

**Biosecurity for Meat Goat Producers**  
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**Unit Objective**

After completion of this module of instruction the producer should be able to define biosecurity and distinguish between biosecurity programs and biocontainment programs. The producer should be able to evaluate his/her goat operation as it relates to biosecurity risks and develop plans for keeping the goat herd free of diseases and healthy. The producer should be able to complete all assignments with 100% accuracy and score a minimum of 85% on the module test.

**Specific Objectives**

After completion of this instructional module the producer should be able to:

1. Distinguish between a biosecurity and biocontainment program.
2. State ways to prevent an animal from carrying disease into your goat herd.
3. State ways how stress affects the health of the goat.
4. Select factors to follow before taking your goats to a goat show.
5. Select factors to follow while your goats are at the show.
6. State reasons why an animal will test positive for a disease when it was negative at the time of purchase.
7. State the purpose of fecal examination.
8. State what can be done to new goats arriving at the farm for control of parasites if fecal examinations cannot be done.
9. Select things that can be done to acclimatized a goat to the new goat herd.
10. State acceptable time frames for a goat's quarantine that is coming into the new goat herd.
11. Select management protocol factors to consider when working with goats on your farm that are quarantined from the rest of the herd.
12. Distinguish between horizontal and vertical transmission of diseases.
13. Distinguish between direct and indirect disease transmission.
14. Distinguish between fomites and vectors.
15. Select factors to consider when bringing animals into your goat herd.
16. State the disease in goats that causes abortions that is carried by the farm barn cat.
17. Select the major categories of fomites that expose goats to new diseases.
18. Select the most dangerous fomite that people carry on their position.
19. Select the meaning of zoonotic diseases.
20. Select factors to consider regarding keeping your goats disease free than can be related to your trucks and trailers.
21. State sources of vectors that spread disease within the goat herd.
22. State ways to make sure your goat feed is safe and free of disease.
23. Select factors to follow related to biocontainment.
24. Distinguish between good and bad feeding systems in order to control disease within the goat herd.

25. Distinguish between good and bad ways to handle manure on the goat farm.
26. State the meaning of “all in all out.”
27. Match terms related to immunization to the correct definition.
28. State the purpose of necropsy.
29. Select from a list acceptable and unacceptable ways/procedures for euthanasia.
30. State the three acceptable methods of carcass disposal.
31. Identify acceptable ways of identifying goats within the herd.
32. List the steps of the National Scrapie Eradication Program.
33. State the purpose of the Certification of Veterinary Inspection (CVI).
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35. Evaluate your goat farm for biosecurity issues.

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## Introduction

The term “biosecurity” is one that it seems to have become very popular lately. It is frequently used in the media and usually is associated with terrorists or national security or maybe something that a huge commercial livestock corporation would use. However, for anyone involved in livestock enterprises, agriculture in general or just trying to stay healthy, biosecurity is a simple and important tool. *Biosecurity* programs are any program that attempts to prevent the introduction of disease causing agents into an enterprise. Once a disease is present on farm then we turn to *biocontainment* programs to control the spread of disease within the herd.

Here is an example of a biosecurity program in action. One of the most common ways for humans to get infected with the common cold is for a person with a cold to sneeze into their hand and then touch a fomite (e.g., telephone) with that hand. Subsequently, another person handles the telephone and then rubs their eyes with their now contaminated finger. What just happened was the transfer of the virus that causes colds from the respiratory tract of the first person to the mucus membranes of the second person. How could we have prevented the second person from getting a cold? If the sick person had stayed home with his cold (*biocontainment*) none of this would have happened. If he had used a disposable tissue (*sanitation*) it wouldn't have happened. If he had washed his hands (*disinfection*) after sneezing it wouldn't have happened. If you had washed your hands after handling the phone it wouldn't have happened. These are all pretty much common sense and we will apply these same principles to your goat operation to minimize the impact of communicable disease.

Many producers have the mistaken impression that their herd doesn't need a biosecurity program. Let's look at an example where a total lack of biosecurity could wreak havoc on a herd. This is a small group of registered Boer goats. The owners sell goats all over the United States and Canada. One of their neighbors makes them a “real deal” on a goat because it isn't doing so well. 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 multiply drug resistant *Haemonchus* in its abomasum and is infected with a bacteria called *Chlamydia* which causes abortions. In a short space of time all of these disease agents have been spread to the new farm. Now we have foot rot which is a pain in the rear end. Anthelmintics are no longer effective. Goats that have been sold are being sent back because they have abscesses popping up and our pregnant does are aborting. Wow, our goat farm just got real complicated and now no one wants to buy our goats. We are spending all of our time treating sick goats, production is down, and the best buck has an abscess. What a mess and a very simple biosecurity program would have prevented all of this from happening.



How do we prevent the entry of an animal that may be carrying a disease into your herd? The simple answer is to never allow any animals into your herd instead, buy only semen and embryos. While you are at it, put up an 8 foot high security fence around your farm. Never allow animals back on the farm once they leave. Don't allow any visitors on site and after you have gone to town change clothes and shower prior to re entering your farm. I think that all of us would agree that that sounds pretty extreme but realize that on large biosecure farms that is

exactly how things are set up. For those farms the risk of introducing a disease into a 10,000 head confinement swine farm makes those extremes worth their while. For your farm you need to consider the risk of disease entry into your farm and the costs and benefits of keeping disease out of your farm.

