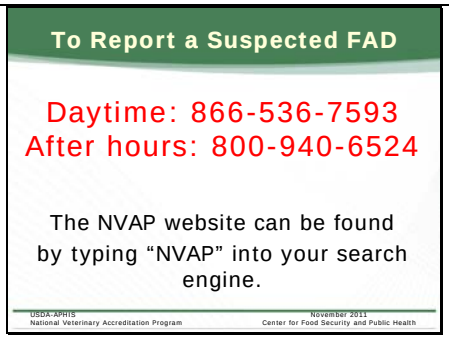
Slide 73	**Vector Control** • Implement insect, pest control measures when necessary – One fly: 6,000 *Salmonella* organisms • Fly strips, timed pesticide misters approved for food producing animals – Fly, mosquito, tick  USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	Insect and pest (**vector**) **control** measures should be implemented when necessary. Each fly, for example, acting as a mechanical vector can carry 6,000 *Salmonella* organisms at one time. Fly strips or timed pesticide misters with products that are labeled for use in food producing animals may be helpful for clinic fly control. See the Fly Control Measures document provided for more details (pictured here). Mosquitoes and ticks also spread disease to animals and control measures are provided in the handouts.
Slide 74	**Rodent and Bird Control** • Eliminate entry points • Remove potential hiding/nesting spaces • Eliminate food sources – Proper garbage disposal • Trap & bait rodents  USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	**Rodents and birds** should also be **controlled** as they can introduce and spread infectious disease. Focus on eliminating openings for entry, removing potential hiding or nesting spaces, eliminating food sources (sealed containers for pet food, livestock feed), and proper disposal of garbage. Trapping and baiting are both options to control rodents that have entered facilities. More details are provided in the Bird and Rodent Control Measures documents. *Presenter: These handouts can be found at the end of the speaker notes PDF provided. If you printed a hard copy, hold them up for demonstration purposes.*
Slide 75	**Outdoor Areas** • Become contaminated with feces, urine • Impervious surfaces (concrete) easier to clean, disinfect – Not always possible • Feces removed in timely manner, area disinfected – Wear appropriate PPE • Drying, heat, sunlight – Viruses survive cold temps  USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	**Outdoor** exercise and elimination **areas** for dogs can quickly become contaminated with feces and urine if not maintained appropriately. Impervious contact surfaces, such as concrete, are easier to clean and disinfect, but are not always possible in clinical practice. In any case, all feces should be removed in a timely manner and the area disinfected if possible. Personnel cleaning these areas should wear appropriate PPE, gloves at a minimum. Physical disinfection, such as drying, heat and sunlight are natural disinfectants which can be used for pens, paddocks, and exercise areas with dirt floors and full sun exposure. Although many bacteria are killed by exposure to cold temperatures, freezing is not a reliable method of disinfection or sterilization; viruses tend to survive better at colder temperatures.

Slide 76	**Ambulatory and Mobile Clinic Biosecurity** • Special biosecurity circumstances – Fomite transmission – External, internal vehicle contamination • Avoid driving through animal waste – Organic material can pack tires, wheel wells and can be carried long distances • Park in clean area, use client's vehicle  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	**Ambulatory and Mobile Clinic Biosecurity:** It is imperative that veterinarians who travel to a client's livestock operation or home consider the special circumstances surrounding biosecurity in these situations. Fomite transmission is one of the principle concerns for the mobile veterinarian. This involves not only external contamination of a vehicle but also potential contamination of the internal compartment from clothing, equipment, etc. Whether you drive a car, van, sport utility vehicle, truck, or a custom designed mobile clinic, specific biosecurity protocols should be adhered to in order to prevent infectious disease spread. External cleanliness of the vehicle is important. Vehicles can serve as fomites, transmitting infectious organisms from one place to another. Avoid driving through areas contaminated with animal waste. This is considered an engineering control (avoiding the hazard) on livestock operations. Organic material and manure can pack the tires and wheel wells of a vehicle and be carried long distances. An alternative is to park your vehicle in a clean area and take all necessary equipment with you, or use a client's vehicle that remains on the premises.
Slide 77	**Vehicle – External** • If driving through animal waste areas is necessary and farm has known/suspect fecal-shed disease – Clean (water, detergent) tires, wheel wells, undercarriage – Rinse, apply disinfectant; allow to dry – Avoid contaminating environment, waterways – If on-farm C&D not feasible, go directly to car wash facility – IMPERATIVE in foreign animal disease outbreak  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	It is important to ensure that the **external** parts of a **vehicle** are clean. If driving through animal waste areas is necessary and the farm has a known or suspect fecal-shed infectious disease, the best management practice would be to clean (water and detergent) your tires, wheel wells, and vehicle undercarriage to remove all organic debris. Follow with a rinse then apply disinfectant to the tire contact surface and wheel wells and allow it to dry for best efficacy. Manage the run off so as not to contaminate the environment or waterways. If on-farm cleaning and disinfection (C&D) is not feasible, go directly to a car wash facility before traveling to other livestock operations. Although these steps may not always be convenient, in a foreign animal disease outbreak, each step would be imperative to limit disease spread.
Slide 78	**Vehicle – Internal** • Cleanliness, organization reduce risk of disease transmission, spread • Coveralls, gloves, boots, equipment: Direct contact with animals – Storage important • Clean/dirty areas minimize cross-contamination  USDA-APHIS National Veterinary Accreditation Program · January 2015 Center for Food Security and Public Health	The **internal cleanliness** and organization of **vehicle** compartments are very important in reducing the risk of disease transmission and spread. Items such as coveralls, gloves, boots, and equipment will likely have direct contact with animals; their storage location is important. If designated clean and dirty areas exist in the vehicle, cross-contamination can be minimized. Establishing a clean and dirty area in the vehicle is essential to prevent disease transmission. This could be as simple as using the passenger seat for all "clean" items and the rest of the vehicle as "dirty".

