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# Biosecurity for Your Goats

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## Quarantined.... No Animal Movement.... Shows Cancelled!

These are all notices neither you nor the goat industry wants associated with goats or goat farms. These generally are used to stop the spread of economically important infectious diseases from one farm to another. Even less economically significant diseases will impact the productivity and, thus, the profitability of your flock. Biosecurity is a system of practices designed to reduce the risk of introducing disease to an operation and prevent disease spread among animals. Many countries have implemented biosecurity protocols designed to protect their animal agriculture and food security, but biosecurity programs are also important for individual operations.

Biocontainment is closely related to biosecurity but focuses on procedures to control disease spread within a herd rather than prevent disease introduction to a herd. Good biocontainment practices also reduce the risk of infections being transmitted to your family, friends, or visitors to your farm. Together, biocontainment and biosecurity programs will decrease infections in your herd, reduce the risk of animals on other operations becoming infected with organisms from your farm, and decrease the likelihood that you, your family, friends, or visitors will be infected with organisms from your goats.

Many producers believe that they do not need a biosecurity program, so let's look at an example in which a lack of biosecurity could wreak havoc. Say that a producer of registered Boer goats who sells his goats all over the U.S. and Canada buys a goat from one of his fellow producers who offered him a "real deal" because the goat was not doing well. When the goat arrives at its new home, it is

obvious that the goat has footrot; it also has a draining abscess under its ear. Not so obvious is the fact that it has multiple drug resistant *Haemonchus contortus* in its abomasum (stomach) and is infected with chlamydia, which causes abortions. In a short period all of these disease agents have been introduced to the new farm. Now the herd has footrot. Anthelmintics (dewormers) are no longer effective. Goats that have been sold are being sent back because they have abscesses. The pregnant does are aborting. Before long, no one wants to buy this farm's goats. Time, resources, and energy on the farm are spent treating sick goats, production is down, and the best buck in the herd has an abscess.

All of this could have been avoided had this farm had even a simple biosecurity program that called for: knowing the source and health history of new animals; isolating new animals from the main herd and testing them for appropriate diseases; designing strategic vaccination programs; implementing sanitation procedures, such as disinfecting equipment and implementing proper manure management; and managing and regulating visitors and animal traffic. Many other key components of disease control are often overlooked. For example, minimizing stress helps animals resist and overcome disease challenges. Animal stress can be reduced by providing a comfortable and clean environment, sufficient housing space, and adequate feed

bunk space. Providing quality feed and water, maintaining a balanced ration with proper nutrient levels, and providing transition diets to herds around kidding also help decrease nutritional stress and ensure optimal immune function for disease resistance. Controlling your animals' exposure to wildlife, insects, and wind-borne pathogens are other areas for consideration.



*A sign such as this at the American Institute for Goat Research farm can alert visitors to a farm's biosecurity protocol.*

At its essence, biosecurity is health promotion and protection for your goats. This chapter provides a very basic view of biosecurity and is meant to help you better understand how and why biosecurity practices work. For more specific and timely information on biosecurity, talk to your veterinarian; he or she can also help you develop a framework and customize a biosecurity program most effective for your farm.

### Risk Assessment

What are the biosecurity risks on your farm? Are your goats intensively raised or do they have access to open range where direct contact among kids is minimal and fecal material is dispersed widely?

What diseases are already on your farm? What diseases are you willing to live with, and which ones do you want to get rid of (the most costly)? How do you measure the cost of disease? What is the principal source of income from your goats and what diseases are most likely to impact that income source? For example, if selling milk is your primary source of income, then diseases that cause a reduction in milk production and quality would be high priority. If your principal income comes from selling kids for slaughter, then diseases that result in abortion, lower kidding ratios (kids born to does bred), and reduced weight gain would be of highest priority. Keep in mind that many practices implemented to control one disease will also stop transmission of other diseases. For example, some producers have found when they control the spread of caprine arthritis encephalitis (CAE) in their herd through removing newborn kids prior to nursing, they can also control caseous lymphadenitis (CL) and Johne's disease.

### Cost

The adoption of biosecurity practices is a balance of the benefits and costs associated with implementation. Benefits accrue only if there is a risk of disease in the first



*Monitor animals regularly.*

place. For example, vaccinate only for diseases that pose a risk to your animals. Biosecurity works similar to an insurance policy in that you are betting the costs of the biosecurity procedures are less than what it would cost if you happened to get a new disease. The benefit is lower out of pocket costs and potential increased productivity. Goat herds with relatively unhealthy animals will incur added costs for vaccines and medications to treat clinically sick animals. If disease control programs are initiated, the cost of diagnostic tests will be an added expense. In addition, dead animal disposal is both an economic and environmental problem.

The cost of disease is usually thought of in terms of animals that die. Dead animals, however, usually represent only a small percentage of the total cost of disease. For example, animals that become temporarily disabled from disease have to be treated, which can entail veterinary fees, medications, housing, and labor. In addition, animals suffering from disease usually do not gain weight or reproduce, which affects productivity. The good news is that most of these animals recover. The bad news is that some of these animals will never really catch up with their contemporaries and will be poor producers throughout their lives. They will not weigh as much at slaughter, their carcass will not grade as well, there will be more condemnations and carcass trim and, of course, you will need to keep the animal until all drug residues are gone. Animals that do not recover may require the same or even higher costs in veterinary fees, medication, housing, and labor, but these animals will never return to production and will either die or be euthanized. In these cases, producers end up with dead animals on which they spent a great deal of time and money prior to their deaths.

The time and resources spent with sick animals could be used more productively on healthy animals. Usually, the majority of animals with disease are subclinical. Only a small percentage actually shows signs of illness (the tip of the iceberg principle). Even without clinical signs of illness, these subclinically affected animals are often less productive than those that were never infected.

In addition to production costs, there are costs associated with losing markets. If you are selling fat goat kids to a local slaughter house and one goat has a large CL abscess then you will probably lose that market. If you are selling breeding animals locally and word gets out that several farms experience abortion storms after buying one of your does, then you will probably lose that market. If one of your does tests positive for any of the federally or internationally regulated diseases (e.g., scrapie, tuberculosis) you will not be able to sell animals until the disease has been eliminated. There are also some intangibles associated with the presence of disease

in a herd, including loss of reputation and loss of pride in the operation. It just is not much fun to raise goats when there are always a number of sick or dead goats, or when people think that your goats are not good enough.

Disease prevention programs always entail increases in labor costs, capital outlays for biosecure facilities, and expenses for disinfectants and other materials. Some producers somehow believe it is always easier to spend money to treat sick animals than it is to spend money to prevent them from being exposed to disease. The real question is not whether you need a biosecurity program, but how much of a program can you afford?

At this point, make a list of the diseases already in your herd and then write a list of diseases you want to prevent. Table 1 lists common critical diseases of goats. Then picture your farm as it is now and imagine what your farm would be like if any of those diseases were introduced to your herd. What value do you place on keeping those diseases out of your herd? Now list all of the ways those diseases could enter your farm. How biosecure are you? Is it time to step up to the next level? If it is, then you need to develop a cost-effective biosecurity program for your farm. This is best done in collaboration with your herd veterinarian.

You may ask why it is so important to work with a veterinarian. The control or prevention of some diseases can be challenging, expensive, and depending on the operation, unrealistic. A veterinarian will be able to help you determine where to begin and help you develop an efficient cost-effective program. As an example, let's examine the particularly challenging infection caused by *Coxiella burnetii*. *C. burnetii* causes what's known

as coxiellosis in goats, and is better known by the name of the infection in humans, Q fever. By all accounts, *C. burnetii* is fairly ubiquitous in nature, and is a common infection in sheep, goats, and cattle in the U.S. A national dairy cattle study conducted in 2007 found that bulk milk tanks on more than 75% of dairy cattle operations were positive for the organism *C. burnetii*. While most animals, including domestic cats and wild animals, can become infected with *C. burnetii*; cattle, sheep, and goats are considered the most important domestic reservoirs of the bacteria. Abortions due to *C. burnetii* are primarily seen in sheep and goats, but many infected sheep and goats have no signs of illness. Diagnostic tests are available but they are not 100% reliable and these may be negative when the animal is infected. Goats can also be shedding the organism and yet have negative blood tests. In this case, test results for the herd are more beneficial in determining the likelihood an individual animal is infected. Knowing whether a newly purchased goat is infected may only be important if you know your herd is truly negative for *C. burnetii*. It is frequently the introduction of a new (and infected) animal to a previously negative herd which precipitates an abortion storm. If your herd is *C. burnetii* positive, knowing the infection status of a new addition is likely not important for this disease. In summary, your veterinarian can help you determine when to test, what to test for, and what to do based on your test results.