## The Cost of Disease

Costs of disease are usually thought of in terms of animals that die. However, those are usually only a small portion of the true cost of disease. Animals that become temporarily disabled from disease have to be treated which means veterinary fees, medications, feed, housing and labor. During their disease they will not gain weight or they will not reproduce which means lost productivity. The good news is that at some point they will recover and go back to work. The bad news is that these animals never really catch up with their contemporaries and will be poor producers forever. They won't weigh as much at slaughter, their carcass won't grade as well, there will be more condemnations and carcass trim and of course you will need to hold the animal until all drug residues are gone. Animals that are permanently disabled from disease require the same costs in veterinary fees, medication, housing and labor to treat but unfortunately, these animals will never return to production and will either die or be euthanized. In this case we end up with a dead animal on which we spent a lot of time and money prior to its death. The time and resources spent with sick animals could be used more productively taking care of healthy animals.



In addition to production costs there are also costs associated with loss of markets. If you are selling fat goat kids to a local slaughter house and one of them has a big CL abscess then you have probably lost that market. If you are selling breeding animals locally to farmers and word gets out that after buying one of your does several farms experienced abortion storms then you have probably lost that market. If you are selling nationally or internationally and one of your does tests positive for any of the federally or internationally regulated diseases (e.g., Brucella, Tuberculosis) you have just been removed from that market.

There are some intangibles associated with the presence of disease in a herd. These are loss of reputation and loss of pride in your operation. It just isn't as much fun to raise goats when there is always one limping, or dead or when people just think that your goats aren't good enough.

Obviously, the cost of disease is high but many of these costs are "hidden costs." Costs associated with prevention programs are usually very obvious costs. Prevention programs always entail increased labor, increased capital outlays for biosecure facilities, increased expenses for disinfectants and disposables. Somehow 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 question then becomes not whether you need a biosecurity program but how much of a program are you willing to afford?

At this point you need to sit down and make a list of the diseases that you know you have in your herd already and then write a list of diseases that you don't want in your herd. ([Table 1 is a list of](#)

[common critical diseases of goats.](#)) Then picture your farm as it is now and picture your farm with those new diseases in it. What is the value to you of keeping those diseases out? Now picture your farm and 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 focus on a biosecurity program that is cost effective for your farm.

## **Disease Transmission**

How do diseases enter a herd? There are two broad ways that disease agents can be transmitted, either *Horizontally* or *Vertically*. Vertical transmission means the spread of disease from mother to kid shortly before, during or shortly after birth (the perinatal period). It can occur via chromosomes, across the placenta or through colostrum. An important example for goat producers would be CAE which is spread via colostrum from mother to kid immediately after birth.

Horizontal transmission means the spread of disease between animals. Horizontal is more important than vertical transmission in most cases and is all that can occur in the absence of reproduction. For instance, in a pen of wethers there would be no possibility of vertical transmission.

Horizontal transmission is divided into *Direct* and *Indirect* transmission. *Direct transmission* between animals requires contact. This can be fence-line contact, introduction of an animal into the herd or an animal that went to a show and came back home. Animal movement is by far the most important method of bringing a disease from one herd to another. This is especially true of homologous animals (animals of the same species) but can occur with heterologous animals (animals of different species). In other words on the goat farm the most dangerous animal to bring into your herd is another goat. However, bringing in a cow can also expose your goats to very serious diseases as well.

*Indirect transmission* is either by fomites or by vectors. These are a little more complicated to control than direct transmission. Fomites are inanimate objects that carry disease. This would include the soles of your shoes when you walk through manure going from one pen of animals to another. Vectors of disease are animate objects that carry disease. This can include domestic animals, wild animals or insects. Vectors can be either mechanical or biological. Mechanical vectors just carry a disease agent whereas biological vectors play a role in the life cycle of the disease agent. Examples would be a cat carrying salmonella bacteria on its feet from one feed trough to another and a cat whose feces have *Toxoplasma oocysts* spreading disease by defecating in feed bins.

## Figure 1: Disease Transmission

1. Horizontal
  - A. Direct
    - i. Direct contact
    - ii. Direct projection (droplets)
  - B. Indirect
    - i. Fomites
    - ii. Vectors
      - a. Biological
      - b. Mechanical
    - iii. Airborne
      - a. Dust
      - b. Droplet nuclei
2. Vertical
  - A. Transovarial
  - B. In-utero
  - C. Colostral

### ***Bringing new animals into the herd***

Let's look at how these principles apply directly to your farm. The most common source of new infections is by bringing a new animal into the herd. It is necessary to bring new genetics into breeding herds on a regular basis. The safest way is to bring in only frozen semen or embryos. However, even these 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:** Find out the disease history of the herd of origin, the results of previous testing in the herd and the status of the herd with any certification program. Disease history's can be obtained from the owner of the herd and through the farm's veterinarian. Have your veterinarian call their veterinarian. The questions you want to ask are:

1. What diseases do you test for?
2. What diseases do you have?
3. What diseases do you not have?

If the herd is certified free of Brucellosis, Tuberculosis and Scrapie then those are 3 diseases you won't have to worry about. If the herd doesn't test for any diseases then they don't know what diseases they have. If they have tested all goats for CAE and all were negative then they probably don't have CAE. If they haven't tested any for CAE then their status is unknown. All

diseases are not created equal and some are much more important than others. The important thing here is to know what diseases they don't have.

