U.S. agriculture is very vulnerable to the accidental or intentional introduction of foreign animal diseases. Agents against animals have been part of nearly every nation sponsored offensive biowarfare program. Increasing awareness and preparedness about the threat of foreign animal disease and the impact they could have is vital to safeguarding American agriculture.

United States agriculture is very vulnerable to the accidental or intentional introduction of disease agents (FMD), as well as emerging (Nipah) or re-emerging diseases (such as exotic Newcastle disease). Today we will talk more about those vulnerabilities and ways to minimize the United States’ risk of a devastating disease from entering our country.

High concentration of animals (cattle feedlots, swine confinement units, poultry barns) could aid in the distribution of a foreign animal disease agent. Auction markets mix animals which are then loaded and transported, sometimes over 1,000 miles where they are then mixed with other animals. Since almost all severe, highly contagious diseases of livestock have been eradicated from the U.S., and the use of any vaccine for them is either nonexistent or not employed, livestock have limited immunity to foreign animal diseases (FADs). Another concern is our centralized feed supply and distribution. As feed can be an ideal vehicle in which to distribute an agent or compound, one feed manufacturer can supply hundreds or thousands of farms, unknowingly distributing an infectious disease agent throughout the country.

The U.S. is currently very inefficient in our ability to trace animal movement, making us vulnerable to economic devastation. A national animal identification plan has been discussed and may soon be implemented because of the BSE case in Washington in 2003. We are a global society and our international trade and travel has greatly expanded in the last quarter century. With the widespread distribution of infectious disease agents in other countries, we are very vulnerable to the accidental or intentional introduction of these pathogens. Our mobile society leaves our borders open for trade, making us vulnerable to agents or contaminated equipment being smuggled in if inspections are not thorough. Another concern is the lack of biosecurity for our animals and plants, which will be further discussed. Finally, there is also a great need to improve foreign animal disease (FAD) awareness and education among veterinarians and producers. We all must be able to recognize the signs and know how to report them in order to decrease our vulnerability to disease spread. Today’s presentation is designed to give you some of those tools.
During this presentation we will define agroterrorism and discuss the importance of agriculture to our nation. It is also important to discuss the economic impact agroterrorism could have on our nation, and learn which agencies are involved in prevention and response. We will also identify potential agents that could be used against livestock and have specific examples of an accidental or intentional disease agent, a re-emerging disease and an emerging disease. Finally, various disease control and biosecurity measures will be discussed.

There are several components to terrorism. Bioterrorism, often defined as the use of biological agents that target humans, plants or animals is what we think of the September 11th attacks and anthrax letters that were used in 2001. Agroterrorism, for our purposes, will be defined as the use of biological (to include toxins), chemical, or radiological agents targeting agriculture or its components and its adverse impact on livestock, the food supply, crops, industry, workers, the consuming public, and our economy. And finally, there are other terrorism components such as conventional, radiological, nuclear, chemical and cyber that are typically directed at the human population.

An attack on animals generally evokes less emotion than an attack on the human population, resulting in there being less likelihood of a retaliation. Due to the nature of the pathogen, an exposed herd may go undetected for days, or even weeks, allowing the perpetrator to escape undetected and the origin of disease difficult to trace. This may also allow the perpetrator to deny involvement and point toward natural circumstances as the cause, referred to as “plausible deniability”. Many of the infectious agents that could be used to target animals are not zoonotic (transmissible from animals to humans), so they are safe for the assailant to work with.

This graph depicts the onset of an infectious disease outbreak. Note the time from exposure to the onset of symptoms. This demonstrates how cases may be delayed in their recognition, and by the time clinical signs are seen and care is sought, the disease could be widespread.