**Table 1. Critical contagious diseases of goats**

<b>Brucellosis, Bacteria: <i>Brucella</i> species</b>	
Importance:	A contagious zoonotic disease of livestock and wildlife that has significant consequences for animal and public health and international trade. Bacteria of the genus <i>Brucella</i> cause the disease. Brucellosis occurs primarily in cattle, bison, and swine, although cervids, goats, sheep, and horses are also susceptible. Spontaneous abortions are often one of the first indications of infection. Birth of weak kids and mastitis are also possible signs of infection.
Transmission:	Transmission typically occurs through contact with placenta, fetus, and birth fluids, but can also spread from blood, semen, urine, and milk. The organism can remain infectious for long periods of time on equipment, wool, hay, water, and other objects. Infected animals can shed the organism in milk for months to years.
Prevention*:	No goat licensed vaccine available in the U.S. Prevention includes ensuring that new additions are <i>Brucella</i> test negative and from herds with no known history of Brucellosis.
Epidemiology:	Certain species of the <i>Brucella</i> organism can be transmitted between cattle and goats. Brucellosis is also contagious to humans through consumption of raw milk or raw milk products such as cheese and through contact with infectious birth products. A successful surveillance strategy for this regulated disease has made Brucellosis rare in domestic animals in the U.S. Feral pig populations are more commonly infected with Brucellosis.

<b>Caprine arthritis encephalitis (CAE), Small ruminant lentivirus: <i>Retroviridae</i></b>	
Importance:	Causes lifelong infection which may eventually manifest as arthritis, neurologic weakness of the legs, pneumonia, mastitis, reduced milk production or progressive weight loss.
Transmission:	Infection is transmitted primarily through virus-infected colostrum or milk to kids, also horizontally through use of needles on more than one animal, direct contact, and other means.
Prevention*:	Feed heat-treated colostrum and pasteurized milk to kids while separating positive does from newborns before nursing. Conduct serological testing and remove positives. Allow new additions only after they have tested negative and if they are from test-negative herds.
Epidemiology:	Common infection in the U.S., especially in dairy goats. Once infected, goats are infected for life. Most goats are infected when young.
<b>Caseous lymphadenitis (CL), Bacteria: <i>Corynebacterium pseudotuberculosis</i></b>	
Importance:	Internal abscesses result in unthrifty goats and carcass condemnation at slaughter. Un-sightly external abscesses may decrease breeding value and age of culling. CL is a zoonotic pathogen but human infections are rare.
Transmission:	Primarily horizontal via direct contact or from contaminated objects such as feed troughs, shears, ear taggers, tattoo tools, etc. Bacteria are shed from draining abscesses and infect others through open wounds or through skin punctured by a contaminated object.
Prevention*:	Purchased new additions should be abscess free and from test-negative herds. Vaccination should only be used in infected herds as vaccinated goats will be seropositive.
Epidemiology:	Disease most commonly infects sheep and goats and can be transmitted between the species. Not all abscesses are visible as some are internal. Disease may become visible months after infection.
<b>Chlamydial abortion, Bacteria: <i>Chlamydia abortus</i></b>	
Importance:	One of most common causes of abortions in goats and is a zoonotic pathogen.
Transmission:	Bacterial shedding is greatest around time of abortions or births but also occurs in vaginal secretions in the days before and after abortions. Shedding also occurs in feces.
Prevention*:	New additions should be from abortion-free and test-negative herds. Aborting does should be isolated and aborted fetuses and placentas removed immediately to reduce transmission. No licensed vaccine for goats exists currently, but there is a vaccine licensed for use in sheep. Discuss with your veterinarian whether vaccination is appropriate for your herd.
Epidemiology:	Zoonotic pathogen usually of goats and sheep, but can also infect cattle, pigs, horses, and deer. Abortions usually occur in late gestation.
<b>Contagious ecthyma (sore mouth, orf), Parapoxvirus</b>	
Importance:	Affected kids may not nurse properly, may cause mastitis in affected does, and secondary bacterial infections, ultimately resulting in kid losses or poor does. This is a zoonotic pathogen.
Transmission:	Spread between sheep and goats and to humans through direct contact with scabs of infected animals. The vaccine is made of a live virus and will cause disease in humans and animals.
Prevention:	Only vaccinate if sore mouth is present on the operation; purchased new additions should be from known disease-free herds.
Epidemiology:	Zoonotic viral pathogen of sheep and goats. Boer and Boer crossbred goats especially susceptible to severe symptoms. Asymptomatic sheep and goats can spread infection. Virus is extremely hardy and can remain infectious in scabs shed into environment for months to years, and serve as a source of infection to susceptible animals.

<b>Coxiellosis (Q fever), Bacteria: <i>Coxiella burnetii</i></b>	
Importance:	One of most common causes of abortions in goats and a zoonotic pathogen.
Transmission:	Transmission occurs primarily through aerosolized organism during birth or abortion. Infected animals will also shed organism in feces, milk, and vaginal secretions for weeks to months after kidding.
Prevention*:	New additions should be from test-negative herds with no history of abortion storms and should themselves be test negative. No vaccine is currently available in the U.S.
Epidemiology:	Zoonotic bacterial pathogen in which cattle, sheep and goats are important reservoirs, but also found in the majority of other mammals. The organism is hardy and remains infectious in the environment for long periods of time. The highest numbers of organisms are shed during an adverse pregnancy event (abortion, stillbirth, neonatal weakness).
<b>Gastrointestinal worms, Parasites: <i>Haemonchus contortus</i> (Barberpole worm)</b>	
Importance:	This is the most pathogenic worm species in goats and sheep in the U.S. It accounts for 80 to 90% of parasite eggs shed in goat feces in the Southern U.S. and less so in northern climates, but still substantial. May cause severe anemia and weight loss. Resistance to dewormers is common and is a serious issue for producers.
Transmission:	Eggs from infected sheep and goats hatch into infective larvae while in the feces. These larvae then move onto surrounding forage where they will be eaten. Dewormer resistance is developed through overuse of dewormers.
Prevention:	Have new additions dewormed before arrival at your premises. Deworm and fecal egg count new additions while they are quarantined on your premises. Use the FAMACHA® card to treat only those most at risk for illness from <i>Haemonchus</i> . Some producers over time keep only those goats not affected by <i>Haemonchus</i> .
Epidemiology:	Increased numbers of eggs passed in young and pregnant goats around the time of kidding.
<b>Johne's disease, Bacteria: <i>Mycobacterium avium</i> subspecies <i>paratuberculosis</i></b>	
Importance:	Underdiagnosed fatal gastrointestinal disease primarily of goats and other ruminants which causes weight loss, reduces productivity, and increases culling.
Transmission:	Kids (less than 6 months of age) are most susceptible and can be infected in utero, through ingestion of infected colostrum, milk, or manure contaminated grass, water, or feed. Older goats may become infected, especially if immunocompromised (poor nutrition, stressed, etc).
Prevention*:	New additions should be from test-negative herds, avoid grazing on pastures where goats, sheep, or cattle from herds or flocks of unknown disease status have grazed, and avoid contact with sheep or cattle of unknown disease status (including milk or colostrum from such animals).
Epidemiology:	A healthy appearing goat may be infected and not show signs for years but still shed the organism. The disease can be transmitted from one ruminant species to another.
<b>Scrapie, Prion or protein-like agent</b>	
Importance:	This is a fatal degenerative disease of sheep and goats believed to be caused by prions, an abnormal form of a normal cellular protein that transforms the normal protein into an abnormal form. Its presence in U.S. sheep and goat populations prevents the export of breeding stock, semen, and embryos to certain countries. In infected flocks and herds, it causes economic losses due to reduced productivity and early death of infected animals. Infected goats will eventually show neurological signs, weight loss, and behavioral or gait changes. This is a USDA regulated disease which is planned for eradication.

<b>Scrapie, continued</b>	
Transmission:	Kids are most susceptible to infection in the first few months of life. Highest risk for transmission is usually at birth when infected doe kids or ewe lambs. Infectious particles are then orally transmitted to newborns in the vicinity.
Prevention:	New additions should be from herds with no known scrapie-like illness and preferably no known exposure to sheep. Do not allow goats to come in contact with sheep flocks.
Epidemiology:	Disease is rare (<0.1%). The agent survives environmental conditions and most disinfectants. Goats with sheep contact have greatest risk for infection.
<b>Tuberculosis, Bacteria: <i>Mycobacterium tuberculosis</i> complex</b>	
Importance:	A contagious zoonotic disease of livestock and wildlife that has significant consequences for animal and public health and international trade. Rare in U.S. goats, but certain geographic regions of the U.S. have greater incidence in wildlife and cattle. This is a USDA regulated disease.
Transmission:	Inhalation of infected droplets exhaled by the lungs of an infected animal is the usual mode of transmission, but infection through ingestion (usually by milk) can also occur.
Prevention:	New additions should be from TB-negative herds, and should be themselves intra-dermal skin test negative. Reduce herd exposure to wildlife (deer, elk, pigs, bison) which can be reservoirs of infection.
Epidemiology:	Can be transmitted between species (including humans). Goats can serve as a reservoir for cattle and human infections, or become infected by cattle or human infections.

*\*Negative serologic test results for individual animals do not necessarily mean an animal is not infected. All test results should be discussed with your herd veterinarian to determine the appropriate course of action.*

## Disease Exposure

Most commonly, diseases are introduced to a herd through new additions, but they can also be introduced by a visitor that recently visited another livestock operation, the tires of a vehicle that just came from another operation, wildlife, or vectors such as flies or ticks. Do you know how diseases usually enter your herd?