**Step 2:** Determine the pre-purchase disease status of the individual animal(s) that you are purchasing. You and your veterinarian would want to see all records on this animal that would show what immunizations it has had, which diseases it has been tested for and what problems it has been treated for. Next you are going to want to request a panel of tests to determine the disease status of the individual animal. The diseases you test for are diseases that there is some chance the goat may have. For instance, in the U.S. it would be foolish to require a goat to be tested for Foot and Mouth Disease. However, it would be reasonable to want it tested for things like Johne's disease. Some testing can be done only by examination. For instance to determine if a goat was free of lice or foot rot someone has to look at it. Ideally this would be the veterinarian for your herd who does the examination. 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. Veterinarians are legally and ethically bound to provide honest and accurate assessments of health status.

**Step 3:** Assuming the goat is negative historically and on the current tests then we will bring it to our herd but keep it in quarantine. How long in quarantine? Well the answer is longer is better than shorter. Ideal duration is probably 60 days and the shortest interval you would use would be 30 days. What is a quarantine facility? A quarantine facility is an animal holding facility that is physically completely separated from the rest of your herd. That means no fence line contact, no aerosol contact, no manure runoff contact and no potential for 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 quarantine. On small farms make sure that the quarantine barn is visited at the end of the day. Change boots and clothing before entering quarantine facilities and don't go back to the main herd after you have been in the quarantine unit. Feed, feed buckets, bedding and manure can not be exposed to the nucleus herd. The most important issue here is transferring disease back to the nucleus herd but neither do we want the quarantined animals to be infected by the nucleus herd.

**Step 4:** At the midpoint of the quarantine period (30 days) a careful physical examination should be performed on the animal to make sure that it is free of physically obvious disease. At the same time consider retesting the animal for whatever critical diseases you are trying to exclude from your herd. There exists a distinct possibility that the purchased animal will test positive to a disease which it was negative for at time of purchase. The following situations could cause this scenario:

- a. The animal was incubating the disease at the time of purchase.
- b. The initial test was a false negative.
- c. The stress of movement caused a latent infection to reactivate.
- d. The animal was exposed to the disease in transit or after reaching your farm.
- e. Some form of dishonesty or "laboratory error" has occurred.

**Step 5:** At this time it may be beneficial to administer an appropriate antibacterial to the animal either by injection or in the feed to attempt to eliminate agents of disease which may exist in a

sub-clinical fashion. For a goat this would most commonly be a tetracycline. (Note: some veterinarians and producers are opposed to the use of prophylactic antibacterials (metaphylaxis). If you use antibacterials make sure it is used according to the label and that the withdrawal times are followed).

It will also be necessary to make the goat as parasite free as is possible. Ideally, this is done by checking a fecal sample for parasites and then deworming successively until the goat is parasite free. If fecal exams can't be done, then dosing with three unrelated drugs will go a long way towards removing parasites from the incoming goat. For example, dose with Ivomec, Albendazole and Levamasol simultaneously. At this time you would vaccinate the incoming animal for any known endemic diseases of your herd. So if you had Chlamydia in your herd you would want all new entries to be fully immune to Chlamydia prior to entry into the herd.



**Step 6:** The incoming animal should be acclimatized to your herd. This includes environment, feed, water and diseases. If you are buying a goat from Canada and bringing it to a hot humid place like Louisiana you will need to slowly acclimatize the goat to the environment. This will allow the animal's innate resistance to be minimally stressed and will help the goat in preventing disease. The same holds true for feed and water. Sudden changes in food and water are viewed with suspicion with goats which means they may eat or drink less than they should. Hungry goats can overeat on a new ration and cause gastro-intestinal upset which may set the stage for infectious diseases. For some diseases we don't have vaccines. The incoming animals should be acclimatized to diseases existing in your herd by contact between it and members of the herd.

**Step 7:** At the end of the quarantine period it would be wise to allow exposure of the new animal to a small sentinel group of animals. Sentinel animals are animals from your herd that act like a "canary in a coal mine." If they don't get sick after mixing then it is safe to assume that the rest of your herd will be safe. If they do get sick then they can be kept in quarantine until cured or removed from the herd. At any rate, at least your whole herd didn't 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***

In addition to bringing a new animal into the herd, direct animal contact can occur by fence line contact, show or sale contacts, or your goat may share a trailer ride with some other goats. All of these allow direct contact and exposure. That would mean that the exposed goat would need to go through quarantine period again to be safe. If there is an adjoining neighbor with goats then there will be fence-line contact. The solution to this is to double fence the perimeter. The space between the two fences is used as a corridor. When greeting new arrivals goats snort and blow nasal secretions. These droplets will travel up to 3 feet so make sure that animals are separated by at least twice that far (6 feet).