There are many methods of delivery and points in the agriculture process that an agent could be introduced and animals could be exposed. While agroterrorism largely focuses on the intentional introduction of disease agents, an accidental introduction by international travelers is a possibility. At first onset, an intentional outbreak of a disease in animals is hard to differentiate from a natural outbreak, which delays finding the true source. The simultaneous release of three to four highly contagious, foreign animal pathogens in several key locations around the country could be overwhelming. Finally, a false claim or hoax of a disease outbreak could diminish public confidence in food safety for particular food products. The perpetrator relies upon the media to do the damage for him/her by spreading the rumors.
With the complexity surrounding an agroterrorism attack, how might one suspect the disease was caused intentionally? Various clues generated by the outbreak itself might include: traceback of animals that yield a dead-end with no evidence of exposure to other infected animals or common feed; animals that have not passed through a common livestock market or farm; a history of other events that have happened at that farm/facility that might be tied to a particular employee; the occurrence of several, smaller outbreaks across the nation at one time; the manifestation of signs not typically seen with a particular disease that suggest an atypical route of exposure; overwhelming mortality; or unusual season of occurrence. These taken separately might not alert the investigator to agroterrorism, but the combination of two or three, plus other history or suspicions, might be all that is needed to make the connection.

Next we will cover some of the historical aspects of agroterrorism.

It has been pointed out that the first use of biological weapons in the twentieth century was not against humans, but against animals. One of the first known offensive biological weapons programs was begun by Germany around the time of WWI and continued into the years of WWII, during which time they experimented with airborne foot-and-mouth disease virus. France, whose biological program began in 1921, had researched the use of rinderpest against cattle and late blight (the cause of the Irish potato famine that killed one million in 1845-46). Anti-agricultural biological weapons, overseen by the Ministry of Agriculture, were also developed by the Soviet Union in the late 1940s to early 1950s. The U.S. began its offensive biological warfare research in the fall of 1941. Not only did they look into human disease agents, but also researched the use of Newcastle disease virus, fowl plague, foot-and-mouth virus, hog cholera, and various crop pathogens.

The end of the U.S. offensive biological program was announced on November 25, 1969 by President Richard Nixon, and finalized in 1970; the cost of the entire program was $726 million. The reason behind the U.S. eliminating their bioweapon program was from a practical, military standpoint; there were other weapons that could be used where the results were virtually guaranteed. Biological weapons were generally unpredictable compared to conventional weapons and they could be lethal if winds shifted. It was very costly to continue to operate and the bioweapon research facilities were aging. This photo depicts researchers at Fort Detrick, Maryland, the US Army’s base for biowarfare research.
This next section demonstrates how important agriculture is in our society and to our economy.

From cattle to turkeys, livestock and poultry generate needed income for producers and the economy while supplying safe product to our tables. Listed is the economic importance of livestock and poultry in our nation and estimated numbers as of 2003. These are live animal values and do not consider the value of the products we harvest from these species. Interesting to note that in 2002, the U.S. was second only to China for egg production, and produced more eggs than the whole of the European Union combined.

U.S. agriculture has changed in the last century as this slide portrays. It is estimated that in 1900 roughly 39% of the U.S. population lived on farms, today that figure is less than 2%. Farms today are more specialized and much larger. Cattle operations have changed the least of all livestock (decreased 30%) but those farms raising milk cows, hogs, and chickens are only 5-6% of all farms. Horses and mules were once a mainstay of labor on farms, but today contribute to 22% of farm labor. Consolidation in agriculture has also taken place in related off-farm businesses as noted by the number of meat packing plants and grocery store distribution points. This chart is taken from the USDA NASS website at http://www.usda.gov/nass/pubs/trends/timecapsule.htm

The food of America is now produced by fewer farmers located in more geographically defined parts of the country: pigs in Iowa, North Carolina, and Illinois; beef cattle are fairly widespread but Texas, Kansas, and Nebraska are the country’s biggest producers; dairy operations are widespread too, but we do see this industry heavily tied to the states of California, Wisconsin, Pennsylvania, and Minnesota.

The poultry industry is becoming more consolidated too. Egg layers are throughout the US but predominantly in Iowa and Ohio; broiler chickens are primarily raised in Georgia, Alabama, and Arkansas. As animal production relies heavily on corn production as a feed source, many of the corn belt states are high animal concentration states, like Iowa and Illinois. This consolidation means that use of animal disease pathogens could be used in a relatively focused region of the U.S. but have widespread national repercussions. With consumers demanding a more consistent end product, such as a cut of meat or the size of the turkey on Thanksgiving day, producers are raising more genetically similar animals. This may increase the chance of widespread disease if the pathogen is engineered to exploit those traits.
Now that we have explored the importance and economic value of agriculture, we will examine what type of impact a foreign animal disease could have.

