

Preventing Pneumonia and other Respiratory Illness in dairy barns

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Why do animals suffer from respiratory illness including pneumonia?

Animals get sick because pathogenic organisms infect the respiratory tract and overcome the animal's immune system.

What factors contribute to the organisms overcoming the immune system?

The two most important factors are the presence of a very large number of pathogens and suppression of an animal's immune system. When animals are sick, they shed large numbers of pathogens. If the building's ventilation system does not adequately exhaust these pathogens and bring in fresh air, these pathogens will persist and more animals will be infected. High humidity in the barn also contributes to high levels of air-borne pathogens.

Animals' immune systems can be suppressed by high levels of ammonia in the air, spoiled feed that might contain mycotoxins and stresses such as:

- Moving or transporting including loud noises
- Moving animals amongst groups
- Lameness
- Sickness (mastitis, digestive upset or other illnesses)
- Excessive animal competition (overstocking)
- Heat, cold and draft
- Uncomfortable resting area
- Large temperature fluctuations
- Poor nutrition
- Dust that irritates the respiratory tract

Very young animals have lower immunity than older animals and are more susceptible to stress.

How does poor ventilation play a role in respiratory illness?

Ventilation removes air-borne contaminants from buildings and brings in fresh outside air. Contaminants that cause the most concern are pathogens, moisture and ammonia. Pathogens come from animals that are sick or have been sick. Housing sick animals away from healthy animals helps to prevent transmission of disease, which often occurs with nose-to-nose contact. Most pathogens die within a few minutes when released into air, but they can live much longer when relative humidity is high, especially at levels greater than 80 percent. While ventilation will not lower relative humidity below that of

the outdoor air, good ventilation can keep the interior humidity similar to outdoor air. Pathogens also survive in the air longer when the temperature is higher. Keeping the indoor air temperature as close to that of outside in winter helps to kill pathogens.

Ammonia is released from manure when bacteria decompose urea in the manure. The rate of activity of bacteria doubles for each 10-degree (F) rise in manure temperature above about 40 degrees. If the rate of microbial activity is x at 50 degrees, it is $2x$ at 60 degrees; $4x$ at 70 degrees; and $8x$ at 80 degrees. The rate of release of ammonia follows a similar pattern. Keeping the barn and manure temperature close to that of the air outside limits the rate of ammonia production. Proper ventilation helps to keep the room air temperature as low as possible and helps to remove ammonia-contaminated air from the barn.

How do you know if you are ventilating the barn enough?

When you operate the ventilation system so the barn air temperature stays no more than 5°F warmer than the air outside and there is no strong odor of ammonia, the barn is probably ventilated adequately. If moisture condenses on building surfaces, the ventilation rate is not high enough.

How do I control the air exchange to limit the temperature to within 5 degrees of the air outside?

This depends on the type of ventilation system you have.

With natural ventilation, make sure the eaves are open enough. In very cold weather, the eaves should be open a few inches. As the outside air temperature rises, open them more. If the wind is blowing, you can close the eaves more than on calm days. You also should make sure the ridge is opened adequately. For a “cold,” naturally ventilated barn, the ridge should be opened two inches for each 10 feet of building width and the eave openings sized for half that on each side. For a barn 100 feet wide, the ridge should be open 20 inches (2 inches/10 feet x 100 feet) and the eaves should be open 10 inches on each side. Natural ventilation works best when the roof slope is four inches rise on 12-inch run.

With a mechanical ventilation system, a fan should run continuously to maintain air quality. Thermostats should control the other fans. Set the thermostats so they maintain the air temperature as low as possible, while still keeping animals comfortable. Adjust the air inlets in proportion to the rate of ventilation provided by the fans. The inlet system should direct air away from the animals to avoid drafts in winter.

What mistakes do people make?

1. Limiting ventilation to keep exposed water pipes from freezing. Use other measures to protect pipes from freezing and increase the ventilation rate to control air quality.

2. Limiting ventilation to keep manure from freezing. Most manure handling systems work best when the manure doesn't freeze. Make changes to manure handling practices and run the ventilation system at a higher rate to maintain air quality.
3. Limiting ventilation to prevent drafts. Air movement at low temperature can cause drafts, which are especially stressful for younger animals. Instead of closing down the ventilation system to control drafts, provide solid pen partitions to protect animals from drafts when they are resting. In open front sheds, use plywood attached to gates to provide the draft protection. For small animals, consider a plywood hover (horizontal roof) within the pen to limit drafts. Adding a curtain on part of the open front can limit drafts, but be careful not to close up the ventilation system too much while trying to limit drafts.
4. Underestimating the effects of fluctuating temperature. In spring and fall, daily high and low temperatures may fluctuate widely. Temperature extremes can cause a lot of stress in animals. In greenhouse barns or translucent structures like some calf hutches, solar energy can cause barn air temperatures to be even higher than outside air, causing even more extreme temperature variations. Take care to control indoor temperature with ventilation or sunshades. Animals that have developed a thick winter coat are ill equipped to handle a sudden rise in temperature.

The fluctuating temperatures of spring and fall also can cause problems in conventional buildings. If the ventilation system is adjusted to maintain a 5-degree temperature difference between inside and outside air during the coldest part of the day (early morning) and the ventilation rate is not increased as outside temperature increases (mid-morning to late afternoon), then the temperature in the barn will be much higher than outside. This can result in more ammonia, pathogens, dust and moisture in the barn. The higher temperature and increased contaminant levels will increase stress levels in the animals and suppress their immune systems, increasing the likelihood of respiratory disease. Producers must be vigilant to make proper ventilation system adjustments during the extreme swings of temperature that occur in spring and fall.

5. Being unprepared for weather changes. Often the spring weather warms up quickly and unexpectedly, before producers are prepared to start increasing the barn ventilation. Consequently, the barn becomes quite warm, humid and odorous (ammonia) and these conditions can result in respiratory illness.

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