## **Livestock shows**

Shows provide a real challenge to biosecurity programs. The ideal solution is to never bring home an animal from a show. For terminal meat class shows that is the obvious solution, for breeding class shows it is not a practical solution. Shows create an environment where animals of different species, breeds, age, sex, geographical locations, management systems and disease status come together for a brief period of time and intermingle. The animals are stressed from travel, noise, and unfamiliar settings. Stress can lead to increases in pathogen shedding and to increases in susceptibility 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 the flu.

### **Before the show**

Make sure that the exhibition center provides adequate housing, that pens are cleaned and disinfected and that ventilation is adequate. Make sure 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 goat on its return. Do not mask signs of illness in your goat. If it is sick then stay home. Make sure that you have a Scrapie Tag for your goat (wethers excluded) and that you have any required health tests performed and that you have a current Certificate of Veterinary Inspection. Minimize stress on your goat by providing it with a pen that is as close to those in the exhibition facility as is possible and use the same bedding, feed and water source as you will have at the show. Keep fans on the goat at home, the white noise they produce will be the same as you will recreate at the show. Transport your goat in your own trailer. Avoid traveling in a commercial trailer or commingling with other livestock.

### **At the show**

Keep your goats comfortable. Use adequate bedding and fans to provide white noise and ventilation. Use the same water, feed and hay that the goat was fed at home. Avoid sharing grooming equipment, feed buckets, manure shovels. 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 yourself (wash your hands before handling your goat or your goats food). Try to get a corner pen so that animal traffic and contact is minimal.

### **After the fair**

Disinfect all equipment that went to the fair. Don't forget your trailer. Place the goat into your quarantine system and watch carefully for signs of clinical disease. Pamper your goat. Its more exhausted and stressed than you are.

### *Diseases from other species*

In addition to other goats you need to prevent access of other animals to your goats. In general the more closely related the animal is to a goat the more dangerous it is in terms of disease transmission. Sheep and goats share the same parasites. Cattle and goats share a number of diseases. Unrelated animals are not necessarily safe. For instance Toxoplasmosis is a disease that causes abortions in goats. It is transmitted by the domestic cat which is a biological vector for the agent. Cats get infected by eating mice, the parasite completes its lifecycle in the cat and only in the cat and then the cat defecates in a feed bin and goats get fed grain which is contaminated with cat feces. Cats can also serve as mechanical vectors. It is amazing how much manure and disease agents can attach itself to the foot of a cat and it is amazing at how they can travel from pen to pen and trough to trough.

Now you might say “wait a minute, my cats control rodents on my farm and rodents transmit disease.” It is true that mice and rats can spread some important diseases like Leptospirosis which is spread in the urine of rodents. Cats are generally inefficient at rodent control and if you are relying on cats only then you will have a rodent problem. Rodents can be controlled by cats in addition to traps and baits but there are obvious dangers to the cats with this system. For the most part Toxoplasmosis is spread only by young cats (kittens). As the cat matures it becomes resistant to infection. Kittens can be avoided by spaying and neutering cats and maintaining a population of only adult cats.

### *Diseases introduced by fomites*

The major categories of fomites that may expose your goats to new diseases would be: People, Trucks, Trailers, Feed and Water. People include friends, neighbors, buyers, veterinarians, employees and delivery personnel. Recognize that some of these 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 the same boots and coveralls may be a serious threat.



Facilities with extremely high biosecurity standards discourage casual visitors from entering the livestock holding areas. When visitors do come they would require them to disrobe, shower and dress them in protective clothing and boots from the unit. Is all that necessary for you on your farm? Probably not, but again, think of the principles involved and implement it to the extent that is practical for your operation. It is best to keep people (especially other livestock producers) from getting in the casual habit of walking through your facility. People who go out to see the animals should have a real reason and the reason “just because they are cute” is certainly a valid reason; but those people must realize that a sick animal isn’t cute. If at all possible set up your pens so that goats can be observed from outside the pen or by putting all of your sale goats into a separate pen and not moving them back to the nucleus herd.

For people the most dangerous fomite is usually their shoes. People who have on boots that cannot be sanitized and that have been around livestock during the last week are 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 is a practical way to minimize the contamination they may carry. For visitors that 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 which are passed from animals to humans). The resulting diseases can sometimes cause serious human health issues. Protective clothing can be in the form of coveralls, apron, jacket, etc. Just make sure it is something that will cover the outer clothing of your visitor. At first your visitors will think that you are crazy when you ask them to follow these procedures. In the long run what you will find is that people who want to buy animals from you will appreciate the obvious efforts you make to keep them healthy and disease free.

### **Trucks and trailers**

Trucks and trailers that are used for hauling livestock accumulate manure and other body fluids. If these vehicles are not washed and sanitized between loads they can serve as a very efficient fomite. If you are buying or selling an animal that will be transported by truck or trailer, inquire about the provisions the driver makes to insure the sanitation of his vehicles. Also ask about the presence of other livestock passengers on the trip. If your goats get on a trailer with goats from 10 other farms they will share the pathogens from all 10 farms. If you are trying to sell high health status goats you have a problem and need to find a new transporter.