### *The case for a closed herd*

A closed herd can mean different things. At its strictest, a closed herd is one in which no animals from other operations are introduced, no animals that leave the farm are allowed to return, and there is no contact with livestock from another operation (fence line, commingled grazing, etc.). Many operations, however, close their herd to new does, but will bring in new bucks. Other operations do not allow the addition of new animals, but do allow the return of animals that left the operation to attend shows or other events. Any new animal (doe, buck, or kid) or any animal leaving and then returning to the farm presents a risk. Additionally, risks may come to you in the form of two-legged visitors (other farmers and even you - especially if you visit other farms, shows, etc.), the feed supply truck or other vehicles or equipment that go from farm to farm, four-legged visitors such as wild deer, coyotes, or other wildlife, and six-legged visitors such as ticks, flies, etc.

Many very large swine operations provide an excellent example of a closed herd. These operations buy only semen and embryos (no new animals are introduced to herd), have an 8-foot security fence around the farm, enclose pigs in buildings with screened ventilation, never allow animals back on the farm once they leave, do not allow any visitors on site, and require that employees change clothes and shower prior to entering the farm. This setup is financially smart for large operations which could lose thousands of dollars because of a new infection. While this type of closed herd is not usually feasible for goat operations, implementing some of these biosecurity practices will help reduce the risk of introducing disease. Which practices you choose to implement depends on the level of risk on your farm, the diseases already present, and the amount of money or time you are willing to devote to biosecurity.

### *Adding new animals to the herd*

All of the major diseases of goats can be carried by healthy appearing goats. The introduction of new animals from outside sources is the most common way herds acquire new infections. It is usually necessary to bring new genetics into breeding herds on a regular basis; otherwise, herds will suffer from inbreeding. The safest way to introduce new genetics is to bring in only frozen semen or embryos. Even frozen semen or embryos,

however, can serve as a source of disease. Once you have decided on an animal whose genetics are necessary for your herd, what do you do next?

### Step 1: Disease history

Find out the disease history of the source herd, the results of previous testing in that herd, and the status of the herd with any certification program. Disease histories can be obtained from the owner of the herd and through the farm's veterinarian. Have your veterinarian call their veterinarian to find out what diseases the herd has been tested for, what diseases are present on the operation, and what diseases are known to be absent.

Buy goats only from herds that are Export Certified in the Scrapie Flock Certification Program. For more information on scrapie and the federal scrapie eradication program, go to [http://www.aphis.usda.gov/animal\\_health/animal\\_diseases](http://www.aphis.usda.gov/animal_health/animal_diseases). If you decide to buy goats not enrolled in the Scrapie Flock Certification Program, know that



*Scrapie ear tag.*

the greatest risk factor for goats becoming infected with scrapie is exposure to sheep with scrapie. If buying goats from operations that own sheep or have goats that have had contact with sheep, make sure that the sheep flock in question is Export Certified in the Scrapie Flock Certification Program. If you buy goats from operations that also have cattle, make sure that the cattle herd is accredited tuberculosis free.

The scrapie website above will also provide information on which goats need official ear tags or other form of identification. All states require certain goats to be officially identified before change of ownership. It is your responsibility as a person who owns or handles goats to know and adhere to state requirements for your respective state and, if moving out of state, to know and adhere to the federal requirements and those of the states to where animals are being moved. For further information, visit <http://www.eradicatescrapie.org/>.

Keep in mind that operations that do not test for any diseases do not know what diseases are present. If operations have tested all goats for CAE or CL and all were negative, then CAE or CL is probably not present. However, a negative test from just the animal(s) being purchased does not mean the animal has not been exposed to the disease and won't become ill down the road. Some diseases are much more important than others.

The important thing when buying new animals is to know what diseases are not present in the source herd.

### Step 2: Current disease status and testing

Determine the disease status of individual animals before you make a purchase. For each animal, you and your veterinarian should review all records pertaining to immunizations, diseases tested for, and illnesses treated. Next, request that individual animals undergo a panel of tests to determine their disease status. Only test for diseases that may affect your goats. For instance, in the U.S. it would be foolish to test a goat for foot and mouth disease (FMD) because the disease is not present in the U.S.; however, it would be reasonable to test your goats for Johne's disease. Some testing can be done only by examination. For instance, to determine if a goat is free of lice someone has to look at it, ideally your veterinarian. If it is not practical for your veterinarian to do the examination then the veterinarian who works for the source herd would be a suitable alternative.

### Step 3: Quarantine

Assuming the goats (and source herd) test negative for the disease you're looking for - and have historically been tested and found to be negative for the disease - then you could bring them to your farm, but keep them quarantined. The ideal duration for quarantine is 60 days. Many farms quarantine new animals for only 21 days. A longer quarantine is more likely to reduce any transmission of a previously unrecognized infection. A 2009 study of the U.S. goat industry (NAHMS, 2009) showed that nearly 50% of goat operations always isolated new additions and, on average, these new additions were isolated for 21 days. Again, many diseases have a longer incubation period than this, so the longer you can quarantine new goats, the lower your risk of introducing a new infection to your herd.

What is a quarantine facility? This is an animal holding facility that is physically separated from the rest of your herd. There is no fence line contact, no aerosol contact, no manure runoff contact, and no potential for disease spread by fomites or vectors. Ideally, it is far enough away that you need to drive there. A manageable protocol on a large farm is to have an employee that only takes care of the quarantined animals. On small farms,

make sure the quarantined animals are visited at the end of the day. Change boots and clothing before entering the quarantine facilities and do not go back to the main herd after you have been in the quarantine facilities. Feed, feed buckets, bedding, and manure from these animals cannot be exposed to the nucleus herd. While the most important issue here is transferring disease back to the nucleus herd, you also don't want the quarantined animals to be infected by the nucleus herd.

During quarantine, new goats should be dewormed and their feces tested for parasites. Deworming goats should ideally prevent the introduction of any new parasites to your operation, but unfortunately anthelmintic resistance is a severe problem in the goat industry. Fecal testing goats 2 to 3 weeks after deworming will help you determine whether there is resistance to dewormers by identifying parasite eggs persisting in the feces. A more useful method for identifying resistance would be to conduct a fecal egg count reduction test. Briefly, this method calls for conducting a fecal egg count initially, then deworming, and 2 weeks later doing another fecal egg count. The difference between the first and second egg counts provides a measurement of the dewormer efficacy. More than a 95% reduction in eggs indicates a susceptibility of the parasites to your dewormer. Any less than 95% egg count reduction represents some level of resistance. A more detailed explanation of this method can be found on the website of the American Consortium for Small Ruminant Parasite Control (<http://acsrpc.org/>) and in the chapter on herd health procedures.



Worm egg.

**Step 4: Physical examination and disease retesting**

At the midpoint of the recommended quarantine period (30 days), a careful physical examination should be performed on the new goats to make sure they are free of physically obvious diseases. At the same time, consider retesting the animals for whatever critical diseases you are trying to exclude from your herd. It is possible that purchased animals will test positive for a disease to which they tested negative at the time of purchase. The following situations could cause this scenario:

1. The animal was incubating the disease at the time of purchase.

2. The initial test was a false negative.
3. The stress of movement caused a latent infection to reactivate.
4. The animal was exposed to the disease in transit or after reaching your farm.
5. Some form of laboratory error has occurred.

**Step 5: Vaccinations**

Vaccinate incoming animals against any known endemic diseases in your herd. For example, if you had chlamydia in your herd you would want all new animals to be fully immune to the disease before entering the home herd. Typically, vaccinated animals are not fully protected until 3 to 4 weeks after vaccination, which is why isolating newly vaccinated animals is important.

**Step 6: Acclimate new animals to your herd**

Incoming animals should be acclimated to your home herd's environment, feed, water, and any disease. For instance, if you purchased goats from Canada and brought them to a hot, humid place like Louisiana you should slowly acclimate the goats to that type of environment. Doing so allows the animals' innate resistance to be minimally stressed. The same holds true for feed and water. Goats presented with sudden changes in feed and water might not eat or drink as much as they should. In contrast, goats might eat too much of a new ration, which may cause gastrointestinal upset, potentially setting the stage for infectious diseases.

**Step 7: Expose to small group of goats**

At the end of the quarantine period, producers should expose new animals to a small sentinel group of animals from the home herd. Sentinel animals act like a "canary in a coal mine;" if the sentinels do not get sick after commingling with new animals, then it is safe to assume that the rest of your herd will not get sick. If the sentinels do get sick, however, then they can be kept in quarantine until cured or removed from the herd. At any rate, at least your whole herd did not come down with the disease and you have proven to yourself that the incoming animal is not a carrier of disease.

**Other sources of direct contact**

Direct animal contact can also occur along fence lines, at shows or fairs, or during transportation with other goats. If your farm shares a fence line with a neighbor who has goats, there will be fence line contact between your goats and your neighbor's goats. The solution to this is to double the fence on the perimeter, which creates a corridor between the two fences. Goats snort and blow nasal secretions when introduced to new goats. These droplets can disperse up to 3 feet (1 meter), so make sure that animals are separated by at least twice that distance (6 feet or 2 meters).