Slide 79	**Vehicle – Internal (cont'd)** • Sealable plastic totes to establish "areas" – Protects clean contents from getting dirty – Holds dirty items, contaminated clothing, trash in one location • Similar containers for shoe, boot covers – Clean with soap, water – Soak in disinfectant for appropriate contact time between calls  USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	In order to maintain **internal cleanliness** of a **vehicle**, an inexpensive option to minimize infectious disease spread in a vehicle involves the use of sealable plastic totes to establish "areas". Sealable plastic totes come in multiple shapes and sizes and make excellent storage for clean and dirty items. Other advantages include easy to clean exterior; provides clean storage for coveralls, scrubs, gloves, palpation sleeves, etc.; tight seal protects contents inside from getting dirty; can be secured on the floor, back seat or in the trunk; contain dirty items, contaminated clothing or trash in one location; and easy to "clean up" at the end of a day. Removal of the dirty container and its contents reduces the risk of mixing dirty with clean items. Similar containers can be used for shoe or boot covers as the photo depicts. Once cleaned with soap and water, protective footwear should soak in a disinfectant for an appropriate contact time (follow label directions for best efficacy). With plastic sealable containers, it is easier to make sure this happens between farm calls. Simply leave footwear in the disinfectant as you drive to the next call. The solution will not spill and footwear will no longer be a potential fomite.
Slide 80	**Equipment** • When cleaned properly, poses minimal risk • Certain equipment more difficult to clean, disinfect – Ultrasound equipment, rope halters, obstetrical chains • Multiple-use items cleaned, disinfected between uses • Single-use gloves, needles, syringes, scalpels • Leave all garbage at origin – Sharps in sharps container  USDA-APHIS National Veterinary Accreditation Program January 2015 Center for Food Security and Public Health	**Equipment** used on clients' animals, when cleaned appropriately, poses minimal risk of infectious disease spread. Certain equipment may be more difficult to clean and disinfect due to the type of material it is made out of or how it is constructed (ultrasound equipment, rope halters, obstetrical chains). Multiple use items, such as surgical instruments, halters, or muzzles, should be properly cleaned and disinfected prior to use at another facility. This is essential to minimize the risk of disease spread. Disposable equipment, such as gloves, needles, syringes, and some scalpels are intended to be single-use to minimize animal-to-animal disease spread. A good disease control practice is to leave all garbage generated on a call at the source, allowing pathogens to remain where they originated. All sharps should be placed in a sharps container and properly disposed of.