An accidental or intentional introduction of a foreign animal disease could lead to severe economic losses in the US because of the disruption in the world trade market. In 2003, the U.S. exported $56.2 billion in agricultural commodities; $12.2 billion came from animals and animal products. If we cannot export, our products lose value which has a negative effect on the economy, livestock and grain producers, and the unemployment rate could increase. USDA Outlook Report, Nov 25, 2003 http://usda.mannlib.cornell.edu/reports/erssor/trade/aes-bb/2003/aes40.pdf

The impact and consequences from a foreign animal disease such as FMD in the U.S. could be severe. Harsh restrictions on movement would be enacted. We would see road closures, quarantined farms, and animal movement ceased. Access to camp sites, state parks, wilderness areas, lakes, city parks, and zoos may be denied. The psychological impact and mental health of livestock producers, veterinarians and the local community could be negatively affected if entire herds are quarantined and destroyed. The public could be shocked by some of the images the outbreak produces and alter their buying habits as consumers. It is unlikely that an agroterrorist attack would create mass food shortages; but movement restrictions could complicate availability temporarily.

The impact could be felt, in the case of a foreign animal disease discovery, in as quickly as 24 hrs. Exportation of livestock could be halted. Tourism would drop, just as was seen in the U.K. There are direct and indirect ties to agriculture by allied and reliant industries, and a significant event would have a domino effect. Restaurants, grocery retailers, food processors and distributors would be affected, as would transporters. The direct costs of eradication and control involve disease surveillance, diagnostic testing, tracebacks on animal movement, implementing and maintaining quarantines, depopulation costs, indemnity paid to the farmer, overtime for law enforcement, hiring additional veterinarians, overtime for USDA and other federal or state employees … the list goes on and so do the costs. Losses due to a foreign animal disease may take years to fully realize.

Next we will discuss the agencies in the United States that are protecting our borders, farms, and food supply seven days a week, 24 hours a day.
The lead federal agency in safeguarding American livestock and poultry health, and in responding to a foreign animal, emerging or re-emerging disease, is the USDA-APHIS, Veterinary Services Division (VS). The Emergency Programs (EP) division, founded in 1972, prepares and trains for response to outbreaks of foreign or newly emerging animal diseases. EP provides training to many veterinarians and support personnel whose work requires knowledge of foreign animal diseases. In the event of a foreign animal disease outbreak, these trained professionals would be called upon to help in diagnosis, control, monitoring, and eradication.

Four USDA-APHIS laboratories comprise the National Veterinary Services Laboratories (NVSL) and provide services for the diagnosis of domestic or foreign animal diseases, import/export testing of animals, training, and testing for eradication or control programs. All NVSL laboratories are located in Ames, Iowa, with the exception of the Foreign Animal Disease Diagnostic Laboratory (FADDL) at Plum Island, New York. There, foreign animal diseases are studied and veterinarians are trained to become foreign animal disease diagnosticians. There are roughly 400 trained foreign animal disease diagnosticians—private, state, federal, and military veterinarians—spread out across the nation that could be called upon in the event such a need arose. All suspected foreign animal disease (FAD) outbreaks must be investigated within 24 hours of notification.

Agriculture border controls were maintained by the USDA-APHIS-Plant Protection and Quarantine. These responsibilities have been transferred to the Department of Homeland Security (DHS), Customs and Border Protection as of March 1, 2003. DHS CBP is responsible for monitoring 317 ports of entry into the US and are constantly on the lookout for imported animal and plant material. Under the CBP are the Customs Service, the Border Patrol, Immigration and Naturalization Service, and Agricultural Inspections; more than 40,000 employees working to safeguard our borders and ports.