## Livestock shows

Shows provide a real challenge to biosecurity programs. Shows create an environment where animals of different species, breeds, ages, geographical locations, management systems, and disease status come together for a brief period and intermingle. The animals are stressed from travel, noise, and unfamiliar settings. Stressed animals tend to shed organisms more often than animals not stressed, and uninfected stressed animals can be more susceptible to disease. A show is like elementary kids going back to school in the fall. There is always an outbreak of respiratory disease, diarrhea, or flu. The ideal solution is to never bring home an animal from a show. For terminal meat class shows that is the obvious solution, but it is not practical for breeding class shows.

### Before the show

Make sure that the exhibition center provides adequate housing, that pens are cleaned and disinfected, and that ventilation is adequate. Confirm that all animals entering the show will be examined by the show veterinarian and that all state and local animal health laws will be enforced. Work with your veterinarian to establish a herd health program for your show goats and for the goats staying home that will be exposed to the show goats when they return. Do not mask signs of illness in your goats. If they are sick, don't take them to a show.

Make sure that you comply with your individual state requirement for official identification of the goats going to the show. The accelerated National Scrapie Eradication Program (NSEP) requires most breeding animals and all animals over 18 months of age to have official identification applied before interstate transport or change of ownership. This is typically accomplished using an official ear tag with a unique flock identification number. Producers can obtain official ear tags for free from the USDA by calling: 1-866-USDA-TAG (873-2824). Many states have identical requirements to the USDA interstate requirements, while other states have additional require-

ments regarding intrastate movement and/or interstate movement, and some states exempt certain classes of sheep and/or goats. It is your responsibility as a person who owns or handles goats to know and adhere to state requirements for your respective state and those of the states to where animals are being moved.

Make sure that you have performed all required health tests, and that you have a current certificate of veterinary inspection. When possible, minimize stress on your goats by putting them in pens that resemble the pens at the exhibition facility, and use the same type of bedding, feed, and water source that you will use at the show. Run fans in the goat barn at home. The white noise will be similar at the show. Transport your goats in your own trailer. Avoid traveling in a commercial trailer or commingling with other livestock. If using a commercial trailer or borrowing one from someone else, it should be cleaned and sanitized prior to coming onto your premises. And certainly, before your goats are loaded.

### At the show

Keep your goats comfortable. Use adequate bedding and fans to provide white noise and ventilation. Avoid sharing grooming equipment, feed buckets, manure shovels, etc. If you loan out equipment, disinfect it before using it on your goats. Discourage visitors from touching or feeding goats by putting signs up. Practice good personal hygiene (wash your hands before handling your goats or your goats' feed). Try to get a corner pen so that animal traffic and contact is minimal. You want to reduce the stress of going to a show as much as possible so your goats' immune system has the best chance of fighting any pathogen encountered.

When showing, it is a good idea to open your own goat's mouth thereby preventing the judge, who has just been checking other goat's mouths, from spreading anything to your goats.

### After the show

Disinfect all equipment you took to the fair, including your trailer. Place returning goats into your quarantine system, and watch carefully for signs of clinical disease. Pamper your goats. They are more exhausted and stressed than you are.

### Diseases from other species

In addition to limiting contact between your goats and other goats it also important to limit contact between your herd and other animal species. In general, the more closely related the animals are to goats, the more danger they present in terms of disease transmission. For example, goats and sheep are affected by the same parasites. Goats and cattle share a number of diseases (TB, Johne's disease, etc.). Unrelated animals are not



Scrapie compliance encouragement poster.

necessarily safe. For instance, toxoplasmosis is a disease that causes abortions in goats. It is caused by a parasite which also infects humans, that completes its life cycle only in cats, and is transmitted in cat feces. For this reason pregnant women are told to avoid changing litter boxes. The cat is the biological vector for the disease agent and becomes infected with toxoplasma by eating mice. Cats defecate in the goats' feed bin, contaminating the feed. Both adult cats and kittens will shed millions of organisms for as long as 3 weeks after infection. Previously exposed adult cats will shed less of the organism. So spaying and neutering cats and keeping only adult cats on the premises is a good idea. Cats can also serve as mechanical vectors. It is amazing how much manure and how many disease agents can attach to the foot of a cat, which then travels from pen to pen and trough to trough.

While it is true that cats control rodents and that rodents can transmit diseases such as leptospirosis in their urine, cats are generally inefficient at rodent control. If you exclusively rely on cats to control mice and rats, then you will have a rodent problem. In addition to cats, rodents can be controlled using traps and baits, but there are obvious dangers to the cats with this system.

### *Diseases introduced by fomites*

Fomites are objects that may be contaminated with infectious organisms and help to transmit diseases. The major categories of fomites that may expose your goats to new diseases are: people, trucks and trailers, feed, and water.

#### **People**

People include friends, neighbors, buyers, veterinarians, employees, and delivery personnel. Recognize that some of these fomites are more dangerous to your goats than others. A friend from the city who has no livestock is a minimal threat. A veterinarian that has just come from treating a sick goat and is wearing unsanitized boots and overalls may be a serious threat. A visitor from another country who happens to be wearing the same shoes they wore on their own farm could be a really serious threat.

Facilities with extremely high biosecurity standards discourage casual visitors from entering livestock holding areas. When visitors are allowed, they are required to disrobe, shower, and dress in protective clothing and boots provided by the facility. Although your operation might not need requirements this strict, in general it is best to keep people (especially other livestock producers) from getting in the casual habit of walking through your facility. If at all possible, set up your pens so that goats can be observed from outside the pens, or put all of your sale goats into a separate pen and don't move them back to the home herd.

Footwear can be a fomite. People who wear boots that cannot be sanitized and have been around livestock during the last week present a threat. For those people, keep some disposable plastic boot covers handy or keep some spare boots around. For people with boots that can be sanitized, a boot scraper, boot wash, and sanitizing dip are practical ways to minimize contamination. For visitors who will be handling animals on the farm, hand washing and protective clothing is appropriate. Have a sink and soap handy for before and after visits. Hand washing after visits is especially important for children and people with compromised immune systems. Remember that goats can carry zoonotic diseases (diseases passed from animals to humans). Protective clothing can be



*Simple preventive measures, such as disposable boots, can keep diseases off your farm.*

coveralls, aprons, jackets, etc. Just make sure that the protective clothing covers the clothing of your visitors. At first your visitors will think that you are crazy when you ask them to follow these procedures. In the long run, you'll find that people who want to buy animals from you will appreciate the obvious efforts you make to keep your animals healthy and disease free.

Do not let visitors enter your goat operation if they have been in a foreign country within the past 5 days. Many countries have serious goat diseases not present in the U.S., one of which is foot and mouth disease (FMD), an economically serious disease. FMD is a severe, highly contagious viral disease of cattle, pigs, sheep, goats, and other cloven-hooved animals. It causes fever and blister-like lesions and erosions on the tongue, lips, mouth, teats, and between the hooves of affected animals. There are many biosecurity procedures in place at U.S. international

airports that reduce the likelihood of a person introducing foreign animal diseases to the country (the national level biosecurity mentioned earlier), but the risk is still present. More information on FMD can be found at: [http://www.aphis.usda.gov/publications/animal\\_health/2013/fs\\_fmd\\_general.pdf](http://www.aphis.usda.gov/publications/animal_health/2013/fs_fmd_general.pdf) or by searching for foot and mouth disease on the APHIS website.

### Trucks and trailers

Trucks and trailers used for hauling livestock accumulate manure and other body fluids. If these vehicles are not washed and sanitized between loads they can serve as very efficient fomites. If you are buying or selling animals that will be transported by truck or trailer, inquire about the provisions the driver makes to ensure that his vehicles are sanitized. Also, ask whether livestock from other operations will be transported with your animals. If your goats get on a trailer with goats from 10 other farms they will share the diseases from all 10 farms. If you are trying to sell superior health status goats you have a problem and need to find a new transporter.

When a vehicle comes to pick up your animals have the driver park outside the livestock area and bring the animals to the vehicle. Doing so ensures that feces falling from the trailer will not be in your biosecure area, and it also prevents any animal that might escape the trailer from contaminating a large portion of your livestock area. If you have a loading area on your farm, place it at the quarantine area of the pen from which you sell goats. Similar arrangement should be made for feed trucks and other farm service vehicles.

### Feed

Feed can be a source of infections such as *Salmonella*. Feed can become contaminated at the mill, store, or on your farm by feces of birds, snakes, cats, or rats. The solution is to buy feed from reputable suppliers and try to minimize storage times. On the farm, keep the feed in rodent-proof containers and avoid having spilled grain on the premises as it attracts birds and rodents.

### Water

Clean and safe water is crucial to healthy livestock. Water for your farm may be supplied by a municipality or other public water source, a private well, or surface water such as a river, pond, or lake. In most cases, municipal water is a very safe source of drinking water for livestock and it is the responsibility of the municipality to ensure its safety. However, there have been instances in which even municipal water was a vehicle of disease. If the water is from a well or surface water, you are responsible for ensuring this water is safe for your livestock. Well water can be a source of contamination from runoff and may serve as a source of disease. Probably of more concern is



*Livestock trailers should be cleaned and disinfected after use.*

surface water in ditches and ponds. Water that flows onto the property from other livestock enterprises should always be fenced off, not used, and not allowed to contaminate your water source. This water can be carrying pathogens or chemicals which could make your goats sick.

