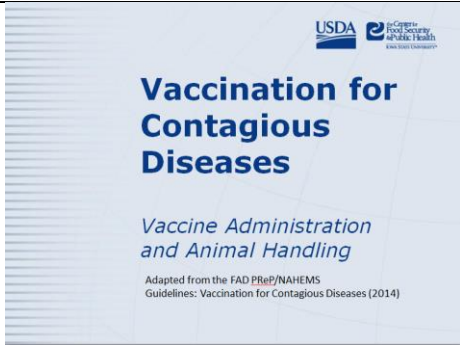
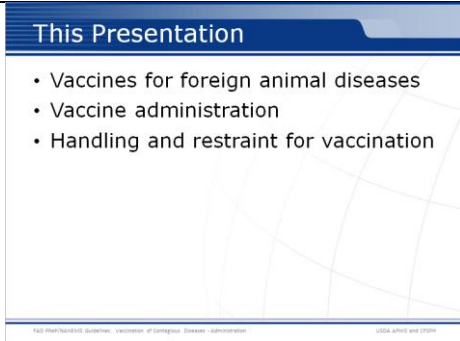


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The control of a foreign animal disease outbreak may require large-scale vaccination of livestock and other domestic animals to minimize the impact on animal and public health, ensure continuity of the U.S. food supply, and minimize the economic impact on food producers. The principles discussed in this presentation are intended to provide general information to conduct large-scale vaccination of a variety of domestic animal species as may be required in an animal health emergency. Decisions regarding the choice of vaccine and the selection of animals to vaccinate will vary with the disease involved, species affected and the stage of the outbreak, and may change as the situation evolves. As always, it is important to evaluate each situation and adjust procedures to the risks present in the situation. [This information was derived from the Foreign Animal Disease Preparedness and Response (FAD PRéP)/National Animal Health Emergency Management System (NAHEMS) Guidelines: Vaccination of Contagious Diseases (2014)].

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This presentation will provide information implementing an effective and safe emergency vaccination program, including:

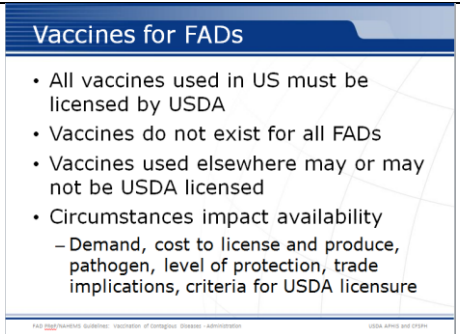
- Information concerning the availability of vaccines for foreign animal diseases
- Guidance on vaccine administration in different species
- Species-specific methods of handling and restraint for vaccination

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USDA APHIS has identified key terrestrial FAD threats that if introduced to the United States, or its Territories, may pose a severe threat to animal health and, in some cases, the economy and/or human health. These FADs may infect one or more species of animals. Some of the vectors that transmit FADs are found in the United States, while others are foreign to the United States. Examples of these diseases include highly pathogenic avian influenza, foot-and-mouth disease, and classical swine fever. Vaccines can be an important tool in an emergency response effort if a suitable vaccine is available and can be administered in a timely manner. Vaccination is intended to increase the disease resistance of susceptible animals to the disease, reducing the shedding of the FAD agent in infected or exposed animals, or both. A full listing of Key Terrestrial FAD Threats to the United States can be found in APHIS Foreign Animal Disease Framework: Response Strategies (FAD PRéP Manual 2-0) (<http://www.aphis.usda.gov/fadprep>).

