



Biosecurity for Sheep and Goat Producers

Biosecurity in the animal industry is based on those management practices that prevent infectious diseases from being introduced into or spread among a herd or flock. For high health status within a herd or flock, evaluate biosecurity practices routinely.

Phases of Biosecurity

Biosecurity has four sequential phases: mitigation, preparedness, response and recovery.

Mitigation is a type of prevention that lessens danger or harm by securing premises against infectious diseases.

Preparedness includes planning, training for and implementing mitigation practices. Producers analyze the weaknesses and strengths of their facilities to determine the most effective ways of protecting them.

Response is handling a disease outbreak efficiently and effectively. The first 24 hours are crucial. Abnormal animal health issues, including massive die-offs and unusual symptoms such as blisters on the nose, mouth and teats, must be immediately reported to a veterinarian or state/federal animal health regulatory officials. The more rapidly a diagnosis is made and quarantine zones established, the more likely spread of the disease can be controlled.

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Neither state nor federal animal health regulatory agencies charge producers or local veterinarians to investigate a possible disease outbreak. The officials involved are responsible for establishing quarantine areas, collecting and submitting test samples, and determining the appropriate fate of the diseased animals.

Recovery begins when the disease outbreak has been eradicated or controlled. During recovery, premises and facilities are restored to an acceptable operational level. Covering pits, sampling ground water and disinfecting premises might be part of the recovery process. Authorities determine what steps are needed to ensure the disease does not recur.

After recovery, the process cycles back to mitigation so areas needing attention can be improved. This constant cycle helps ensure prevention, control or eradication of infectious diseases.

Types of Diseases

Diseases are foreign, emerging or endemic. A foreign animal disease is one not currently found in the United States. Federal and state animal health regulatory agencies monitor these diseases to guard against their devastating social and economic effects.

Emerging/endemic diseases are either new to the United States or are new forms of old diseases that are becoming more prevalent. The emergence of an animal disease may be related to commerce, mutation of disease-causing agents, or changes in environmental conditions.

Foreign or emerging/endemic diseases can also be zoonotic, which affect both animal and human health.

If a disease is infectious, it is caused by a pathogen—such as bacteria, protozoa, viruses, fungi and rickettsiae—that invades a susceptible animal and then multiplies, causing illness. Non-infectious disorders are those caused by toxins or malfunctions of the body.

Epidemiology of Diseases

Epidemiology studies disease transmission. Disease is transmitted directly or indirectly.

Disease Transmission

Direct transmission occurs when a susceptible animal is exposed to respiratory air droplets; saliva; nasal, ocular or genital mucus; fetal fluids; feces or urine; milk; skin; or blood of an infected, contagious animal. Disease may also be transmitted directly through reproductive acts and *in utero*.

Indirect transmission occurs when animals come in contact with infected inanimate objects, environmental

fomites and animate vectors. Needles, balling guns, dehorner, trucks, trailers, tires, shovels and wheelbarrows can spread disease indirectly, as can contaminated soil, food and water, and other objects. People can carry pathogens between animals and operations on their clothing, shoes and hands. Arthropods such as ticks, flies, mosquitoes and fleas can transmit pathogens from an infected animal to a susceptible animal.

Vector transmission is biological or mechanical. Biological vectors are needed for the life cycle of the pathogen, as when the disease agent develops inside the arthropod before infecting susceptible animals. A mechanical vector only carries the pathogen. Arthropods, animals and people can be mechanical vectors.

With direct and indirect transmission, there are five primary routes by which pathogens enter susceptible animals through aerosol inhalation, skin contact, oral and reproductive systems, and blood.

Because pathogens on air droplets can be transmitted through aerosol inhalation from respiration, sneezing or coughing, susceptible animals should be kept apart from infected animals.

Pathogens are transmitted orally when susceptible animals consume contaminated soil, food or water, or lick or chew on contaminated objects. Milk of infected dams can transmit disease to nursing animals. To reduce the level of contaminants in the environment, routinely dispose of manure, disinfect feed and water troughs, and remove objects that animals might chew or lick.

Pathogens also can enter the body through breaks in the skin and cause a systemic infection.