Typically, drinking water is tested for the presence of bacteria. It may also be tested for the presence of metals, salts, pesticides, and other compounds. If your water is from a source other than a municipality, have it tested periodically. Most states offer water testing so ask your veterinarian, extension agent, or state health department about available services.

Bacteria tested for in water are often reported as either fecal or total coliforms. Total coliforms include bacteria that are found in the soil, plants, and in the digestive tract of animals. While they are an indicator of water quality and the levels should be low, they may not be the most relevant result for your farm. Fecal coliforms are typically present in large numbers in the digestive tract of warm-blooded animals and humans. Therefore, they indicate fecal contamination of water. Some fecal coliforms, such as *Salmonella* or *E. coli*, may cause disease so this water should not be used for drinking. While not all fecal coliforms are pathogenic, their presence indicates the potential for a health risk.

Water should also be tested for nitrates, salinity, pH, and chemicals. Many chemicals are only tested for when there is a particular concern or suspicion of their presence in excess. For this reason, you should work with your

veterinarian or extension agent to better understand the concerns for your area and your farm.

If surface water passes through your operation, you want to ensure the water which leaves your operation is not contaminated by manure, pesticides, or other chemicals. Just as you want safe water for your livestock and family, it is your responsibility to reduce contamination for the next user.

### *Diseases introduced by vectors*

Vectors are animals or insects that spread disease. They can be either biological vectors and be a part of the life cycle of the agent, or they can just carry disease agents inside or outside their bodies. Many viral diseases are insect vectored, including bluetongue and West Nile. In the case of West Nile virus, a mosquito feeds on an infected bird and a week later feeds on your goat, giving it the disease. In this case, control would be difficult because the infected bird may have flown from hundreds of miles away. Obviously, it would take a very stringent biosecurity program to prevent the entrance of mosquitoes into the biosecure area. One solution would be to use mosquito repellent and immunize your goats against the disease.

## Biocontainment

A good biocontainment plan can limit the spread of disease already present on your operation and also serve as a backup for your biosecurity plan in the event a new disease is introduced to your operation.

If there already are sick goats on your premises, separate them from those that appear healthy. Any sick animals should be kept separate in housing just for sick animals. Let's say you have a goat that develops a CL abscess, which is caused by a highly contagious bacterium that can live in the environment for about 6 months. The first goal would be to isolate the goat in a pen away from the rest of the herd. That way if the abscess ruptures prior



*Care should be taken when draining caseous lymphadenitis abscesses.*

to treatment it will not contaminate other goats in the herd or the environment. Sick pens should be cleaned between animals.

A second goal might be to raise uninfected kids separately from CL-infected does. Kids can be infected by ingesting colostrum from their mother. The longer kids stay with their mothers the more likely they are to become infected. You might want to consider establishing a “clean herd” and a “dirty herd.” Infected animals are the dirty herd and uninfected animals make up the clean herd. If newborn kids are separated from their mother before becoming infected, then they can join the clean herd. The best plan is to remove the kids from their mother at birth. To confirm that the kids are not infected, have them tested at 6 months of age.

As mentioned before, visitors can spread diseases from one area of your operation to another. If visitors are going to visit different areas of your operation, make sure they visit the animals most susceptible to disease first. In other words, they would first visit the neonatal unit, then the breeding unit, gestating animals, weanlings, replacement doelings, and any sick animals that need attention. The concept here is that kids are very easily infected with disease agents and that as they age they become more and more disease resistant. Visitors should never go in reverse order or return to a unit previously visited. These same rules apply to farm employees.

Know your herd. Any unusual increase in numbers of sick, aborting, dead, or dying animals needs to be quickly evaluated. The more rapidly a diagnosis is made, the fewer animals that will become sick. The rate of abortions expected annually should be less than 2% of the bred does. If more than 5% of the bred does abort, you ought to more aggressively pursue a diagnosis. Abortion rates between 2 and 5% indicate ongoing infection in the herd and, while not an immediate threat, you may want to identify the cause and determine whether you want to control this disease. Any aborting does should be separated from the rest of the herd so as to reduce transmission between does.

### *Human health considerations*

Many diseases which affect goats will also cause humans to become ill; these are zoonoses. Good biocontainment will include a priority to prevent disease transmission from goats, or other animals on the farm, to human workers or visitors. In general, there should be no human food or drink consumed near livestock or in livestock facilities. Hand washing facilities should be conveniently located and used often. Wash with warm water and soap for at least 20 seconds. All clothing used in the barn or with livestock should be removed before

entering the house. Ideally, these clothes should be washed separately from household clothing. No goats should be allowed in the house.

In addition to the recommendations above, precautions should be taken by any person working with goats to reduce risk of exposure when working with potentially infected animals. These include the following:

- Wear a properly fitted respirator mask that will effectively filter out bacteria in the air (N95 or higher rated, talk to your doctor first about whether it is safe for you to wear a respirator) when working with kidding goats, handling placentas or aborted fetuses, and during activities that create a dusty environment such as when cleaning barns, moving bedding material, or moving animals.
- Disposable gloves and protective eyewear should be worn when assisting with kidding.

If your farm is experiencing goat abortions, no visitors should be allowed in the kidding areas. Since some of the organisms that cause abortions in goats (*Coxiella burnetii*, *Chlamydophila*), can also lead to miscarriage in humans, pregnant women are at especially high risk and should not be working with the goat herd if there are abortions. Neither should immunocompromised or elderly people. People can become infected by handling infected placentas and kids, being present when goats are giving birth, being exposed to windborne organisms in barn dust, and drinking raw milk from infected does. Symptoms of acute Q fever (caused by *Coxiella burnetii*) in humans include flu-like illness (high fever, headache, chills, sweats, possibly nausea and vomiting, diarrhea) and generally appear 2 to 3 weeks after exposure (range 3 to 30 days).

Healthy goats can carry and transmit pathogens like *Salmonella*, *Campylobacter*, and *Listeria* in their feces and these can sometimes also be transmitted in milk. For this reason, drinking raw milk is never recommended. Pasteurizing milk at 145°F (63°C) for at least 30 minutes or at 161°F (72°C) for 15 seconds will destroy *C. burnetii* and other pathogens that can be present in raw milk.

Sore mouth (orf) is another zoonotic infection which can be prevented if disposable gloves are worn when working with infected sheep or goats. Gloves should also be worn when vaccinating for sore mouth as this is a live vaccine which can cause infection in humans. Vaccination will cause an orf infection in the animals and contaminate the premises with virus-containing scabs. For this reason, vaccination is only recommended in herds previously infected. People are at risk for infection during the following activities: when working with

infected animals if they have an open cut or sore, if they are bitten by an infected animal, handling contaminated equipment, and tube or bottle feeding infected kids. The sores can be painful and may become infected with bacteria if not properly managed. If you are experiencing pain, fever, or notice the sore is becoming rapidly larger, you should seek medical attention.

Even after taking all possible precautions, it is still possible to become infected with a zoonotic illness from your goats or other livestock. If you seek medical attention, be sure to let your provider know you work with goats and any other animals you have.

### ***Cleaning and disinfection***

The best defense against disease spread is cleaning and disinfecting. The idea is to reduce the amount of pathogens on your premises such that there are not enough left to sicken your animals. Keep in mind that organic material such as manure, soiled bedding, and dirt can inactivate disinfectants. When cleaning anything, whether it be cement floors, waterers, or trailers, it is important to remove all residual organic material by washing with soap and water. A low-pressure hose should be used, as it reduces the amount of infectious agents being distributed in the air. Let the surface dry before applying disinfectants. There is no one disinfectant that works for all situations, although bleach works on a wide variety of pathogens. For places where not all organic material can be removed, use a disinfectant that will work in the presence of organic materials. Your veterinarian should be able to recommend the most efficient and cost-effective product for your purposes. A thorough explanation of disinfectants can be found at: <http://www.cfsph.iastate.edu/BRM/resources/Disinfectants/Disinfection101.pdf>.

### ***Manure management***

Infectious disease organisms are often shed in manure and can remain infectious for long periods. All manure should be handled as a risk material. Animals that eat feces have more disease problems. Why would a goat eat feces? As you probably know, goats are very picky eaters, and they especially avoid eating close to fecal pellets. They don't even like to eat grass that is close to fecal pellets. However, if they get really hungry they will overcome this natural instinct to avoid feces.

When does lie in feces their teats and hair coat become contaminated. As a result, their kids ingest feces along with milk when nursing and does ingest feces from their hair coat while grooming. Goats hate to lie in feces or on wet ground. Slatted bedding frames can be built that will allow goats to be off the ground and in a dry environment. Feces pass through the slats to the area

under the goats, creating a cleaner living environment. Wooden pallets function in the same way.