When a vehicle comes to pick up your animals have it park outside the livestock area and bring the animals to the vehicle. This avoids the possibility of feces falling from the trailer into your biosecure area and it also prevents the possibility of an animal escaping from the vehicle and contaminating a large area. If you have a loading area on your farm place it at the quarantine area or the pen from where you sell goats. Similar arrangements should be made for feed trucks and other farm service vehicles. If they don't have to enter your biosecure areas have them off load outside into your vehicle and transport the material to where it needs to go.

### **Feed**

Feed can be a source of infectious material being imported onto your farm. Bovine Spongiform Encephalopathy (BSE) was transmitted all over the world by putting rendered ruminants into feed for ruminants. It is now illegal in the US and the rest of the world to use rendered ruminants in ruminant feed. More common than mad cow disease, feed can serve as a source of Salmonella infections. The feed can get contaminated at the mill, at the store, or on your farm by feces from birds, snakes or rats. This results in feeding grain mixed with Salmonella to your livestock. The solution is to buy feed from reputable suppliers and try to minimize storage times. On farm, keep

the feed in rodent proof containers and avoid having spilled grain on the premises as it serves to draw birds and rodents.

## **Water**

In most cases municipal water is a very safe source of drinking water for livestock. However, there have been instances where even municipal water was a vehicle of disease. Well water can be a source of contamination from runoff and may serve as a source of disease. Probably of more concern is surface water in ditches and ponds. Water that flows onto the property from other livestock enterprises should always be fenced off.

## ***Diseases introduced by vectors***

Vectors are animals or insects that spread disease. They can be either biological vectors and be a required 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. This would include diseases such as Bluetongue and West Nile Virus. The insect is necessary in both of these cases and the time the virus spends in the host is what makes it infectious. In the case of West Nile Virus, a mosquito would feed on an infected bird and then a week later feed 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 the goat against the disease.

## **Biocontainment**

We have protected the nucleus herd from outside threats, now it is time to worry about controlling diseases which already exist in our herd. The first goal is one of biocontainment. That means we want to limit the disease to a certain population of animals in the herd or to a certain geographic location in the herd and not allow it to spread from there. Let's say we have a goat that develops a Caseous Lymphadenitis abscess. This is caused by a highly contagious bacterium which 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 to being treated it will not contaminate other goats in the herd or the environment.



The second goal might be to get a non-infected kid off of this doe. We know that kids may be infected by ingesting colostrum and that the longer the kid stays with its mother the more likely it is to become infected. Our plan here might be to have a “clean herd” and a “dirty herd”. The infected doe is the dirty herd and since the rest of the herd is uninfected they are the clean herd. If the newborn kid can be removed from its mother without becoming infected then it can join the clean herd. The best plan is to remove the kid at birth. Raise it on a bottle and place it with the clean herd. To increase the possibility that the kid was not infected we could do a blood test on it when it gets to be 6 months of age.

Visitors moving through an animal enterprise can serve to spread disease from one area to another. When visitors enter the unit they should visit only the areas they need to see and they do it in order of the livestock disease susceptibility. This means that they would visit the neonatal unit first, the breeding unit next, then gestating animals, then weanlings or replacement doelings and lastly any animal that is sick and needs attention. The concept here is that baby goats are very easily infected with disease agents and that as they age they become more and more disease resistant. The cycle begins again when the doe becomes pregnant and has a fetus inside her which is again very susceptible to disease. Visitors would never go in reverse order or go back to a unit after they had visited the next unit. These same rules apply to employees on the farm.

### ***Feeding systems***

Feed and feed buckets can serve as fomites within the different units of the farm. If you have two houses of kids you are bucket feeding and you exchange buckets between the houses then you are getting cross contamination with pathogens between the two houses. The same would hold true for feed and feed buckets.

One of the common mistakes people make is using equipment to move manure and also to move feed. For instance a front end loader on a tractor is used to scrape manure out of the lot and is then used to haul bails of hay to the goats in the pasture. The hay has become contaminated with feces and could serve to spread parasites or diseases like Johne's disease. On a smaller scale this feces to hay contamination can be done by cleaning fecal pellets out of a trough with the same scoop that you use to get feed.

Goats are very adept at climbing into troughs and defecating. This serves as a source of infectious material for other goats. This can be avoided by making feed troughs and hay racks goat proof. Goats love to get on top of round bales and while they are on top they defecate and urinate. This serves as a mechanism of disease transfer but also results in the goats refusing to eat the soiled hay. Round bales need to be placed in round bale feeders that allow goats to eat the hay but not get up on top of it. This will prevent fecal to oral disease transmission and also minimize the amount of hay wasted. Alternatively, hay can be fed in limited quantities to limit the amount of waste.