Originally established by the USDA in 1984, the Beagle Brigade is now part of the US Department of Homeland Security, Customs and Border Protection. There are currently 141 detector dog teams in the US, primarily located in 24 international airports, 9 land border ports of entry, and 9 major international mail facilities that sniff out luggage, packages, mail and any other items brought into the US. Dogs are trained for 8-12 weeks and practice a week before working full-time. Their success rate is about 90% after two years of experience. Along with other detector dogs (pedestrian, cargo and maritime teams), during fiscal year 2002, over 8 million passengers, 22,536 vehicles, and 43,641 aircraft were searched. Of the 2 million interceptions of prohibited agricultural products made each year, detector dogs make 75,000 of them. This photo depicts a beagle sniffing baggage at an airport; the vest he is wearing says “Protecting American Agriculture”.

USDA manages quarantine stations throughout the US to help safeguard against the introduction of disease. Livestock and poultry must be accompanied by a health certificate and must undergo quarantine at one of four facilities: Newburgh, NY; Miami, FL; Los Angeles, CA; Honolulu, HI. Exceptions are those animals coming from Mexico and Canada, which are inspected at the ports of entry. In 2002, the U.S. imported 1.5 million cattle and 5.8 million pigs. The same requirements are set for imports of deer, elk, llamas, and other cervids and camelids. Special rules apply for zoo animals and ostriches and emus. Personally owned pet birds must go through one of six USDA-operated bird quarantine facilities: New York, NY; Miami, FL; San Ysidro, CA; Hidalgo, TX; Los Angeles, CA; Honolulu, HI. Those birds...
coming from Canada may enter without quarantine due to similar health standards. Importation of dogs, cats, turtles, and monkeys is overseen by the CDC’s Division of Global Migration and Quarantine. There are many porous borders surrounding our country, so increased awareness and mitigation becomes more essential each day.

As you have learned throughout this presentation, agriculture in the U.S. is driven by our ability to export. Changes in the disease status of one or more food animals will compromise our ability to export with devastating results. Livestock, poultry, and wildlife can all be affected by a foreign animal disease and the impact will depend on the agent used, dissemination of agent and infected animals, rapidity of detection and response to control, trade restrictions enacted, and other factors. This next section will address some of the USDA high consequence livestock pathogens that could be used in an agroterrorism attack or be accidentally introduced.

The USDA has identified some pathogens as being of high consequence and concern to livestock. This slide depicts the full list of diseases, and there is a handout available for audiences if you choose to use it. The Center for Food Security and Public Health has designed PowerPoint presentations on many of these diseases that you will find on the Agroterrorism CD-ROM.

Several of the diseases listed on the previous slide have zoonotic potential. The human health consequences vary depending on the specific agent. For more information, please refer to the disease specific PowerPoints located on the Bioterrorism and Agroterrorism CD ROMs, or the wall chart. A 1998 USDA assessment entitled “The Potential for International Travelers to Transmit Foreign Animal Diseases to U.S. Livestock or Poultry” concluded that while it is possible for humans to transmit some of these diseases to animals, the risk, after taking into account various factors and circumstances, is negligible. High on their negligible list for mechanical transmission by humans to animals was Newcastle disease and swine vesicular disease. Only two diseases, avian influenza and foot-and-mouth disease (FMD), had any potential for biological transmission, but was considered very low.

Next we will discuss Foot and Mouth Disease and its implications should it be accidentally or intentionally introduced into the U.S.
Foot and Mouth Disease (FMD)

- Virus
- Considered to be the most important livestock disease in the world
- Not in U.S. since 1929
- Vesicular disease of cloven-hoofed animals
- Spread by aerosol & fomites

