PURDUE EXTENSION

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EXPERT REVIEWED

Dust Management in Horse Facilities

Introduction

Why should a horse owner be worried about the air quality in their equine facilities? Is there really anything that can be done to improve the quality once the barn is built? This paper addresses those questions by providing management practices that can promote ideal air quality. The quality of air in barns and stables is important because high levels of dust, mold and other airborne irritants often occur in horse environments. In particular, dust can lead to or aggravate respiratory health issues (see Purdue Extension publication ID-443-W, *Equine Respiratory Diseases*). Both recurrent airway obstruction and inflammatory airway disease are examples of common diseases that can increase in severity upon exposure to dusty environments.

Clinical Signs of Respiratory Disease

- Cough
- Nasal discharge
- Wheezing
- Flared nostrils and labored breathing
- Reduced performance
- Exercise intolerance

People often overlook the fact that many of their equine companions spend at least half their day confined to the stable. As horse owners come and go throughout the day, they don't always think of how a little bit of dust in the corner or hint of ammonia in the air can have a profound affect on the health of their horses and stable employees. Horse owners should take steps to reduce prolonged exposure to those irritants.

Factors of Air Quality

In the barn, airborne dust is composed of particulates from various sources, including soil, mold, bacteria, insects and mite fragments, hair, manure and plant material, to name a few. Dusts and molds can be recognized by the naked eye and by smell, but most airborne particulates, even aerosolized molds, are microscopic (less than 10 microns) and cannot be seen. Dust particles are classified based upon size and expected penetration into the human airways:

- Total dust
- Inhalable dust
- Thoracic dust
- Respirable dust
- Fine particles
- Ultrafine particles

A horse with inflammatory airway disease being treated by aerosol therapy using a specially designed face mask.

Katherine Smith, Kathleen Ivester, and Laurent Couëtil, Purdue University Department of Veterinary Clinical Sciences, SVM;
Mark Russell, Purdue University Department of Animal Sciences

Total dust represents all dust particles and is mostly composed of dust that can be physically cleaned from barns. Thoracic dust is a slightly smaller particle size than total dust, able to reach only the upper portion of a human's airways. Respirable dust can reach the deepest airways and is so small in diameter that it often is not trapped by natural clearance mechanisms, such as mucus. This particle is of particular interest because it is thought to be important in the common lower airway diseases in horses. Ultrafine dust has yet to be thoroughly researched, but is so small it is thought to be able to slip into the bloodstream and lead to problems elsewhere in the body. While these size classifications are based upon the ability of particles to reach each portion of the human airway, we apply these conventions to evaluation of equine environs.

Combinations of total, inhalable, thoracic and respirable dust are most often measured when studying horse facilities. Examples of contributors to increased dust levels are hay, bedding and unnecessary clutter that "collects dust." Mold spores can accumulate in hay, grain and old tack and equipment left lying around the barn. Even the best quality hay contributes to mold and dust levels. Additionally, secretions containing bacteria and viral particles originating from a sick horse can contaminate tack and equipment in the barn, and often be transferred from horse to horse by shared common items and tools, such as feed buckets, halters and brushes.

In addition to dust, horses frequently are exposed to airborne ammonia. How can ammonia be identified? Ammonia monitors and tests are available to determine levels in a particular stall or area of the barn, but most horse owners recognize ammonia by smell. Horse farms have a classic odor — a mixture of manure, hay and grain — but ammonia has a distinct smell. When cleaning a horse stall, it is common to strip wet bedding down to the floor. Often there will be a noticeable difference in the smell, and the odor can sting nostrils and make the eyes watery. Ammonia originating from decomposed urine in bedding can be an irritant to the respiratory tract, and levels of ammonia typically increase closer to the floor of the stable. Horses that are lying down, and ponies and foals whose breathing zone is closer to the ground, can have significantly higher exposures to ammonia.

Mechanics of Altering Stable Air

There are several factors to consider when thinking about the overall topic of stable air quality. Both ventilation and air exchange rate in a stable greatly affect the ability of airborne particulates to settle or be removed from the barn. Ventilation is the process of replacing stale air with fresh air. Most horse barns have inadequate ventilation, which can increase the risk of respiratory disease in animals and humans. Ventilation involves infiltration, mechanical and natural ventilation. The air exchange rate — how fast outside air can replace indoor air — also is important. As fresh air from the outside enters a barn, particle concentration in the air will decrease, providing a healthier breathing environment.

Infiltration is unintended ventilation. It occurs in a barn when air slips in through cracks in walls and floors or through gaps around windows and doors. Although not the ideal form of ventilation, many stables have significant infiltration. Mechanical ventilation utilizes equipment such as fans, vents in the walls, and ducts. For natural ventilation consider the stack/chimney effect, aspiration and perflation. Aspiration can be thought of as the effect of the wind blowing across the roof of the barn, while perflation is the effect of air blowing from one side of the stable to the other. The stack/chimney effect depends on temperature and moisture differences between the inside and outside, as well as the height of the stable.

A horse barn equipped with a cupola to assist with ventilation.

This is visually demonstrated by the steam seen as heat rises from a horse's back while in the barn. In warmer temperatures, the hot air in the barn escapes through openings in the ceiling or at higher levels of the barn (vents, windows, cupolas, etc.), reducing the pressure at the lower level of the barn. The reduction in pressure near the ground allows cooler air to be drawn in through open doors, windows and vents. This phenomenon can occur in reverse to a lesser degree during cooler months when the difference in temperature between the inside and outside of the barn isn't as great. Under these conditions, the stack effect is not as strong.