Periodically, feces need to be removed and are often composted in a pile. Temperatures in the pile will help kill many of the pathogens normally found in feces and improve the quality of the fertilizer you are producing. Make sure the manure pile is contained and that there is no runoff of liquid from areas of manure concentration to pastures where goats are grazing. In particular, make sure there is no runoff from the feces of adult animals to pastures with immature animals. State and local composting regulations exist and should be followed for your area.

Feces should be applied to crop land, not to pasture. Fertilizing pasture with raw goat manure will result in disease transmission to grazing animals. Fertilizing hay fields with goat manure and the subsequent cutting of a hay crop will not result in animals eating disease producing agents. Since some goat diseases can be transmitted to people through aerosolized manure, do not distribute manure during windy days. This aerosolizes the manure and any infectious organisms not killed in composting. Ideally, plow-in the manure promptly after application.

Cover manure, bedding, and other potentially contaminated materials during transport to help prevent spread of *C. burnetii* and other organisms.

**Animal identification and recordkeeping**

The importance of animal identification (ID) and accurate recordkeeping cannot be underestimated. It is essential that every animal have a permanent and unique ID, usually an ear tag, but a neck chain works, too. Some goat breed registries require tattoos and have their own policies regarding placement of the tattoo. Ear tags are preferred for goats that graze, as neck chains can get caught in branches and other hazards.

Make sure to follow your state’s animal ID laws for goats. At a minimum a state must enforce the Federal ID requirement; however, states have the prerogative to add additional ID requirements. To view your state’s goat ID requirements, visit [www.eradicatescrapie.org](http://www.eradicatescrapie.org). The Federal ID requirement was implemented as part of the National Scrapie Eradication Program. This requirement states that registered goats, goats used for milk production, and any goat housed or pastured with sheep must be officially identified before a change of ownership. See Table 2 for more specific requirements for meat or fiber goats.

Now that your goats have unique IDs, use them to record birth date, illnesses, test results, treatment, treatment dates, and departure from the premises. Other information such as dam, sire, kiddings, kids per pregnancy, sales, ownership, illness, drug withdrawal periods for treated animals, and reasons for culling are useful for

herd management decisions. These records should be reviewed quarterly for completeness and accuracy. Copies should be made and kept in a safe place. Records must be kept for at least 5 years from the date your goats are transported or sold from your farm.

**Feeding systems**

Feed and feed buckets can serve as fomites within different units on the farm. If you have two houses of kids and you bucket feed and exchange buckets between houses, you are probably cross-contaminating both houses.

A common mistake of producers is using equipment to move manure and feed. For instance, a front-end loader is used to scrape manure out of the lot and is then used to haul bales of hay to the goats in the pasture. The hay has become contaminated with feces and could serve to spread diseases like *Salmonella* or Johne’s. On a smaller scale, feces-to-hay contamination can occur when cleaning fecal pellets out of a trough using the same scoop used to get feed. Ideally, separate equipment should be used to clean manure and to scoop hay or feed. If this isn’t possible, then the equipment must be cleaned between uses.

Goats often climb into troughs and defecate, which creates a source of infectious material for other goats. This problem can be avoided by making feed troughs goat proof. Goats also love to get on top of round hay bales. While there they defecate and urinate, which serves as a mechanism of disease transfer and results in the goats refusing to eat the soiled hay. Round bales should be placed in round bale feeders, which allow goats to eat the hay but not get up on top of it. Alternatively, hay can be fed in limited quantities to limit the amount of waste.

To prevent contamination, feed should be stored in rodent-proof containers when possible. Doing so restricts rodents’ access to feed as well as that of other wildlife,



*Use round bale feeders to prevent fecal contamination of hay.*

**Table 2. National Scrapie Eradication Program identification requirements for meat goats****Meat or fiber goats needing identification**

- ✓ Goats not in slaughter channels on change of ownership
- ✓ Bucks and does when taken to shows
- ✓ Scrapie-exposed goats
- Some states have stricter requirements (check with your State Veterinarian)

**Meat or fiber goats not needing identification**

- ✓ Goats in direct slaughter channels
- ✓ Wethers
- ✓ Commercial goats from low-risk herds (not exposed to sheep or scrapie, not registered or exhibited)
- Some states may require slaughter kids to be identified

**If moving goats to a different state:**

- Identify all bucks and does, including show goats
- Identification is not necessary for:
  - Goats in direct slaughter channels
  - Goats moved for management purposes and not mixed with other herds

**Identification approved for the Scrapie Flock Certification Program**

- Scrapie ear tags (free from the USDA)
- Approved electronic ID
- Approved tattoos, including some breed registry tattoos – check with your breed registry
- Remember to keep animal records for at least 5 years.

**For more information go to:**

1. National Scrapie Eradication Program - <http://www.eradicatescrapie.org/>
2. USDA Animal Plant and Health Inspection Service  
- [http://www.aphis.usda.gov/animal\\_health/animal\\_diseases/](http://www.aphis.usda.gov/animal_health/animal_diseases/)
3. Contact your State Veterinarian

birds, dogs, and cats - all of which can spread disease through urine and feces. Spilled feed should be cleaned up immediately. Unopened feed sacks should be stored off the ground, possibly on pallets, to allow for easy inspection of rodent activity.

***Milk feeding systems***

In general, meat goat kids receive milk only from their dams. Although there is a possibility of transmitting disease through the dams' milk, the risks are fairly minimal. In some circumstances, kids are fed or supplemented with milk from other does or with milk from does on other farms. Unpasteurized milk can contain a variety of pathogens including those that cause mastitis (e.g., staph and strep), diarrhea (e.g., *E. coli*, *Salmonella*), respiratory disease (e.g., *Pasturella*, mycoplasma), abscesses (*Corynebacterium pseudotuberculosis*), and a variety of systemic disease (e.g., listeriosis, CAE, Johne's, and brucellosis). The odds of one doe having disease may be low, but if you pool milk from 100 goats then you are increasing the odds of exposing kids to disease. If you pool unpasteurized milk and feed it to newborn kids, you are likely spreading some diseases to the newborns. Disease transmission by unpasteurized milk is a huge problem for dairy-goat operations. Pasteurizing milk or

feeding milk replacer eliminates the possibility of disease transmission. A few operations will supplement milk or colostrum to newborns by using either milk or colostrum from another operation with goats, sheep, or cows. When doing this, it is important to know the disease status of the flock/herd from which the colostrum or milk was taken. The flock or herd should be free of Johne's disease. The milk used should not be from animals treated with antibiotics for which there is a withdrawal time. Even though the milk is pasteurized, it should be cooled and kept cool in clean and closed receptacles until it is ready to be warmed and fed to kids.

Providing colostrum to newborn kids as soon as possible following birth is critical to protecting the kids against infectious diseases in the first weeks and months of life. Colostrum provides newborn kids with vital antibodies from the does. There are, however, a number of reasons for not letting newborns get colostrum from their mothers. For example, producers attempting to eliminate CAE in the herd should remove newborns before they suckle mothers likely to be infected with CAE. Colostrum from does other than a kid's dam should be heat-treated, not pasteurized, prior to feeding. Pasteurizing involves heating the liquid to at least 145°F (63°C), which

damages the milk's protective antibodies. Heat-treating uses a lower temperature of 140°F (60°C) that does not affect the antibodies allowing them to confer immunity to the kid. Another option would be to use goat colostrum replacers which are available commercially.

### ***Watering systems***

Once you have ensured water coming into your farm is safe for use, you want to reduce contamination on the farm. Communal watering containers can be a source of community infection. If every goat in the herd drinks out of the same trough and one of them has sores on its mouth caused by contagious ecthyma (orf, sore mouth), then the virus deposited in the waterer may well infect a substantial number of goats. This problem can be minimized by keeping troughs filled with fresh water at all times and by chlorinating the water. City water is normally chlorinated. Well water can be chlorinated. Water provided to goats should be in waterers off the ground and away from contamination sources. Goats should not be allowed to climb into water troughs. At least one study found an association between fecal contamination of water and proximity of the water trough to the feedbunk. The rule of thumb here is that you should not expect goats to drink water that you would not drink.

Natural water sources, such as streams or ponds, provide a breeding ground for mosquitoes and biting flies. Depending on the water source, larvivorous fish may help control mosquitoes. Other insects may need to be controlled by use of insecticides.

Also of concern is contamination of livestock water by chemicals. You should consider whether any fuel storage is in proximity to your water supply. Do you mix, apply, or store pesticides within 100 feet of your well, pond, stream, or other surface water supply? Do you rinse your sprayer within 100 feet of your water supply? You get the idea. Protect your water, goats, and family from pesticides and other harmful chemicals.

### ***All-in, all-out***

Another important concept of biocontainment is "all-in, all-out" management. With all-in, all-out management, animals are brought to a facility and raised to a specified production level as a group, then removed as a group at the same time. Facilities are then cleaned and disinfected before bringing in the next group of animals. This concept was invented by the poultry industry and has improved their health standards dramatically.