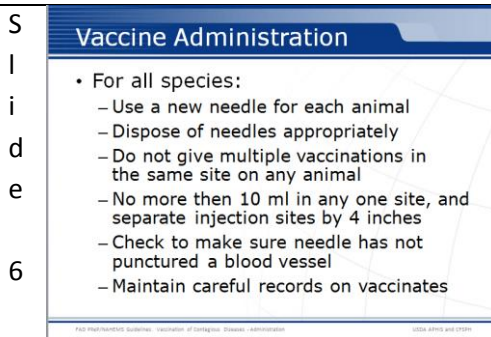
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Many vaccines are manufactured in the United States; all vaccines used in the United States must be licensed by USDA. However, vaccines do not exist for all animal diseases that are foreign to the United States. There are some vaccines for FADs that are used in other countries to control endemic situations, but they may or may not be licensed for use in the United States. Circumstances that broadly impact the availability of these vaccines in the United States include market demand, the manufacturer's cost to achieve licensing by USDA and produce the vaccine, the pathogen, the specificity of the vaccine to protect against a potential disease threat, trade implications should animals be vaccinated, and ultimately meeting the USDA criteria for the license. Also, to be produced in the United States, the level of laboratory biosecurity and containment necessary for development and manufacturing may be elevated; the use of biosecure laboratories may be economically cost prohibitive depending on the demand for the vaccine. The Compendium of Veterinary Vaccines for Transboundary Diseases is intended to be an international web-based resource on the availability of vaccines for transboundary diseases (<http://apps.cfsph.iastate.edu/Vaccines/index.php>).

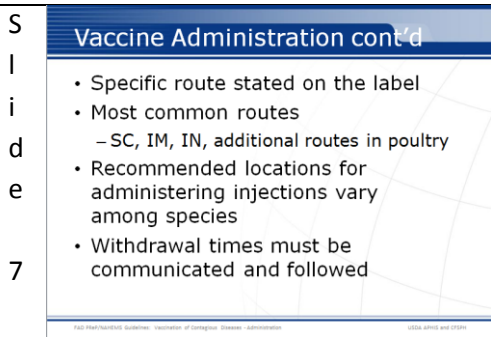


In a foreign animal disease outbreak that requires vaccination, decisions regarding which vaccines to use and which animals to vaccinate will vary with the disease involved, species affected, and stage of the outbreak, and may change based on evolving information about the situation. USDA licensed vaccines are not available for every foreign animal disease, however with science and technology, additional vaccines are being developed. It is important to use proper technique, route of administration, and the appropriate injection site when administering any vaccines. Ensure the animal is properly restrained to allow successful administration and to reduce the potential for causing injury to the animals and the responders.

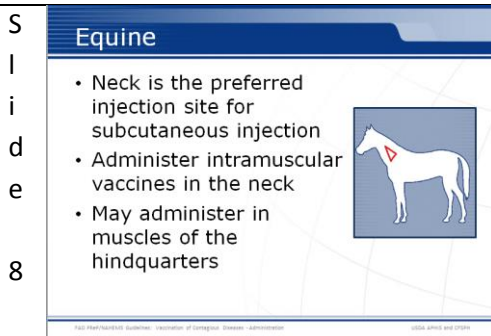


During administration of vaccines in all species, remember the following:

- A new needle should be used for injecting each animal when there is concern about spreading diseases between animals;
- Ensure all needles are accounted for before and after administration. Properly dispose of all used needles in a puncture-proof container.
- If giving multiple vaccinations to one animal, do not give them in the same site;
- Do not administer more than 10mL in any one site, and separate injection sites by at least four inches;
- To ensure that the needle has not inadvertently punctured a blood vessel, draw back the plunger of the syringe to see if any blood appears in the hub of the needle. If blood does appear, simply withdraw the needle, replace it, and try again.
- Maintain careful records to identify each and every vaccinated animal.



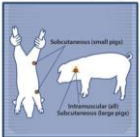
Vaccines licensed for use in the United States are approved for administration by a specific route stated on the label. The most common routes of administration of vaccines are subcutaneous injection (SC), intramuscular injection (IM), and intranasal administration (IN). The SC route injects the vaccine under a loose area of skin on the animal. The IM route injects the vaccine deep into a muscle. The IN route administers the vaccine onto the mucous membranes of the nasal cavity. Vaccination of poultry may also use oral, spray (or nebulization), eye drop, cutaneous scarification, and in ovo injection routes. Recommended locations for administering injections vary among species. Withdrawal time, the number of days from the time a vaccine is administered until the animal or its products such as milk may enter the food chain, must be communicated and followed. In an emergency situation, instructions will be provided by Incident Command on which vaccines to administer, which population of animals are to be vaccinated, which route of administration is appropriate, and recommended withdrawal times (if applicable).