Soffet and ridge vents also can be used to improve ventilation. Soffet vents are installed under the eave of the roof and work to pull cool air in, allowing warm air to escape through openings in the roof. Ridge vents run along the entire length of the peak (ridge) of the roof. These work primarily to allow warm air to escape from the facility.

How Can Air Quality be Improved?

Much research has been conducted to determine what influences particulate matter in the air. This research allows stable owners to improve the quality of air by making very basic changes to their management practices:

Clutter

The first thing to think about is minimizing the clutter around the barn. If half the bridles haven't been used recently, it isn't necessary to scatter them over the tack trunk. Removing dust-collecting objects from the barn will remove only the visible dust; the particles that tend to be the most harmful are those that can't be seen with the naked eye. Every little bit of dust reduction helps, so cleaning out the barn is a good start.

Bedding

The bedding used in stalls can have a significant affect on the respirable dust concentration in the barn. A majority of barn owners choose to bed their horses on straw, even though research shows that it is one of the dustiest materials that can be used. Wood shavings provide a good alternative, and there are many new items on the market — such as bedding in pellet form and shredded paper and cardboard — that generate very little dust.

Feed

What a horse is fed also has an affect on the amount of dust in a barn. Several different studies have shown hay to be dustier than other available forages. Furthermore, horses tend to bury their noses deep in hay while eating, especially in round bales, thereby exposing themselves to even higher dust levels. Alternatives to hay include alfalfa cubes or pellets, silage or haylage. Haylage is made from grass cut at an earlier time than hay. After it has been dried to an appropriate level, the haylage is wrapped in plastic, retaining the original nutrients. One study showed that changing a horse's diet and bedding from hay and straw to haylage and shavings can reduce dust levels by more than 97 percent (Couëtil 2008, p. 281). A veterinarian or local Extension educator can provide information about alternative forages available in an area.

How and where horses are fed hay also can have an affect on the dust levels. Feeding hay in hay nets or racks seems to increase the dust particulate in the breathing zone when compared to spreading hay out on the stall floor. Feeding hay from hay nets or rack also places the horse's head at an unnatural level for grazing and can result in the horse's nose and eyes

A horse fed hay from a rack is exposed to 2-3 times more dust than when fed hay on the ground.

being exposed to more dust and hay particulate.

While hay is one of the dustiest forages available for horses (even good-quality hay), measures can be taken to limit dust levels if that is the only option available. Upon delivery, thoroughly check a number of randomly selected bales for excessive levels of visible dust and any mold that may have developed during storage. Hay should be stored as far away from stalls as possible. Although it may be convenient to store hay directly above the stalls, this practice results in a constant source of new and, potentially, harmful dust. If a storage trailer or separate weatherproof building is available, it is beneficial to store the majority of hay outside the barn. Finally, soaking the hay for a short period of time prior to feeding can reduce dust. Studies have shown that soaking hay for 15 minutes versus half a day doesn't make a major difference on dust levels. Merely immersing the hay before feeding it to a horse can provide some benefit. Care should be taken not to soak the hay for too long, because soaking overnight can begin to drain some of the nutrients from the hay.

Another management consideration is whether to keep barn doors open or closed. Depending on the circumstances, open barn doors can help reduce levels of dust. The stack effect of natural ventilation relies on fresher, cooler air being moved into the barn near the ground level, as warm air is expired through the ceiling or various vents. Opening the doors provides a way for outside air to circulate through the barn, helping remove stale air through other ventilation mechanisms such as fans and vents. Closing the doors reduces the amount of fresh air able to enter the barn and limits it from moving through cracks in the walls or smaller windows. While the tendency might be to wait to open all the doors until a spring day, consider opening them even when the temperatures are a little chillier outside. Doing so can help reduce dust and ammonia levels and make the stable a more pleasant environment for both horses and humans.

Dust Generating Tasks

Sweeping aisles and tossing hay into stalls allows horse owners to visualize the dust being generated, but there are a few other tasks which generate dust that owners often don't think about. Cleaning stalls has been shown to magnify dust by nearly 16 times normal levels. It is a good idea to turn horses out or exercise them outside while stalls are being cleaned and aisles swept. It takes 30 minutes to one hour for dust to settle once cleaning tasks are completed, so don't move a horse back inside immediately after a stall is cleaned.

Considerations for Construction or Renovation

If building or renovating a barn, make sure the structure has the proper number of vents for optimum air exchange rates, as well as an adequate number of windows and doors. Even during colder temperatures, windows should remain open as much as possible. Vents in the roof — or some form of opening to allow stale air to escape — are essential. In addition, strategically placed fans, in conjunction with open doors, can help recirculate the stable air and not allow dust to settle inside the stable. However, it is important to consider the placement of fans so that settled dust is not blown back into the air.

Conclusion

The quality of air in stables is of utmost importance to the horses living there and the people working in the barn. There are many changes in stable management that can be made, including changing feed and bedding. Structural and mechanical changes to a barn also can improve poor ventilation. Ideally, horses should spend as much time turned out as possible, but many get only a few hours outside each day. For those horses there are many things an owner can do to make sure the animal is breathing the highest quality air possible.

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