Let's apply all-in, all-out management to a simple goat farm. We buy 100 goats and put them on a 10-acre pasture. Over a period of months the goats contaminate the pasture with parasite eggs which hatch into larvae. We recognize the parasite problem and remove all but

10 goats from the pasture. These 10 goats will continue to maintain the level of parasite contamination on the field. Months later we put 100 goats back on the pasture. They will quickly become infected with parasites just like our original group. If we had removed all goats from the pasture and let the pasture sit, or used it for a hay field, the pasture would have been parasite-free for our next group. This same strategy can be applied to kidding barns and weaning pens. Most parasites and pathogens can't live for very long without their hosts. Continuous occupation results in continuous maintenance of pathogens. This cycle can be broken by removing the host and sanitizing the facility.

### ***Immunizations***

Health is a balance between the resistance of the animal to disease and the dose of disease to which the animal is challenged. Sanitation is the tool that is used to reduce the disease challenge to animals. Disease resistance is composed of environmental factors and immunologic factors. Goats that are well-fed and housed will be more resistant to disease than goats that are poorly nourished and poorly housed. Goats that are immunized against a specific disease by vaccination will be more resistant to it than goats that have no immunity.

There is no one vaccination program which works for every farm. What you vaccinate for should depend on the potential for exposure of your goats to the things for which you are vaccinating. Immunization can be done with the injection of commercially available vaccines (e.g., tetanus toxoid) or by the administration of immunoglobulins (e.g., colostrum or tetanus antitoxin) or by natural exposure to the disease producing agent (e.g., toxoplasmosis, chlamydia). All of these result in an animal that is partially or completely immune to the disease.

Core vaccines are those that provide protection against diseases which are a significant health risk to most goats. These are 'no brainers.' Core vaccines for goats would be tetanus and *Clostridium perfringens* types C and D. A national study of the U.S. goat industry found that only 49% of goat operations vaccinated their goats. Of those that did vaccinate, 89.5% vaccinated for *Clostridium perfringens* types C and D, and 86.6% vaccinated for tetanus. Here is why vaccinating for *Clostridium perfringens* types C and D is important. *Clostridium perfringens* types C and D are present in the environment. They are normally found in the soil and digestive tract of goats and other animals. During times of stress, sudden changes in feed, overeating of grains, or for other reasons that slow feed passage through the gastrointestinal tract, these bacteria rapidly reproduce and generate large quantities of toxins. The toxins will circulate in the bloodstream and can cause sudden death, especially in kids. Adults can also



become sick, have a reduced appetite, abdominal pain, diarrhea, and other nonspecific signs. Tetanus is another soil organism. It infects goats, humans, and other animals through open wounds. Once in the body, it produces a toxin which ultimately can result in death if not treated.

All other vaccines should be discussed with your herd veterinarian to decide whether the benefits of vaccinating outweigh the cost. Vaccinations should be given at certain times to be most effective and your veterinarian can help determine an appropriate schedule. When you meet with your veterinarian decide on the following: determine what diseases to vaccinate against, identify what goats will benefit most from vaccination, and determine when vaccines will be given to provide the best protection.

Make a plan specific to your farm and your management and stick with it.

### ***Disease surveillance***

Disease surveillance is critical to maintaining the health and security of your goats. You should do surveillance on your farm to know what's going on in your herd. What diseases are present? You should also do disease surveillance to know whether your management practices are reducing the prevalence of disease in your animals, or whether your goats are eating enough quality feed. Surveillance can include anything from close visual inspection of individual goats to diagnostic blood tests, fecal samples, or fetal/placental tissue results.

So when should you do surveillance? You likely already do it every day. Know your goats' eating habits, general disposition, and behaviors. Any sudden change can indicate a problem. Unusual signs of illness (especially when more than one goat is involved) should prompt a quick call to the herd veterinarian and likely diagnostic sample submissions. Visual surveillance can also include

examination of your goats for pale conjunctiva (inner eyelid) which would indicate anemia possibly due to the parasite *Haemonchus contortus* (Barberpole worm). This is covered in more detail in the parasite control chapter of the handbook.

Beyond general daily visual inspection, some surveillance can be done by inspecting production records. Is your kidding ratio (number of kids born per does bred) less than expected? This could be due to poor feed quality, reabsorbed or early fetal abortion due to infectious disease, high abortion rates due to infectious disease, etc. How about average weaning weights? Lower than expected weaning weights could be due to mastitis decreasing milk production, lack of adequate colostrum, undiagnosed and untreated parasitism, underfeeding, etc. Surveillance of newborns to ensure they effectively nurse their dam within 6 hours of birth will identify the newborns that need to be supplemented with bottle fed or tubed colostrum. Maybe the same doe produces low weight kids, or no kids. What was the body condition score of this goat when bred? At least one study has shown an association between low body condition score at breeding and high abortion rates (on range conditions). So surveillance of your animal records, vigilantly maintained, can help identify key management issues.

Finally, tissue, blood, and fecal samples submitted for diagnostic tests should be reviewed for surveillance of infectious diseases. Some diagnostic laboratories will accept samples submitted directly by owners while others require veterinary submission. Submissions can be routine if an owner is concerned about eliminating diseases (such as CAE). In the case of CAE, annual blood testing is recommended to ensure herd prevalence is being reduced. When a goat herd is experiencing several abortions at once (generally more than 5% of bred does) it's a great time to make sure aborted fetuses and placentas are submitted for diagnostic testing.

Never underestimate the value of a good necropsy. When there is an unexpected death in your herd, it is highly recommended that you have your veterinarian perform a necropsy. In addition to finding the cause of death, necropsies also allow your veterinarian to examine all tissues for evidence of disease. Necropsies will be most informative if the animal has just died, or is moribund and can be euthanized.

Again, surveillance (of all kinds) is crucial to a healthy goat herd.



*Use vaccines in accordance with label instructions.*

## KANSAS ANIMAL HEALTH REPORTABLE DISEASES

The Kansas Department of Agriculture's Division of Animal Health mission is to ensure the public health, safety and welfare of Kansas' citizens through the prevention, control and eradication of infectious and contagious diseases and conditions affecting the health of livestock and domestic animals in Kansas. Below is list of animal diseases the Animal Health Commissioner has determined to be immediately reportable to Kansas Animal Health officials. *Other diseases the livestock commissioner determines to be immediately reportable due to an animal health emergency situation may be added at any time.*



### CERVID & CAMELID

Foot and Mouth Disease  
Vesicular Stomatitis  
Tuberculosis (active and latent)  
Anthrax  
Brucellosis  
Rabies



### CATTLE

Foot and Mouth Disease  
Vesicular Stomatitis  
Tuberculosis (active and latent)  
Anthrax  
Brucellosis  
Rabies  
Rinderpest  
Bovine Leukosis  
Psoroptic Mange  
Scabies  
Johne's Disease  
Trichomoniasis



### EQUINE

Piroplasmosis  
Vesicular Stomatitis  
Equine Infectious Anemia  
Anthrax  
Brucellosis  
Rabies  
Equine herpesvirus myeloencephalopathy (EHM)



### SHEEP & GOATS

Foot and Mouth Disease  
Vesicular Stomatitis  
Scabies  
Anthrax  
Scrapie  
Psoroptic Mange  
Brucellosis  
Rabies



### SWINE

Foot and Mouth Disease  
Vesicular Stomatitis  
Classical Swine Fever/  
Hog Cholera  
Anthrax  
Vesicular Exanthema  
Pseudorabies  
Brucellosis  
African Swine Fever  
Porcine Epidemic Diarrhea Virus (PEDv)



### AVIAN

Avian Influenza  
Fowl Typhoid  
Exotic Newcastle Disease  
Psittacosis  
Pullorum



### ZOONOTIC (HUMANS)

Influenza +  
Rabies +  
Tuberculosis + (active and latent)  
Botulism +  
Plague or Yersinia pestis +  
Q Fever (Coxiella burnetii) +  
Anthrax +  
Ehrlichiosis +  
Brucellosis +  
Campylobacter Infections +  
Cryptosporidiosis +  
Giardiasis +  
Hantavirus Pulmonary Syndrome +  
Leptosy or Hansen's disease +  
Listeriosis +  
Lyme disease +  
Rocky Mountain Spotted Fever +  
Salmonellosis, including typhoid fever +  
Any transmissible spongiform encephalopathy or other prion disease +  
E. coli 0157:H7 and other Shiga toxin-producing E. coli +

+ Disease must be reported to KDHE  
\* Disease must be reported to KDA and KDHE

KDA: (785) 564-6601 • KDHE hotline: (877) 427-7317  
KDA Division of Animal Health • 1320 Research Park Drive, Manhattan, KS 66502 • (785) 564-6601 • agriculture.ks.gov/animalhealth

*Lists of reportable diseases can be obtained from your State Veterinarian or from your state department of agriculture, such as this example from the Kansas Department of Agriculture Division of Animal Health.*

### Reportable diseases

Some animal diseases are considered reportable diseases and any occurrence of them must be reported to the State Veterinarian. These may be foreign animal diseases, zoonotic diseases, or diseases termed program diseases where industry is working with state and federal agencies to control or eradicate the disease, such as scrapie. Your veterinarian will know which diseases are reportable in your state. States also publish lists of such diseases.