### ***Milk feeding systems***

In general meat goat kids receive milk only from their dams. There is possibility of disease transmission but it is fairly minimal. Under some circumstances kids are fed or supplemented with milk from other does and sometimes with milk from does from other farms. Non-pasteurized 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 and Mycoplasma), abscesses (Corynebacterium pseudotuberculosis) and a variety of systemic diseases (e.g., Listeriosis, CAE, 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 the kid to

disease risk. Disease transmission by non-pasteurized milk is a huge problem for dairy goat operations. Pasteurizing milk or feeding a milk replacer eliminates this possibility of disease transmission.

### ***Watering systems***

Water in waterers can become a source of community infection. If every goat in the herd drinks out of the trough and one of them has sores on its mouth caused by Contagious Ecthyma 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 water. City water is chlorinated out of the tap. Well water can be chlorinated by adding chlorine to it. The rule of thumb here is that if you should not expect goats to drink water that you would not drink.

### ***Manure programs***

The invention most responsible for the longevity of humans is not the miracles of modern medicine but the invention of the flush toilet. Animals that are exposed to feces and forced to eat them have more disease problems than those that are not forced to eat feces. Why would a goat eat feces? If you watch goats eat you will learn that they are very picky eaters and that they especially avoid eating close to fecal pellets. They don't even like to eat grass that is close to fecal pellets on the pasture. However, if they get really hungry they will overcome this natural instinct to avoid feces.

Goats that are forced to lie in feces will be forced to eat feces. The doe that lies in feces gets them on her teats. Her kid nurses her and ingests feces along with its milk. The doe later grooms herself and ingests feces from her hair coat. How do you avoid the problem? Goats hate to lie in feces or on wet ground. Given a choice they like to lay up high and dry. Slatted bedding frames can be built that will allow goats to be off the ground and in a dry environment. Any feces they pass go through the slats to the area under the goats. Wooden pallets function in the same way.

Periodically, the feces need to be removed. They will be composted by putting the feces in a pile. The temperatures in the pile will help to kill many of the pathogens normally found in feces. It also improves the quality of the fertilizer you are producing. Make sure the manure pile is contained and that there is no run off 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 that house immature animals.

Feces should be applied to crop land, not to pastures. Fertilization of pastures with raw goat manure will result in disease transmission to grazing animals. The most important disease transmitted by feces is intestinal parasites. Fertilization of a hay field with goat manure and the subsequent cutting of a hay crop will not result in animals eating disease producing agents.

### ***All In All Out***

Another important concept of biocontainment is that of "All In All Out" (AIAO). This means that we bring a set of animals into a facility, raise them to a specified production level, remove

all animals at the same time, then clean and disinfect the facility prior to introducing the next group. This concept was invented by the poultry industry and has improved their health standards dramatically.

Let's apply this to a simple example to a 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 ten goats from the pasture. These ten goats will continue to maintain levels of parasite contamination on the field. Months later we put 100 goats back on the pasture. They will quickly become parasite infected 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 principal can be applied to kidding barns and weanling pens. When a group of animals is ready, move all animals out. 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.

### **Immunization of the Nucleus Herd**

Health in goats 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. Dollars spent on a healthy environment always return more money than dollars spent on immunization.



An animal that is immunized against a disease is resistant to that specific disease. 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 the natural exposure to the disease producing agent (coccidia or toxoplasmosis). All of these result in an animal that is partially or completely immune to the disease. Vaccination means to administer a modified live or killed microbiological agent with the goal of preventing an infectious

disease. Vaccination is sometimes incorrectly used as in "I vaccinated my goat with BO-SE to prevent it from getting white muscle disease".

Immunization programs take some of the risks out of raising livestock. Vaccinating goat kids against tetanus will save the life of a kid that otherwise would have died. Fortunately, tetanus is not a contagious disease which means that tetanus doesn't spread from one goat to another. So the vaccine will only save the goat that received a vaccination. Rabies is an infectious and contagious disease. When a kid is vaccinated against rabies he is not only protected from the disease but the other goats are protected from getting rabies from the vaccinated goat. In the case of tetanus it is important that all animals be immunized against tetanus. In the second case it

would probably be adequate if the dog was immunized against rabies and none of the goats were immunized.

If immunization is going to be relied on to protect our goats from disease, then it is important that immunization occur prior to the challenge of disease. If does get infected with Chlamydia and abort only when they are pregnant, then the doe needs to be immunized prior to breeding. See the Preventive Health module for details on immunization programs. Sit down with your veterinarian to make an immunization plan specific to your farm and your management.

## Disease Surveillance

Disease surveillance can be a very useful tool in disease control programs. Disease surveillance lets you know how your disease control program is working at various points in time. There are two general methods to survey the level of disease in a herd. One of them is by examining animals and the other is by examining data from animals. If the level of clinical parasitism in a herd of goats is a concern then do a FAMACHA test on the goats. The FAMACHA is described in the parasite control module but in brief you look at the conjunctiva (inner lid) of the goat's eye and if it is bright red it gets a score of 1 and if it is white it gets a score of 5. Goats with scores of 3, 4, and 5 are anemic as a result of clinical parasitism. If your goats score 1 or 2 your parasite control program is working very well.