Diseases entering the body by the reproductive route infect the genital organs of adults and the fetuses and placentas of pregnant dams.

A disease enters by the blood route when an animal is bitten by an infected vector such as an arthropod, or injured by a contaminated vehicle such as a needle, ear notcher, dehorner or balling gun.

Immunity

Immunity is an animal's ability to resist a particular disease by preventing the pathogen from developing or by counteracting the effects of its toxins. Immune animals carry antibodies that destroy a specific pathogen before it causes illness. Immunity is either natural, active or passive.

Natural immunity exists without exposure to a disease agent. These natural defenses include skin and nasal passages designed to keep disease out, and cells in the body that attack disease-causing organisms.

Active immunity is acquired through vaccination or when the body battles an infection. A vaccine stimulates the production of antibodies without causing the disease. Boosters are needed to maintain active immunity.

Passive immunity is acquired when antibodies are passed from one animal to another, this occurs when antibodies are transferred *in utero* from the dam to the fetus or when a newborn animal drinks colostrum from mother's milk. Since antibodies are large molecules, their ability to cross the placenta varies with species. In species that have placentas impenetrable to antibodies, newborns must consume about 10 percent of their body weight in colostrum within 24 hours of birth to acquire the antibodies. After 24 hours, an animal's simple stomach matures, and antibody molecules are too large to be absorbed across the epithelium.

Vaccinations

Vaccinations provide the body with a way to make antibodies to combat disease without contracting the disease, so that if the animal is exposed to the disease later, its body can produce more of these antibodies to combat the disease.

Vaccines are made from killed pathogens or modified living organisms that have been altered to stimulate immunity without causing disease.

Vaccines are effective in preventing certain diseases in sheep and goats; however, vaccines are not 100 percent effective. By law, all vaccines must come with instructions on proper usage. Some vaccines require only a one-time injection; most require two injections 3 to 6 weeks apart plus annual boosters to maintain immunity. For best protection, vaccinate animals before, not after, they are exposed to a particular disease. Consult a veterinarian about the proper timing of vaccinations as part of an overall herd/flock health management plan.

Vaccine Failures

Vaccines are fragile and must be handled according to the manufacturer's label directions to remain effective. Follow these guidelines:

- Before vaccinating animals, consult a veterinarian and read the label and/or packet insert.
- Note the expiration date and the instructions for storing the vaccine properly.
- Most vaccines must be refrigerated during storage and use. Keep the refrigerator temperature between 36 degrees F and 40 degrees F.
- If vaccines or other medications do not require refrigeration, store them out of direct sunlight in a controlled environment.

- Give the right vaccine to the right species of animal. If the label indicates use in swine, do not use it in sheep and goats. This off-label use is illegal.
- Give the proper dosage, in the recommended area on the animal, using the recommended technique.
- Once a vial is open, do not insert a used needle back into the bottle. Always use a clean needle or a transfer needle.
- Use a clean needle for each animal to prevent disease transmission in a herd.
- When finished vaccinating for the day, properly dispose of the remaining vaccine, which does not keep well once the vial seal has been punctured. Once a vaccine vial is opened, the expiration date is void.
- Do not use chemical sterilants to disinfect syringes for modified-live vaccines.
- Properly dispose of used needles in a puncture-proof container.
- Give boosters when a label requires it.

Biosecurity Practices

Not all biosecurity practices are feasible or necessary for every operation. Producers must assess their risks when deciding which practices to adopt. The following practices can be used by sheep and goat producers:

General

- Consult a veterinarian when implementing vaccination and other herd or flock health management strategies.
- Limit the number of people who enter the premises, and know all people who come and go, including consultants, salesmen, deliverymen, maintenance workers and veterinarians.
- If foreign visitors are expected, require that they have been in the United States for at least 5 days and have had no animal contact.
- Keep gates locked at all times.
- Maintain good perimeter fences.
- Inventory ranch vehicles and equipment regularly.
- Lock all vehicles left outside.
- Use a disinfectant, such as bleach, to kill viruses and bacteria. A mixture of 1/2 cup bleach to 1 gallon of water is sufficient. A pump-up sprayer is ideal for applying disinfectant in most situations.
- Sweep out trailers to remove loose dirt, hay and grain, cobwebs, trash or debris.
- Remove mud and manure by scraping or scrubbing both the interior and exterior of the trailer, truck and equipment.
- Soak and wash vehicles and equipment using water and