Recommended locations for administering injections vary among species. In the horse and other equines, the neck is the preferred injection site for subcutaneous injection of vaccines because of the relatively loose skin in this area. Most intramuscular vaccines in the equine are also administered in the neck. Insert the needle at a 90 degree angle into the triangle area indicated in the diagram, ensure the needle has not entered a blood vessel, and inject the vaccine dose. In some cases, intramuscular injections may be given in the large muscles in the hindquarters of this species. [This illustration shows the injection location on a horse. Illustration by: Andrew Kingsbury, Iowa State University]

**Swine**

- Small pigs
  - Subcutaneous injections: loose flaps of flank skin or behind the elbow
- Large pigs
  - Subcutaneous injections in the neck, just behind and below the ear
- Intramuscular injections: in the neck just behind and below the ear

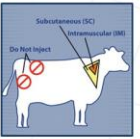


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In small pigs, subcutaneous injections of vaccines should be given in the loose flaps of flank skin of the rear leg or below the elbow. In larger pigs, subcutaneous injections can be administered in the neck behind and below the ear and in front of the shoulder. Slide the needle under the skin and away from the site of skin puncture before depositing the vaccination. Intramuscular injections in all pigs should be given in the neck just behind and below the ear and in front of the shoulder similar to the subcutaneous injection site in large pigs. [This illustration shows the injection locations on a pig. Illustration by: Dani Ausen, Iowa State University]

**Cattle**

- Subcutaneous or intramuscular injections
  - In triangular region of the neck
- Do not inject the upper rump or upper butt

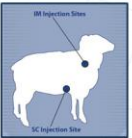


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To administer a vaccine subcutaneously to cattle, inject the vaccine at an acute angle in the illustrated triangular region of the neck where the skin and subcutaneous fat is thick, avoiding the need to tent the skin. Alternatively, the loose skin of the neck can be tented to position the subcutaneous injection. Injections into the muscle of cattle cause blemishing of the muscle, adversely affecting carcass value. Thus, whenever permitted by the vaccine label, it is best to give injections subcutaneously rather than intramuscularly. If a vaccine injection must be given intramuscularly, it should be given in the neck muscles in a triangle outlined by the shoulder, the vertebrae, and the nuchal ligament. Avoid giving any injections into the upper rump or upper butt, as these yield the more valuable cuts of meat. [This illustration shows the recommended injection locations on a cow. Illustration by: Andrew Kingsbury, Iowa State University]

**Sheep**

- Subcutaneous injections in the loose skin of axillary region
- Intramuscular injections given in the neck muscles




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Subcutaneous injections in sheep are usually given in the loose skin of the axillary region, just behind the elbow, where sheep naturally do not have wool. The subcutaneous vaccinations are administered by making a tent of skin and injecting the vaccine. Intramuscular injections ideally are given in the neck muscles. [This illustration shows the recommended injection locations on a sheep. Illustration by: Andrew Kingsbury, Iowa State University]

**Goat**

- Subcutaneous injections: axillary region
- Intramuscular injections in large muscles along the side of the neck



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Similar to sheep, in goats subcutaneous injections are commonly given in the axillary region, just behind the elbow. If possible, avoid injections into the muscles of goats because they can cause blemishing of the muscle, adversely affecting carcass value. Intramuscular injections may be given in large muscles along the side of the neck. [This illustration shows the injection locations on a goat. Illustration by: Andrew Kingsbury, Iowa State University]

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### Needle Sizes

- Recommended needle sizes are based on:
  - Species
  - Age of the animal
  - Route of administration
  - Vaccine manufacturer’s recommendation

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Recommended needle sizes for vaccine administration are based on the species, age, and route of administration. The vaccine manufacturer may also provide recommendations for the choice of needle gauge and length. For further information consult FAD PReP/NAHEMS Guidelines: Vaccination for Contagious Diseases (2014).