Alternatively, fecal samples and blood samples could be collected and a laboratory could determine the Packed Cell Volumes (PCV) and the Fecal Egg Counts (FEC). If PCV's are all over 30% and FEC are less than 100 EPG then the parasite control program is working very well. Some diseases may present few external signs. Johne's disease is a chronic mycobacterial enteritis that causes malabsorption and maldigestion in ruminants. It takes years to develop. Instead of waiting for disease signs, it would be appropriate to test by serology or by fecal bacterial culture. It is important to understand that when you see clinical disease in one goat of a herd you are usually just looking at the "tip of the iceberg." With most diseases, such as Johne's disease for example, 10-20 subclinical cases can be found for every one clinical case seen.

## Necropsy

A very useful surveillance tool is to have necropsies performed on dead and moribund animals. Whenever there is an unexpected death in the herd it would be appropriate to have your veterinarian perform a necropsy. In addition to finding the cause of immediate 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.

## Euthanasia

Occasions arise when a goat has become seriously injured or permanently debilitated and the humane procedure is to alleviate the animal's suffering by euthanasia. This is a controversial subject and is one which commonly evokes outrage from animal rights groups. Putting an animal to sleep can be a traumatic experience for the owner as well as for the animal. The American Veterinary Medical Association (AVMA) recommends the following techniques as being humane methods of euthanizing goats:

1. Intravenous drug overdose with barbiturates
2. General anesthesia followed by injection of potassium chloride.
3. Penetrating captive bolt

The following methods are "conditionally acceptable" for euthanizing goats:

1. Sedation followed by intravenous Chloral hydrate
2. Gunshot
3. Electrocutation

Lethal overdosing with barbiturates or other anesthetic agents is as humane a method as can be performed. Done correctly the animal becomes unconscious and then its heart and lungs stop all activity. Appropriate drugs given intravenously are required and generally this will require a veterinarian. Drugs used to euthanize animals remain in the carcass and will be fatal if ingested by scavengers (birds of prey, coyotes, etc.). It is critical that these carcasses be disposed of in such a way that the carcass does not end up in the food chain.

Captive bolt guns have the advantage over firearms that there is no projectile which can damage people or other objects. Used correctly, the application of a captive bolt to the head of the animal renders it instantly senseless. However, although the animal is brain dead and no longer has sensation it still will thrash around for varying periods of time. Sedation prior to captive bolt or gunshot will alleviate this problem.



Electrocutation across the brain will render an animal temporarily unconscious. Death occurs when the electricity is strong enough to stop the animal's heart or when other methods are used to insure that the animal doesn't awaken. Sedation prior to electrocution is recommended.

Methods of euthanasia which are listed as *inhumane* include:

1. Drowning
2. Air embolism
3. Blows to the head
4. Stunning
5. Cyanide
6. Exsanguination

7. Injected household solvents
8. Hypothermia.

## **Disposing of Mortality**

Disposing of a dead animal has become a larger problem since the advent of BSE. Rendered ruminant products are no longer allowed to be fed back to ruminants in the form of meat and bone meal. Rendering goats is not technically illegal but many rendering facilities now have strict policies that they will not render sheep or goats due to concerns about scrapie.

This leaves the following methods of carcass disposal:

1. Incineration
2. Burial
3. Compost

Incineration is the most expensive of the three. It has the advantage of speed; however, the smell of burning animals is guaranteed to cause complaints in most areas. Prior to burning carcasses in the open or in an incinerator check with your local government for ordinances that may ban or regulate the activity.



Burial is inexpensive but may cause problems with runoff, contamination of water tables and odors. Predators are drawn to burial sites and may disinter the remains. In general you want to bury the carcass at least three feet deep and make sure you are at least 5 feet above the water table. Check with your local government for ordinances that may ban or regulate the activity.

Composting is an inexpensive, environmentally friendly method of carcass disposal. However, it requires a fairly extensive 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.

## **Identify Your Animals**

To evaluate individual animals you will need individual identification of animals. Each animal will need a tag, tattoo, neck chain, ear notches or electronic chip so that you or anyone else can identify it. Due to the nature of goats it is wise to use at least 2 forms of identification in case one is lost. Currently, if you show goats or have purebred/registered goats that you sell or you have sheep mixed with your goats then they are required to have a scrapie tag.

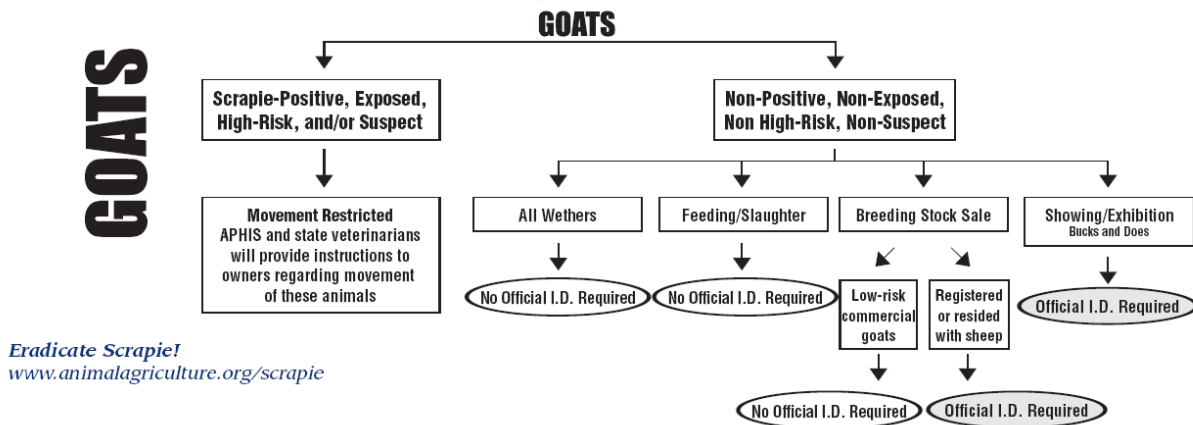
### ***National Scrapie Eradication Program***