- detergent or disinfectant. Use a brush or pressure washer if necessary.
- When washing the outside of vehicles and trailers, start at the top and front and work from top to bottom and front to back.
 - When washing the inside of vehicles and trailers, start with the ceiling and work down the wall to the floor. Begin at the front of the trailer and work toward the back.
 - Control pests such as rodents, arthropods and birds, and limit their access to feedstuffs.
 - Train employees to report sick animals, suspicious activity or people, and unusual events.
 - Know your neighbors and set up a crime watch program.
 - Do not advertise when you will be away from your premises.
 - Request that local law enforcement agencies randomly drive by your premises and look for unusual behavior.
 - Create an emergency contact list of resource people in the community.
 - Make sure critical information is readily accessible to any first responders who might be called to the scene. Include maps of the premises, types and locations of chemicals, and an inventory of animals.

Ewe/Lamb, Doe/Kid

- Implement the Sheep Safety and Quality Assurance Program.
- Identify animals clearly.
- Vaccinate animals regularly to increase protective immunity.
- Isolate new animals from the rest of the herd or flock for at least 2 weeks. During this time watch closely for symptoms of illness or abnormal behavior.
- Look for unusual signs in the herd or flock, such as odd behavior; sudden and unexplained deaths; large number of sick animals; unusual ticks or maggots; blisters around an animal's nose; teats, mouth or hooves; difficulty rising and walking; drop in milk production, or a large number of dead insects, rodents or wildlife. Contact a veterinarian immediately if any of these occur.
- Do not let feces and urine contaminate feed and water sources.
- Do not feed on the ground. Use hay troughs, hay racks, feed troughs or feed bunks.
- Do not feed prohibited mammalian-derived protein.
- Develop a carcass disposal plan.
- Disinfect reusable equipment, including tattooers, ear notchers and hoof tools, between animals.

- Use only Food and Drug Administration-approved medicated feed additives in rations and in accordance with the approved label.
- Ensure that all additives are withdrawn at the proper time to avoid violations.
- Strictly follow all government-mandated guidelines for product selection.
- Comply with label directions for all treatment regimens unless otherwise prescribed by a veterinarian.
- Employ extra-label drug use only when prescribed by a veterinarian with a veterinarian client-patient relationship.
- Do not give injections in locations other than the neck region.
- Use needles of appropriate size and gauge.
- Use products with low recommended dosage and administer at proper spacing intervals in the neck, a minimum of 3 inches separating injection sites.
- Administer intramuscular products with no more than 5 cc per intramuscular site.
- Record information for all animals treated individually.
- Record information for all animals that are group processed or mass medicated as a group or lot.
- Provide appropriate nutritional and feedstuffs management.
- Prevent stress, bruising and/or injury during animal handling.

Feedlot

- Implement the Sheep Safety and Quality Assurance Program.
- Monitor housing and lots to ensure proper sanitation and prevent contamination of carcasses.
- Manage rodent and bird populations.
- Keep feed, water and equipment clean. Do not let feces and urine contaminate feed and water sources.
- Provide appropriate nutritional and feedstuffs management.
- Feed the right amount of healthful nutrients.
- Shear lambs to maintain a clean fleece.
- Remove sick animals from pens and house them separately.
- Develop a carcass disposal plan.
- Provide dry areas where animals can sleep.
- Eliminate injection site lesions by administering inoculations via the preferred routes and in the preferred locations.
- Follow withdrawal times for all drugs.
- Inspect and maintain facilities to ensure proper care and handling.

- Prevent stress, bruising and/or injury during animal handling.
- Control mud, manure and parasites.