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### Handling and Restraint for Vaccination

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Proper animal handling and restraint plays a key role in the health and welfare of livestock as well as the safety of personnel. The ability to effectively handle and restrain an animal or group of animals for vaccination is critical to the success of any vaccination program. Appropriate animal restraint will reduce the risk of injury and stress in livestock and personnel. Handlers should always work slowly and quietly. Handlers should be aware of the size and strength of the animals they are working with. In this presentation, we will discuss general handling, then species-specific handling recommendations, and lastly, provide guidance on species-specific vaccine administration.

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### Key Points of Handling

- Safety is first consideration
- All restraint should be imposed by experienced handlers
- Use behavioral principles to move and restrain animals
- Always leave an escape route

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Safety is always the first consideration. Be mindful of safety for the animal, and safety for the handlers. All restraint should be imposed by experienced handlers. Animal handlers should be trained to use behavioral principles to move and restrain animals. Other points to keep in mind include: Do not begin the restraint process until all the supplies and personnel are ready. Livestock unaccustomed to being handled may bolt, kick, or strike when frightened or startled. Breeding males and animals protecting their offspring can be especially dangerous. Handlers should always leave an escape route to avoid becoming trapped.

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### General Handling


Flight Zone, Point of Balance, Blind Spot

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Animal handlers should be trained to use behavioral principles such as flight zone and point of balance to make moving and handling the animal much easier, safer and less stressful. In general, animal(s) will turn towards the handler and will be inclined to stop moving when the handler is standing outside the flight zone (position A in the illustration), and will move away when the handler steps into the flight zone (position B). Invading an animal's flight zone too deeply can result in unpredictable behavior and possible injury to both the handler and animal. The size of the flight zone varies depending on the animal’s temperament and the extent of past handling. Most species have blind spots directly behind them where an animal may not see a handler, causing the animal to be startled. These are principles that can be applied to many species, not just the pig. [This illustration depicts a pig’s flight zone. Illustration source: Transportation Quality Assurance, National Pork Board]

**Equine Handling**

- Halters
  - Most common method
- Equine Stocks
  - Different from cattle stocks, no head catch
  - Never enter the stocks with a horse
- Twitch
  - Places pressure on a horse's upper lip




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Halters are the most common method of restraint for equines accustomed to being handled. Equine stocks are commonly used for restraint. Stocks used for equine restraint are different from those used for cattle. The sides of the equine stocks are mostly open and stationary, and there is no head catch. For safety reasons, the handler should never enter the stocks with a horse. A twitch is a device that places pressure around a horse's upper lip. The pressure distracts the horse during mildly painful procedures. Care must be taken not to apply a twitch too tightly or for too long to prevent injury to the lip. Other common methods of horse handling and restraint include: lead shanks, blindfolds and eyelid pressing as a distraction. Horses may bolt, kick, strike, or bite when frightened or aggressive, and should be handled by experienced individuals. Wild, feral, or horses unaccustomed to being handled should be treated with extreme caution, and handled with an alleyway or in stocks. [This photo illustrates a horse being restrained with a rope twitch applying pressure on the upper lip. Photo source: Patricia Futoma, Iowa State University]

**Swine Handling**

- Often placed into a smaller pen
- Young pigs may be held
- Snare poles
- Flags, plastic paddles or panels should be used as primary movement aids
- Avoid overuse of electric prods




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When working with swine, work calmly and efficiently. Swine are frequently restrained as a group and moved using principles of the point of balance and flight zone. For handling and vaccination, pigs frequently are placed into a smaller pen giving them less room to move away. The pen size can be reduced by dividing it with a large panel. Young pigs may be held for vaccinations and other routine health care. Snare poles with a cable encircling the upper portion of the snout are a commonly used form of restraint. Flags, plastic paddles, or panels should be used as the primary movement aids. The frequent use of electric prods is detrimental to pig welfare because shocking increases body temperature, heart rate, and the incidence of stressed or non-ambulatory pigs. [This photo depicts swine being moved with a panel as the primary movement aid. Photo source: National Pork Board]