Slide 81		**Equipment: Clean immediately after use.** Once a procedure is complete, washable items should be cleaned immediately since body fluids and organic matter are more difficult to remove once they have dried. If complete cleaning is not an option, rinse with water or soak, to prevent the fluids from drying and adhering, such as the castrator and dehorner soaking in the bucket of appropriate disinfectant in the photo on the right. **Disinfect or sanitize once organic matter is removed.** An appropriate disinfectant should be selected and used after the equipment has been cleaned. In some situations and for some equipment, a sanitizer should be used. Multi-dose syringes used for vaccine or antibiotic administration require special handling. Soaps and disinfectants can bind to the internal surfaces and inactivate modified-live virus (MLV) vaccines. Please refer to the document, Care of Veterinary Vaccine Syringes produced by the University of Nebraska, Lincoln for specific cleaning guidance. *http://www.ianrpubs.unl.edu/epublic/archive/g1443/build/g1443.pdf* **Store equipment in a clean area of the vehicle.** This will prevent contamination prior to the next use. **Examine equipment before use.** Due to the nature of mobile practice, items can become contaminated between uses. Thoroughly examine equipment for contamination before use. If equipment is dirty, don't use it until it has been cleaned and disinfected.
Slide 82		Implement **on-farm infection control procedures** to ensure the farm visit does not introduce or spread disease through your actions. This begins by wearing the proper protective outerwear as a barrier to contamination of street clothes. Some operations may require showering before contacting the animals and wearing farm-specific clothing. Other operations may provide coveralls and protective footwear to wear while working with the animals. For farms that do not provide either, wearing clean outerwear/coveralls and footwear on each operation can prevent disease introduction. As an effort to minimize disease spread on farm, examine sick animals last if possible. Start with the youngest, healthiest animals, working your way to the older animals, handling the sick or isolated animals last. If this is unavoidable, take time to clean and disinfect protective footwear or change into disposable boots when entering healthy or young animal facilities.

Slide 83	**On-Farm Infection Control Procedures (cont'd)** • Wash hands, change contaminated outerwear between animal groups  USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	**On-Farm Infection Control Procedures:** Washing hands and changing out of contaminated outerwear should also occur between animal groups to prevent fomite exposure.
Slide 84	**Summary** • Educate owners about risk of disease spread • Prevent serving as a fomite/contributing to environment of disease spread – Numerous resources to assist • Accredited veterinarians – Part of animals', herds', flocks' health management team – Implement biosecurity, infection control – Expertise, knowledge make you the best professional to rely on for information USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	In **summary,** as accredited veterinarians examining animals in a clinic, animal shelter, or on a livestock operation, the opportunity exists to educate animal owners about the risk of disease spread, and take actions that prevent serving as a fomite or contributing to an environment that allows for disease spread. There are numerous resources to assist in this task as reviewed in this module. Clients turn to accredited veterinarians as part of their animals', herds' or flocks' health management team. Implementing biosecurity and infection control measures to limit disease transmission, either between animals, from animals to humans, or from humans to animals, is an important responsibility of veterinarians. Accredited veterinarians' expertise in microbiology, virology, parasitology, epidemiology, public health, and knowledge of disease control prevention practices aimed at personal protection, cleaning and disinfection, and biosecurity principles makes them the best professional for clients to rely on for information.
Slide 85	**Supplemental Training** • This informational presentation has been approved expressly to serve as one unit of supplemental training for participants in USDA's NVAP • Please ensure you complete, sign and retain a certificate stating that you attended this presentation • Contact your Assistant District Director for more details USDA-APHIS National Veterinary Accreditation Program — January 2015 Center for Food Security and Public Health	*Presenters: Make sure your audience members know about obtaining credit for their attendance.* This informational presentation has been approved expressly to serve as one unit of **supplemental training** for participants in USDA's National Veterinary Accreditation Program. Please ensure you complete, sign and retain a certificate stating that you attended this presentation. Contact your ADD for more details on renewing your accreditation.

Slide 86		This module was made possible, in part, by a Cooperative Agreement from the USDA-APHIS for the National Veterinary Accreditation Program. It was prepared by the Center for Food Security and Public Health, College of Veterinary Medicine at Iowa State University. Authors and contributors include Danelle Bickett-Weddle, DVM, MPH, PhD, DACVPM; Glenda Dvorak, DVM, MS, MPH, DACVPM; Katie Steneroden, DVM, MPH; Vicky Olson, DVM; Alex Ramirez, DVM, MPH; Carrie Hammer, DVM, PhD; and Shaine DeVoe, BS. The illustrations in this presentation were designed by Clint May, BFA, Andrew Kingsbury, BFA, and Dani Ausen, BFA. The content was reviewed within USDA-APHIS-VS by David Pyburn, DVM; Larry Miller, DVM; Timothy Cordes, DVM; Todd Behre, DVM, PMP; Clement Dussault, VMD; Jamie Snow, DVM, MS; and Tom Gomez, DVM, MS. The content has been reviewed and approved by USDA-APHIS Legislative and Public Affairs.
Slide 87		Thank you for your time. I would be glad to answer any questions as time allows. The NVAP website can be found by typing "NVAP" into your search engine.
Slide 88		These numbers are available on the NVAP website. We recommend you copy these numbers and put them on your phone for quick reference. Offer to answer any questions while this slide remains visible.