Fiber

- Implement the Sheep Safety and Quality Assurance Program.
- Maintain adequate nutrition and provide supplements when needed.
- Control internal and external parasites.
- Prevent and promptly treat common diseases.
- Adjust stocking rates to avoid overgrazing. Control mesquite, cedar and prickly pear to provide the best forage production.
- Minimize the effects of poisonous and fleece-contaminating plants through strategic grazing, pasture rotation, control of noxious plants and use of temporary fields.
- Eliminate polypropylene, including hay strings and tarps, from all areas.
- Minimize colored fibers from other breeds and species.
- Do not use branding fluids, except for scorable types only when absolutely necessary.
- Shear and tag ewes before lambing.
- Shear sheep and Angora goats before seeds are released from grasses and other fleece-contaminating plants.

Foreign Animal Diseases Affecting Sheep and Goats

Foot-and-Mouth Disease

Disease-causing organism: Virus
 Mode of transmission: Oral and inhalation
 Symptoms: Blisters or erosions on mouth, lips, tongue, hooves and teats
 Vaccine: Yes, emergency vaccination
 Treatment: No
 Zoonotic: No
 Web link: <http://aevm.tamu.edu>

Rift Valley Fever

Disease-causing organism: Virus
 Mode of transmission: Vector (mosquitoes)
 Symptoms: Fever, anorexia, evident abdominal pain, jaundice, nasal discharge, excessive salivation, abortions and diarrhea
 Vaccine: No
 Treatment: No
 Zoonotic: Yes
 Web link: <http://aevm.tamu.edu>

Emerging/Endemic Diseases of Sheep and Goats

Anthrax

Disease-causing organism: Bacterium
 Mode of transmission: Oral, inhalation and vector
 Symptoms: Staggering, trembling, collapse, terminal convulsions, bloody discharges and death
 Vaccine: Yes
 Treatment: Yes
 Zoonotic: Yes
 Web link: <http://aevm.tamu.edu>

Caseous Lymphadenitis

Disease-causing organism: Bacterium
 Mode of transmission: Break in skin
 Symptoms: Swelling of superficial lymph nodes
 Vaccine: Yes
 Treatment: Yes
 Zoonotic: No
 Web link: <http://www.merckvetmanual.com>

Chlamydia (Enzootic Abortion of Ewes)

Disease-causing organism: Bacterium
 Mode of transmission: Vector, vaginal and uterine secretions
 Symptoms: Abortions, stillbirths, weak kids and lambs, neonatal pneumonia
 Vaccine: Yes
 Treatment: Yes
 Zoonotic: Yes
 Web link: <http://www.merckvetmanual.com>

Coccidiosis

Disease-causing organism: Protozoa
 Mode of transmission: Oral
 Symptoms: Diarrhea
 Vaccine: No
 Treatment: Yes
 Zoonotic: No
 Web link: <http://www.merckvetmanual.com>

Enterotoxemia (Overeating Disease)

Disease-causing organism: Bacterium
 Mode of transmission: Oral (sudden changes in feedstuffs and feeding practices causes *Clostridium perfringens* to release toxins)
 Symptoms: Sudden loss of appetite, profound depression, marked abdominal discomfort manifested by arching of the back and kicking at the belly, loud and painful screaming, profuse watery diarrhea containing

blood, weakness, recumbence and death

Vaccine: Yes

Treatment: No

Zoonotic: No

Web link: <http://www.merckvetmanual.com>

Johne's disease (Paratuberculosis)

Disease-causing organism: Bacterium

Mode of transmission: Oral

Symptoms: Diarrhea, weight loss, swelling under jaw and poor fleece quality in sheep

Vaccine: No

Treatment: No

Zoonotic: Unknown

Web link: <http://aevm.tamu.edu>

Leptospirosis

Disease-causing organism: Bacterium

Mode of transmission: Skin contact, oral, reproductive and inhalation

Symptoms: Abortions, stillbirths, weak lambs and kids, fever, anorexia, decreased performance, jaundice and anemia

Vaccine: Yes

Treatment: Yes

Zoonotic: Yes

Web link: <http://www.merckvetmanual.com>

Listeriosis

Disease-causing organism: Bacterium

Mode of transmission: Oral and vector

Symptoms: Depression, listlessness, diarrhea, paralysis and death

Vaccine: No

Treatment: Yes

Zoonotic: Yes

Web link: <http://www.merckvetmanual.com>

Ovine Brucellosis

Disease-causing organism: Bacterium

Mode of transmission: Oral and reproductive

Symptoms: Late pregnancy abortions, retained placenta, mastitis, lameness and impaired fertility in rams