**Cattle Handling**

- Chutes
  - With or without headgates and metal arms
- 'Lock ups'
  - Dairy operations at the feed bunk




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Chutes, with or without headgates and metal arms to restrain the head, are commonly used for cattle. Dairy operations commonly have 'lock ups' at the feed bunk that can restrain the head and can accommodate multiple cows at a time. Keeping safety in mind, aside from hobby or project cattle, beef cattle are generally unaccustomed to being handled, and may be fearful of humans and protective of their calves. Dairy cattle are generally accustomed to being handled regularly for milking and reproductive examinations. [This photo is an image of multiple dairy cows in 'lock ups' at the feed bunk. Photo source: Danelle Bickett-Weddle, Iowa State University]

**Sheep Handling**

- Approach slowly, calmly
- 'Tipping' restraint
  - Set a sheep onto its rump
- Cupping under jaw and behind head to restrain
- Cupping under jaw and on dock of tail to move
- Alleys and gates



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When handling sheep, approach them slowly and calmly. Never rush them or pull their wool. Different breeds of sheep may exhibit different behaviors. For example, Rambouillet sheep tend to flock together and remain as a group. Cheviots are more independent than other sheep breeds. Setting a sheep onto its rump, called 'tipping' is a common method of restraint. Sheep usually accept this position and it gives the handler access to the hooves and underside of the animal. Another method of restraint is to cup one hand under the bony part of the sheep's jaw (not the throat), and place the other hand at the back of the sheep's head. Pointing the nose upwards helps maintain control. To move a sheep to another location, place one hand under the sheep's chin, and the other hand on the dock, or tail to encourage it to move forward, or use alleys and gates to simplify the process. Single out and catch an individual sheep by crowding the herd into a corner of the pen. Other methods of handling sheep include halters and headgates. [This photo depicts a sheep being set onto its rump, called 'tipping.' Photo source: Patricia Futoma, Iowa State University]

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### Goat Handling

- Tall alleyways, fences
- A chute with headgates
- Halter
- Fitting table or milking stand



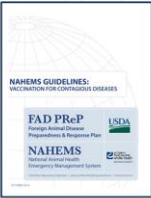
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Goats are more agile than sheep and can be challenging to keep contained. Goats may be difficult to drive or herd, and will commonly find routes of escape. Alleyways, chutes, gates, and fences intended for handling goats are often at least 42 inches tall. Goats should not be restrained by their horns, however, be aware of the horns for safety purposes. For larger herds of goats, a chute with headgates or tall alleyways may be used for vaccination. Some goats are accustomed to handling and can be restrained with a halter. Dairy goats are handled more frequently than meat goats, and may be accustomed to a fitting table or milking stand. Different types of restraints are available for goats that are horned, and those without horns. Other common handling methods including crowding in a small pen, tables (often used for hoof trimming), and collars. [This photo depicts a goat in a chute with a headgate. Photo source: John Lynch, Sydell, Inc]

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### For More Information

- FAD PrEP/NAHEMS Guidelines: Vaccination for Contagious Diseases
  - <http://www.aphis.usda.gov/fadprep>
- Vaccination for Contagious Diseases web-base training module
  - <http://naherc.sws.iastate.edu/>



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More details can be obtained from the sources listed on the slide, available on the USDA website (<http://www.aphis.usda.gov/fadprep>) and the National Animal Health Emergency Response Corps (NAHERC) Training Site (<http://naherc.sws.iastate.edu/>).

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The print version of the Guidelines document is an excellent source for more detailed information. In particular, the Guidelines document has listings of additional resources. This slide acknowledges the authors and reviewers of the Guidelines document. It can be accessed at <http://www.aphis.usda.gov/fadprep>.

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### Acknowledgments

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