An example of an agent that would have severe repercussions whether it is introduced intentionally or accidentally is foot and mouth disease (FMD) virus. FMD has not occurred in the U.S. since 1929 and would have great impact on our livestock sector if it did. This picornavirus is probably the most important infection in livestock in the world today. FMD is a highly contagious vesicular disease of cloven-hoofed animals that causes fever and the formation of vesicles in the mouth, on the tongue, muzzle, feet, teats, and vulva. Production losses can be great and death usually only occurs in the young. Sheep and goats often have very mild signs and cases may be missed if not examined closely. FMD can be transmitted by saliva, respiratory aerosol, direct contact, and fomites (contaminated feed, coveralls, shoes, instruments, etc). It has also been shown that humans can harbor FMD virus in their respiratory tracts for up to two days, posing a theoretical risk for transmitting this agent to uninfected animals. The photo depicts ruptured vesicles on this pig’s leg and coronary band due to FMD. Any case of FMD discovered in the U.S. would need to be reported to the World Organisation for Animal Health (formerly the Office International des Épizooties (OIE)) created in 1924) within 24 hours.

The detection of FMD, and other high consequence livestock pathogens, needs to be reported to the World Organisation for Animal Health (formally the OIE) within 24 hours. The OIE immediately informs all other countries at risk, i.e. those countries receiving our exports. Our borders could, and would, be shut down, and preventative action would be taken by all countries at risk. As is the case with BSE in Washington, once teh infected cow was discovered, live cattle exports ceased to many countries. Borders will not reopen until an international investigation team deems the disease investigation was handled appropriately. In the case of FMD, trade could not resume until 3-months after the slaughter of the last positive animal, given ongoing surveillance through serological testing has occurred throughout the disease monitoring process.

It is important to understand that FMD has and is currently occurring in many countries around the world. This map is taken from the World Organisation for Animal Health (formally known as the OIE- Office of International Epizootics) website as of March 25, 2001, and while it is a little dated, gives an accurate assessment of the worldwide distribution of this disease.

Foot and Mouth disease virus (FMD) only infects cloven-hoofed animals: cattle, pigs, sheep, goats, buffalo, and various wildlife such as deer and elk. FMD could affect approximately 60 species of wildlife and zoo animals and could have an enormous impact on our food animal production. Listed are the animals at risk in the U.S. according to 2003 data. There is also a risk of it spilling over into wildlife and creating a permanent enzootic presence. It is important to note that FMD rarely affects humans and produces only mild symptoms when it does. The negative impact on the economy and exports is the biggest risk associated with an FMD outbreak. This means that the $3.1 billion in beef exports and the $1.3 billion in pork exports each year would vanish unless we control this disease very quickly. There have been many estimates as to the impact of a FMD outbreak in the U.S. Paarlberg, et al., in their recent analysis of a FMD outbreak in the U.S., estimated that $14 billion would be lost in farm income. The photo depicts a salivating cow due to the painful vesicular lesions in her mouth making it difficult to swallow.
U.K. FMD Outbreak, 2001

- Total costs over £10 billion
  - Ag industry, compensation, tourism, sports
- 6 million animals slaughtered
  - FMD free in less than 1 year
- Public perception
  - Animal welfare
  - Smoke pollution

Estimates of the FMD impact on the U.K. put overall economic losses over £10 billion due to the total economic strain placed on the agriculture and food industry (£3.1 billion), compensation to farmers (£1.1 billion), tourism (£4.5 to £5.3 billion by 2005) and sports (£750 million). Indeed, while it is known that 6 million animals were slaughtered in the U.K. to control this disease, resulting in them reaching FMD free status in less than one year, the true costs will likely never be known. The public witnessed something few had ever seen. Mass slaughter was called into question, as were animal welfare and animal rights. Pollution from pyres of burning carcasses was intense in some areas and also impacted public health.

FMD in Wildlife

- Risk of enzootic wildlife infection
  - Permanent trade embargoes possible
- Risk to zoos and endangered species
  - 1985 Israel FMD infection in gazelles
  - 1,500 deaths, spread to neighboring livestock
- Billions spent annually in the U.S.
  - Outdoor recreational activities