Scrapie is a very rare disease in goats; however, it is commonly reported in sheep in the U.S. Because of these factors goats are part of the National Scrapie Eradication Program (NSEP). The good news is that because of the low level of disease in goats the regulatory requirements are

less than those for sheep. You will need to determine what requirements you must fulfill with your goats.

There is an excellent web site (<http://www.animalagriculture.org/scrapie/Scrapie.htm>) that details all the information you will need to meet the NSEP requirements.

The **first step** is to determine if you need to identify your goats. In general this will only be necessary if you are showing sexually intact does and bucks (wethers are exempt), or plan to sell breeding stock that are registered goats or have goats that have been raised in contact with sheep. See the chart to the right.



The **second step** is to obtain a premise/flock number. Eventually, this will be the same as your National Animal Identification System Number. Call 866-USDA-TAG to obtain your premise/flock number.

The **third step** is to determine which approved ID system will work best for you. In general, you can use tags supplied by the program or official custom made tags or if you have registered goats with tattoos or chips you can probably use them with some modifications. Check with your state and federal veterinarians to make sure you are in compliance.



The **fourth step** is to set up a record system that lists each goat. You will be required to retain ID records for 5 years. The records don't need to be detailed but they do need to include births, deaths, and movements of animals.

The **fifth step** is to make sure that every animal that leaves your farm and requires a tag has one in their ear.

The **sixth step** is to remember that all breeding animals and sexually intact goats moving across state lines must have a Certificate of Veterinary Inspection (CVI) which was issued in the last 30 days. In addition to verifying scrapie identification requirements have been met, the goats may also have to be tested for diseases such as Tuberculosis and Brucellosis. Results can take up to a week to obtain so make sure you plan ahead. Individual states can have requirements that are more stringent than the federal requirements listed above. When you contact your veterinarian to

obtain a CVI make sure you tell him/her where the animals will be traveling, their age, sex, registry status, and purpose of movement. Your veterinarian will contact the state veterinary office of your destination and determine what tests and requirements must be fulfilled.

### ***National Animal Identification System***

In the near future you will be required to have your farm and animals enrolled in the National Animal Identification System (NAIS). Recent cases of BSE in cattle have made it critically obvious that the U.S. needs a uniform system of animal identification that will allow regulatory agencies to track the movements of animals quickly and efficiently. The NAIS is being put into place to accomplish those goals. Under this system every facility that handles animals (farms, ranches, livestock shows, livestock sales, veterinary offices, etc.) will have a unique 7 character premises identification number. These numbers began to be issued in 2005.

Once the premise identification is in place, 15 character Animal Identification Numbers (AIN) and 13 character group/lot numbers will be distributed. Animals that are normally moved and marketed as a group (poultry, feeder pigs, etc.) will have a group number. All other animals will have an individual AIN. The program will determine suitable ID systems, such as tags or implants, for each animal species. The program will eliminate redundancy in identification numbers so that an animal's AIN number will be the same as its registry number or the same as its scrapie number, etc. It is the stated goal of this program that in the event of disease exposure all exposed animals will be tracked within 48 hours.

Naturally, certain individuals are nervous about the program and see it as an invasion of their privacy. The USDA has guaranteed that the only information the system will track is the location of the animal and any movements that occur during its life.

## **Setting up a Biosecurity Program: Risk Analysis**

### ***Evaluate risks***

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? If you had foot rot in the herd would the extra labor and expense be worth the savings of not having had a biosecurity program? 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 your farm to determine levels of risk and practical methods of limiting or eliminating risk is called risk analysis. Risk analysis involves you and your veterinarian evaluating your facilities, your disease status, your animals, and your management. When the analysis is over you should have a prioritized list of any significant risks to your animal's health and a plan to minimize or eliminate them.

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

Map your farm and see where you are. Do you have 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 you can separate healthy animals from sick animals?

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

What diseases do you have in the herd at this time?  
Is it worth eradicating those diseases you already have?

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

Are your animals genetically superior animals that would be hard to replace or would you be better off depopulating and repopulating now?

### ***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 not be enough time or expertise available?

### ***Set goals***

Set health goals for your existing animals. For example “all of 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.”

### ***Prepare a written protocol***

Do this with your veterinarian. Consider your goals, animals, facilities, current disease status and management and make up 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 to do. Post signs that clearly delineate biosecure areas from non-secure 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?

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