### Euthanasia

Euthanasia is the humane killing of animals to relieve unnecessary pain and suffering. When an animal can no longer live a productive and normal life functioning and feeling well, the most humane thing to do is provide it with a quick and painless death free of distress. This often difficult decision is usually made with the assistance of your herd veterinarian who may be more experienced with this situation and should be able to recommend the best method of euthanasia for a given circumstance.

Increasing concern for the humane treatment of all animals led to the development of the American Veterinary Medical Association (AVMA) Guidelines on Euthanasia. These guidelines provide recommendations about what constitutes humane euthanasia for animals farmed for

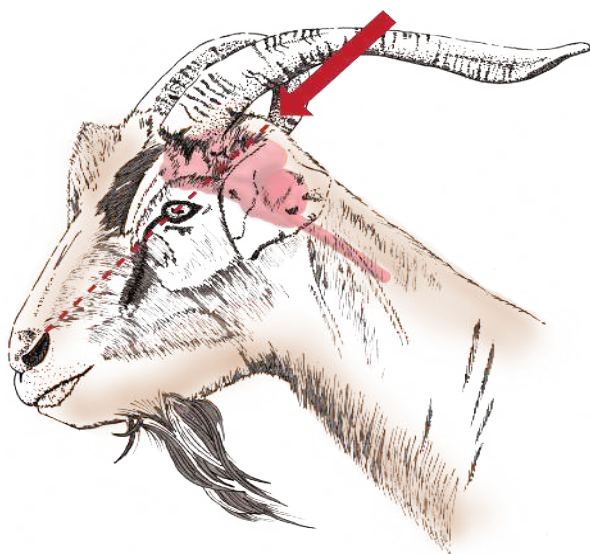
food and fiber (such as goats) and what methods are not considered humane.

Accepted methods for euthanasia listed in these guidelines include the following:

1. Injected barbituates - these are anesthetic drugs, given intravenously, which depress the central nervous system causing the animal to fall into unconsciousness and eventually death. These drugs are controlled substances and require a veterinarian. If the animal carcass will be composted, or left for scavengers, the use of barbituates may not be recommended. A few studies have suggested the barbituates can persist in composted material.
2. Captive bolt guns or firearms – If a firearm is used, the gun should not be flush with the skull but be within a few inches of the target area. The appropriate positioning of a gun or captive bolt varies by animal species, and whether or not



Captive bolt gun.



*Site for gunshot or penetrating captive bolt placement in horned goats is behind the poll.*  
Illustration by K. Williams.

horns are present. This should, at least initially, be shown to you by your veterinarian. When done correctly, it will result in loss of consciousness whereupon the animal will have to be killed by another means.

- a. Once unconscious, the animal can then be exsanguinated (bled). Before considering exsanguination, one must be aware of the potential for disease transmission through the large volume of blood loss.
  - b. Once unconscious, intravenous potassium chloride or magnesium sulfate might be used to actually kill the animal.
3. Electrocutation is difficult to do properly in the farm setting and not recommended.

Unacceptable methods for euthanasia include: manually applied blunt trauma to the head, injection of chemical agents into conscious animals, drowning, or injection of an air embolism.

### ***Dead carcass disposal***

Prompt removal and proper disposal of dead animals from pens before other animals, rodents, or birds have contact with them reduces the spread of infectious disease from the carcasses. On large acreages, prompt removal may be unlikely and some carcasses will likely remain and be consumed by predators. This practice encourages predators to the farm and may result in unwanted predation of other (especially young) goats.

Onsite disposal reduces transmission of contaminated materials to other premises and can be done by composting or deeply burying the carcasses to prevent scavenging. A national study of goat operations in the U.S. in 2009 found that over one-half of operations

buried carcasses on their operation. Burying carcasses may cause problems with runoff, contamination of water tables, and odors. Predators are drawn to burial sites and may disinter the remains. In general, carcasses should be buried at least 3 feet deep and at least 5 feet above the water table. Mortality composting is an inexpensive, environmentally friendly method of carcass disposal. However, it requires knowledge of the technique to work successfully. It has the same problems as burying in that runoff, contamination of ground water, and odors may all be problems if not done properly. Refer to the chapter on mortality composting for more details.

Other options for disposal include: incineration, rendering, and transport to a landfill. Many rendering facilities have strict policies disallowing sheep or goat carcasses due to scrapie. If carcasses are temporarily stored prior to disposal, use closed containers with absorbent materials to prevent splashing and spilling.

All options regarding disposal may be regulated by your local or state government and these regulations often vary by animal species. You should learn what they are. This website provides state regulations - <http://www.vetca.org/lacd/index.cfm>.

### ***Medical treatment device use and disposal***

Any equipment contaminated by blood or tissue should be cleaned and disinfected or thrown away. This includes ear tagging equipment, shears, hoof trimmers, holding facilities, etc. To prevent disease transmission all needles should be used just once and disposed of in a container - e.g., a recycled milk jug or soda bottle - which prevents accidental needle sticks and discourages reuse.

### ***Wildlife control***

It is enjoyable to watch wild deer and birds interact with domestic animals; however, wild animals can also carry diseases such as brain worm or meningeal worm in deer, brucellosis in wild pigs, and *Salmonella* in birds. Wild deer, elk, and bison can also be reservoirs for tuberculosis. Meningeal worm in deer does not cause any illness, but in goats it can cause partial paralysis, difficulty walking, abnormal head position, circling, and other symptoms associated with brain tissue destruction caused by the larvae of this worm. Unless you have high fences or guardian dogs, it will be difficult to keep deer off a large pasture. Deer should be kept away from outdoor watering troughs or other containers. Keeping feed in sealed containers and prompt removal of garbage will go a long way toward discouraging wild pigs and birds from finding food sources on your farm. If wildlife get into stored feed, the feed should be discarded and not fed to your livestock.

### ***Rodent control program***

Rodents are well known disease carriers and should be deterred from entering the barn. They are suspected of playing a role in the large Q fever outbreak in the Netherlands from 2007 to 2009. Cats may help with the control of rodents, but as mentioned earlier, they are not the solution to rodent problems. Rodent traps and bait placed strategically around the premises are more reliable rodent control options. Traps should be set close to walls, in dark corners, and other areas where rodent activity is visible. These traps should be inspected regularly and any dead rodents disposed.

## **Setting Up Your Biosecurity Program**

### ***Evaluate your risk***

What are the risks to your herd at various levels of disease? How many goats are you willing or can you afford to lose to disease? If all of your does aborted one year would you be able to stay in business? What are your marketing risks? If you had CL in your goats would your clients refuse to buy slaughter goats from you? If you had Johne's disease would you still be able to sell breeding stock to other producers?

The process of evaluating a farm to determine levels of risk and practical methods of limiting or eliminating risk is called risk assessment. Risk analysis involves you and your veterinarian evaluating your facilities, your disease status, your animals, and your management practices. When the assessment is completed, you should have a prioritized list of significant risks to your animals' health and a plan to minimize or eliminate these risks.

### ***Evaluate your facilities***

Does your facility allow fence line contact with other livestock? Do you have drainage problems that will contaminate fields with manure runoff? Do you have an area where you can quarantine incoming animals? Do you have adequate facilities that allow you to separate healthy animals from sick animals?

### ***Evaluate your disease status***

What diseases do you have in the herd at present? If you're not sure, think about why you cull most of your animals. Think about which animals die, taking into consideration their age and what clinical signs they had before they died. Consult a veterinarian or extension agent to better understand what might be causing these culls and deaths. It is always a good idea to submit aborted fetuses for evaluation and diagnosis.

### ***Evaluate your animals***

Are your animals genetically superior and hard to replace, or would you be better off depopulating and

repopulating now? Do you want to keep two herds; one that is disease-free and one that has disease but also has good genetics? From this second herd you can introduce clean newborn animals.

### ***Evaluate management***

Is management motivated enough to develop a plan and stick to it? Is management capable of following through on a plan or will there be insufficient time or expertise available?

### ***Set goals and prioritize***

Start small and decide which diseases are highest priority.

What do you want to exclude from your farm?

What disease will RUIN your farm? What will only reduce productivity a little?

What diseases do you already have and want to get rid of?

Set health goals for your existing animals. For example "all my goats will be negative for CL." Be very specific with goals and make no exceptions to these rules; not even for your favorite pet goat. Set health goals for incoming animals. For example "All incoming goats will have to test negative for CL and come from a herd known to be CL free."

### ***Prepare a written document***

Do this with your veterinarian or extension agent. Consider your goals, animals, facilities, current disease status, and management practices. Create a plan that fits your operation. The plan needs to cover biocontainment of existing diseases, disease surveillance, entry of new animals, quarantine procedures, and visitors. Put the protocol in writing. Post it in appropriate places and stick with it.

### ***Communicate***

Communicate with employees, neighbors, customers, and delivery personnel. Let them know what is being done and what will be required of them. Post signs that clearly delineate biosecure areas from nonsecure areas.

### ***Implement the plan***

Put it in play. See if it is workable. At least once per year, sit down and re-evaluate. Is everything working as envisioned?

An excellent checklist to help evaluate your risks can be found at <http://www.cfsph.iastate.edu/BRMForProducers/English/GeneralPrevention/GenPrevPracChecklist.pdf>.