If a foreign animal disease became enzootic within wildlife in the U.S. there would be serious repercussions. Establishing an enzootic foci of at least one foreign animal disease could permanently disrupt trade. The incursion of rinderpest, heartwater, or FMD might be devastating to our wildlife or zoo species, and has the potential to adversely affect endangered species. In April 1985, an outbreak of FMD among mountain gazelles (Gazella gazella) in a nature reserve in Israel resulted in the deaths of approximately 1500 animals and had a 50% case-fatality rate. The virus also spread from the gazelles to unvaccinated livestock on neighboring farms resulting in cases in cattle, sheep, and goats. Spread beyond these farms was prevented due to the prior use of the vaccine in livestock. Control in zoo or endangered species would not involve slaughtering, as could be used in our domestic livestock. Billions are spent each year for recreational hunting, fishing, wildlife watching, and camping activities in the U.S. and this could all be lost, at least temporarily, by the incursion of high consequence livestock pathogens.

Re-emerging Disease

Exotic Newcastle Disease

Next we will discuss Exotic Newcastle Disease and its implications as a re-emerging disease in the U.S.

Newcastle Disease (ND)

- Virus affecting poultry
- Four pathotypes
  - Asymptomatic, lentogenic, mesogenic, velogenic
- END endemic in Asia, Middle East, Africa, Central/ South America
- Causes drop in egg production, neurological damage, and death

An example of a re-emerging disease is exotic Newcastle disease. It affects poultry and is caused by a Paramyxovirus. There are nine avian paramyxovirus serotypes and Newcastle disease virus is designated as APMV-1. Newcastle disease virus strains are grouped into four different pathotypes based on their clinical signs and increasing virulence. These include: asymptomatic enteric, which is generally subclinical; lentogenic, which has mild or subclinical respiratory signs; mesogenic, which has respiratory and occasional neurologic signs; and velogenic, which is the most virulent pathotype with high mortality rates. Exotic Newcastle Disease (END) is endemic in many parts of the world including countries in Asia, the Middle East, Africa, and Central and South America. The United States and Canada have seen high mortality in wild cormorants caused by END. Clinical signs in chicken flocks, include an initial drop in egg production followed by numerous deaths within 24-43 hours continuing for 7-10 days. Birds that survive may have permanent neurological damage including paralysis, and reproductive damage causing decreased egg production. The photo depicts a chicken with respiratory signs and increased salivation due to END.
Exotic Newcastle Disease

- 1950: First U.S. case
- 1972: Eradication campaign began
  - 12 million birds destroyed
  - $56 million dollar cost to tax payers
- 1974: Eradicated END
- Outbreaks continue due to illegal importation of exotic birds and poultry
- Humans can acquire eye infections

The reason END is referred to as a re-emerging disease is due to the fact that the first case occurred in 1950 in partridges and pheasants imported from Hong Kong. In March of 1972 a national animal health emergency was declared and a major eradication campaign began. During the 2 year effort, 1,321 infected and exposed flocks were located and almost 12 million birds destroyed. The operation cost taxpayers approximately $56 million. It wasn’t until July 1974 that the U.S. had succeeded in eradicating END. Outbreaks of END have occurred since in the U.S. due to illegal importation of exotic birds and poultry. Humans can acquire eye infections by direct contact that consists of unilateral or bilateral reddening, excessive tearing, edema of the eyelids, conjunctivitis and subconjunctival hemorrhage. Infections are usually transient, the cornea is not affected, and human-to-human spread has not been reported.

Exotic Newcastle Disease

- 2002-2003: California outbreak
  - 2,662 premises depopulated
  - 4 million birds destroyed
  - $160 million impact
- Developing countries
  - Affects quality and quantity of dietary protein
  - Significant effect on human health

In October 2002, END was confirmed in the State of California. Cases occurred in Nevada, Arizona, Texas and New Mexico. As of July 7, 2003, with the epidemic in the final phase of eradication, almost 4 million birds on 2,662 premises had been depopulated. Eradication efforts had cost taxpayers $160 million by July 2001. In developing countries with endemic END this is an important limiting factor in development of commercial poultry and the establishment of trade links. Many developing countries rely on village chickens to supply a significant portion of dietary protein in the form of eggs and meat, especially for women and children. Continued losses from END affect the quantity and quality of the food of people on marginal diets. The economic impact of END is not only measured in direct commercial losses, but in some countries in the effect on human health.