Vaccine: No

Treatment: No

Zoonotic: Yes

Web link: <http://aevm.tamu.edu>

Q Fever

Disease-causing organism: Rickettsial bacterium

Mode of transmission: Inhalation, reproductive and skin contact

Symptoms: Abortions

Vaccine: No

Treatment: Yes

Zoonotic: Yes

Web link: <http://www.merckvetmanual.com>

Rabies

Disease-causing organism: Virus

Mode of transmission: Skin contact (bite)

Symptoms: Anorexia, apprehension, nervousness, altered temperament, hyperexcitability and death

Vaccine: Yes

Treatment: No

Zoonotic: Yes

Web link: <http://aevm.tamu.edu>

Salmonellosis

Disease-causing organism: Bacteria

Mode of transmission: Oral

Symptoms: Abortion, diarrhea and depression

Vaccine: Yes

Treatment: Yes

Zoonotic: Yes

Web link: <http://www.merckvetmanual.com>

Scrapie

Disease-causing organism: Prion

Mode of transmission: Reproductive and oral

Symptoms: Convulsions, abnormal posture, increased nervousness and excitability, change in temperament, and rubbed-raw areas of fleece

Vaccine: No

Treatment: No

Zoonotic: Unknown

Web link: <http://aevm.tamu.edu>

Soremouth (Contagious Ecthyma)

Disease-causing organism: Poxvirus

Mode of transmission: Skin contact

Symptoms: Crusting lesions around mouth and nose

Vaccine: Yes

Treatment: No

Zoonotic: Yes

Web link: <http://www.merckvetmanual.com>

Tetanus

Disease-causing organism: Bacterial toxin

Mode of transmission: Skin contact and oral

Symptoms: Stiffness, stilted gait, sawhorse stance,

restlessness, recumbence, rigid paralysis and uncorrectable extension of neck and all four limbs

Vaccine: Yes

Treatment: Yes

Zoonotic: Yes

Web link: <http://aevm.tamu.edu>

Toxoplasmosis

Disease-causing organism: Protozoan

Mode of transmission: Oral (cat fecal contamination of feed)

Symptoms: Abortions, fetal mummification, stillbirths, and weak lambs and kids

Vaccine: No

Treatment: Yes

Zoonotic: Yes

Web link: <http://www.merckvetmanual.com>

Vesicular Stomatitis

Disease-causing organism: Virus

Mode of transmission: Oral, inhalation and vector

Symptoms: Blisters and erosions in mouth, tongue, palate and lips

Vaccine: Yes, but not in United States

Treatment: No

Zoonotic: Yes

Web link: <http://aevm.tamu.edu>

Vibriosis (Campylobacter)

Disease-causing organism: Bacterium

Mode of transmission: Reproductive

Symptoms: Abortions and infertility

Vaccine: Yes

Treatment: Yes

Zoonotic: Yes

Web link: <http://aevm.tamu.edu>

Economic Ramifications

In the commercial sheep and goat industry, the major diseases requiring annual treatment or vaccinations are enterotoxemia, soremouth and internal parasites. Assume every doe and ewe has one kid or lamb per year. On the average, drench the females twice per year, drench the babies once per year, and treat the babies twice for overeating disease and once for soremouth. The cost is about \$1 per head to drench sheep and goats and \$0.25 per dose for soremouth and overeating disease, or about \$3.75 to treat a mother and baby for diseases in a normal year. A producer who does not treat for these three diseases could lose up to 15 percent of the lambs or kids to

enterotoxemia, 25 percent of the flock to internal parasites, and 5 to 10 pounds per animal from soremouth. In wet, warm years, the cost to control internal parasites could be much higher. Other diseases treated on an as-needed basis add to this cost. Several diseases can cause abortions. If abortions become a problem, a producer must send a fresh fetus and the placental membranes to the diagnostic lab to identify the disease causing the problem. A producer will generally suffer a great economic loss the first year; however, once the disease is identified he or she can vaccinate animals against that disease in the future.

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