Emerging Disease

Nipah Virus

Next we will discuss Nipah Virus and its implications as an emerging disease in the world.

Nipah is a newly discovered or emerging disease and the virus was isolated in March 1999 in Malaysia. Nipah virus causes severe, rapidly progressive encephalitis in humans and severe respiratory and neurologic illness in pigs. The 1998-1999 outbreak of Nipah virus in Malaysia occurred in three clusters. A total of 265 persons were infected and required hospitalization; there were 105 fatalities (40% mortality). Ninety-three percent (93%) of these cases had close contact with infected pigs. Nipah virus has a high mortality rate in humans (40%). The transmission of the disease to humans is associated with close contact with infected pigs. Currently survival of the virus outside the host is unknown.
Nipah Virus

- Flying foxes (fruit bats)
  - Asymptomatic carriers
  - Virus found in urine, partially eaten fruit
  - Migratory
    - Australia, Indonesia, Philippines
  - No secondary hosts

It has been found that several species of fruit bats (flying foxes) in Malaysia have neutralizing antibodies to Nipah virus. The highest prevalence was for two species of flying foxes, the island flying-fox (*Pteropus hypomelanus*) and Malayan flying fox (*Pteropus vampyrus*) and are common to caves in Malaysia. Additionally, studies indicate Nipah virus can be found in the urine and partially eaten fruit from these species. Several of the same species of fruit bats are also found in Australia, Indonesia, and the Philippines. Since these bats are migratory, increased surveillance for Nipah virus is being conducted in these countries. Investigation of potential secondary hosts (peridomestic species) have also been conducted. No indication of a secondary host has been found. This is a picture of a Malayan flying fox (*Pteropus vampyrus*).

Nipah Virus

- 1998-1999, Malaysia
  - 1.1 million pigs culled
    - 2.4 million pigs prior to disease onset
    - $217 million (USD) lost in this outbreak
  - Pork consumption dropped 80%
  - No new cases since May 1999
  - Surveillance and testing continue
  - Americans and 60 million pigs at risk

The 1998-1999 outbreak of Nipah virus in Malaysia occurred in three clusters. During the outbreak, over 1.1 million pigs were culled to prevent the further spread of the disease, which resulted in a substantial economic loss for this country (an estimated cost of about US $97 million) and loss of export trade (estimated cost of about US$120 million). The pig population in Malaysia prior to the outbreak was 2.4 million animals. Additionally, local pork consumption during outbreak dropped by 80%. Since May of 1999, there have been no new cases of Nipah virus. Serological surveillance of farms and random testing of pigs at abattoirs is currently being performed. Not only are the 60 million head of pigs at risk in the US from Nipah virus, but the zoonotic potential could have a devastating affect on Americans. Continued vigilance in preventing this devastating disease from entering our country is very important.

Biosecurity and Disease Control

The goal with enhancing biosecurity is to stop the introduction and spread of infectious agents to livestock and the food supply. Biosecurity protocols developed and followed appropriately can help prevent domestic and exotic animal diseases. One key component and concern in agricultural biosecurity is the movement of animals, people, and food by limiting access of visitors and wildlife.

Enhance Biosecurity

- Goal is to stop the introduction and spread of infectious agents
- Prevent domestic and exotic animal diseases
- Restricting movement of people and animals is essential

Biosecurity begins at the farm entrance. Risk factors for each farming operation should be identified with the help of the herd veterinarian. Together you can conduct a biosecurity walk-through and develop a biosecurity plan to minimize the chance of disease introduction. Biosecurity measures need to be tailored to each farm or production facility, while keeping the cost-benefit analysis of these recommendations in mind. It is important that all employees are trained and understand their responsibilities on the operation. Photo courtesy of D. Bickett-Weddle, DVM, ISU.
**Enhance Biosecurity**

- Regulate visitors
- Keep visitors sanitary
  - Clean clothing, boots
  - Disposable plastic shoe/boot covers
- Implement insect, bird, and animal control
- Secure water, feed and nutrient sources

Teach clients the importance of regulating and recording visitors that come to their farms and posting clear instructions for vehicles that enter and leave. Help producers develop clearly stated rules for visitors to ensure that biosecurity is not breached. Emphasize the necessity of clean clothing and boots, and controlling insects, birds and animals to lessen the spread of disease. Finally, make sure your input sources such as water, feed, and nutrients are secure by posting signs, putting locks on sheds or wells, and being watchful of those areas. Photo courtesy of D. Bickett-Weddle, DVM, ISU.

**Disease Control**

- Maintain healthy herd
  - Vaccinate
- Proper hygiene for animals and handlers
- Purchase from reputable sources
- Quarantine newly purchased animals
- Separate sick animals

Education is a large portion of your role as a veterinarian. Emphasize to producers the importance of implementing and following biosecurity protocols. For example, producers should maintain a healthy herd by vaccinating and following proper hygiene for animal housing and workers who come in contact with those animals. Instruct producers to purchase animals from reputable sources and quarantine all newly acquired animals. Teach producers to identify and separate sick animals. Photo courtesy of D. Bickett-Weddle, DVM, ISU.

**Disease Control**

- Change high risk management practices
- Avoid animal collection and dissemination points
  - Auction markets, shows
- Nationwide animal identification and tracking system
  - Goal: Premise identification system in place by July 2004

As discussed in the biosecurity slides, part of disease control is minimizing risk. Many producers may have to change some of their high risk management practices in order to minimize the chance of disease exposure and spread. Avoiding animal collection points and dissemination points, such as auction markets and livestock shows. Over 5 million cattle pass through auction markets annually, presenting many opportunities for an agroterrorism attack and dissemination of disease. Since the BSE case occurred in Washington state in 2003, the USDA and FDA are working to implement an animal identification and tracking system. This would allow rapid identification of potentially exposed animals while minimizing unnecessary destruction of non-exposed cohorts. By July 2004, a premise identification system is targeted to be in place for cattle born in the United States. For more information, visit the USDA website at www.usda.gov.

**Disease Control**

- Local and state veterinarians
  - Recognize outbreak of foreign animal disease
- USDA-APHIS personnel
- University extension personnel
- Local, state, federal health agencies
- Law enforcement
- Emergency management division

If livestock are exposed to a pathogen, be it accidental, intentional, emerging, or a re-emerging disease, the local veterinarian could be the first responder called to the farm to determine the cause of illness or death. It is important that veterinarians understand what to do and who to call in the event they suspect a foreign animal disease or an outbreak with suspicious circumstances in order to control the spread of disease. In addition to local veterinarians, USDA officials will also take part in response to an animal outbreak if it is a significant threat. Other resources utilized can be universities and local, state, and federal human health agencies if the agent is zoonotic in nature. Local law enforcement, as well as county or state emergency management divisions, may be recruited depending on the severity.

**Conclusion**
In conclusion, awareness education, such as participating in today’s presentation, is an important component to understanding the impact from an attack on American agriculture. Early detection and response to the disease are critical to limiting the overall impact. Veterinarians, producers, and the animal owning public should know what signs to look for and who to call for assistance. Many U.S. government agencies are working to protect our borders, and it is essential that we cooperate with authorities on all levels to successfully respond to a disease threat. Everyone plays an important role in protecting U.S. agriculture.

As we have seen, foreign animal diseases are a real threat that would impact nearly every citizen if severe enough. The economic consequences of an incident may seem insurmountable, but can be mitigated through planning and preparedness. Awareness of farmers, producers, veterinarians, law enforcement, HAZMAT teams, fire departments, veterinarians, local and state emergency management agencies, and even the community at-large and media will help in recognizing agriculture’s risks and implementing preventive measures. Many agencies and individuals are already working to ensure the safety of our agriculture through various monitoring efforts. It is important to remember that there is minimal direct human illness from any of the high consequence livestock pathogens. Continued diligence, training, and preparation will ensure that we are prepared in case such a terrible event should ever take place. The U.S. is the leader in providing food for the world, but in order to maintain this position we must be prepared and ever vigilant.