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EXTRA

**AIR QUALITY'S
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Air Quality's Effects on Horses

How air quality issues such as wildfire smoke and pollution can affect equine respiratory health

Anna Sochocky

Catastrophic environmental events such as wildfires that diminish air quality and affect horses' breathing might seem beyond human influence. We do have control, however, over the equine management choices we make daily about feed, bedding, ventilation, exercise, and veterinary care. Many of these decisions and strategies can help horses breathe easier during times of both crisis and calm. Here's what you should know about protecting your horse's respiratory health.

A Hidden Danger

The National Interagency Fire Center reports that in 2021 alone 48,725 wildfires burned more than 6.5 million acres, making it one of the worst fire seasons in history. Fires represent an apparent threat to people, property, and animals. The insidious secondary threat of smoke poses hazardous risks, too, of course. But we might not consider the dangers we can't detect by sight or smell.

Natural and artificial combustibles,

including wood, vegetation, and plastics, produce toxic chemicals when ignited. The components of smoke—carbon monoxide and dioxide, hydrogen cyanide, soot, hydrocarbons, nitrogen oxides, and formaldehyde—can be fatal in high doses when inhaled over long periods.

Even the smoke particulates—a combination of solid particles and liquid droplets, each less than 1 micron in diameter—can trigger asthma episodes, infections, and respiratory illness, reducing the lungs' ability

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Even horses experiencing mild cases of smoke exposure need two to four weeks to recover fully.

to expel common irritants like pollen.

“Smoke inhalation at a very high level can create all sorts of issues,” says Kent E. Pinkerton, PhD, professor of anatomy, physiology, and cell biology at the University of California, Davis, (UC Davis) School of Veterinary Medicine. “Searing heat can damage a horse’s respiratory system and its delicate set of cells that line the airways and the gas exchange regions. The particles you can’t see not only reach the upper respiratory tract but go all the way down into the deep respiratory tract, where they can cause considerable amounts of damage.”

He says horses might be sentinels for the effects of wildfire and air pollution due to their respiratory sensitivity. The equine airways’ cleanup mechanisms expel pollutants like pollen and dust daily.

“If the particles are depositing in the airways, then it only takes about 24 hours for clearance of those particles in the airways,” Pinkerton says. “It’s when the particles are so small that they go all the way down into the deep lung, where we have a gas exchange, where we have the alveoli. The half-life of those particles for most species will be about 90 days. It’s a long retention time when

particles are so small and get that deep into the lungs.”

Signs and Effects of Respiratory Distress

A horse’s average respiratory rate ranges from 12 to 24 breaths per minute, moving the equivalent of 16 gallons of air in and out of the lungs every 60 seconds. If breathing appears labored in the abdomen or rib cage and the respiratory rate at rest climbs to 30 breaths per minute, that horse is struggling to breathe. Other respiratory distress signs include flaring of the nostrils, repetitive deep coughing, and yellow or white nasal discharge.

Horses exposed to fire smoke suffer respiratory injury beyond what poor air quality causes, says John E. Madigan, DVM, Dipl. ACVIM, ACAW, distinguished professor emeritus in the Department of Medicine and Epidemiology at the UC Davis School of Veterinary Medicine.

“When we see lung damage in horses related to fires, the most severe problem is inhaling hot gases,” he says. “If the horse is very close to the fire itself and breathing in these scorching gases from the flames,

we know that that produces direct pulmonary insult, causing inflammation or lung damage.”

Even horses experiencing mild cases of smoke exposure need two to four weeks to recover fully. More severe cases that induce a chronic respiratory condition such as equine asthma might need months to be brought back to health. Long-term effects of smoke exposure and its accompanying dangers can also impair a horse’s immune system—damage that might not be evident for weeks.

“Inflammatory cells react to particulate matter that has settled down in the lung, and now there’s a cleanup going on,” Madigan says. “As the air clears, you need to be aware that the horse’s lung is still responding to that insult and is making corrective immunologic clearance of particulate matter, neutrophils, and other things. There’s no infection, but there’s particulate matter that has to be processed. The average horse owner should be aware that the horse doesn’t have some special nose filter that renders the horse unexposed. Watch for signs like cough, nasal discharge, and an elevated respiratory rate, and then call your veterinarian.”

Smoky conditions also put horses off their feed and water. Changing the water frequently so horses continue drinking helps keep their airways moist and clears inhaled matter from the bronchi and bronchioles. If an airway is dry, toxins stay in the passages and even the lungs. Maintaining clean water and food sources can also help avert colic, says Jenifer R. Gold, DVM, Dipl. ACVIM-LA, ACVECC-LA, clinical associate professor at Washington State University, in Pullman.

“If a horse drinks tainted water, they’re not going to drink it again,” she says. “The same is true for food. We saw more colic cases this year than I’ve ever seen.”

Air Quality Outside and In

The U.S. Environmental Protection Agency ranks air pollution and air quality on a scale of 0 to 500. The air quality index (AQI) measures ground-level ozone, particulate matter, and heat and humidity in the air using a color-coding system.

Though the ranking system is geared toward people, the classifications also apply

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If a horse's breathing appears labored in the abdomen or rib cage and respiratory rate at rest climbs to 30 breaths per minute, that horse is struggling to breathe.

to horses. Particulate levels begin to pose dangers to horse health when they exceed 150. At this level owners should limit riding and exercise until the smoke clears and air quality improves. An AQI value above 300 is considered hazardous.

Gold equates negative air quality readings for horses to the effects of heavy smoking: "When the air readings (show) particulate matter in the 300s or 400s, it's like your horse is smoking 80 packs of cigarettes a day," she says. "If your horse is smoking 80 packs of cigarettes, give them up to six to eight weeks to recover.

"The other problem is the particulate matter has changed, especially when you have so many buildings burning," she adds. "It's not just carbon monoxide; you have more cyanide and other toxic chemicals that these horses are (inhaling). We don't know the long term on that and how it affects their performance."

While extreme events like wildfires are obvious causes of air pollution, many other sources and irritants can compromise a

horse's respiratory health, says Colleen Duncan, DVM, MSc, PhD, Dipl. ACVP, ACVPM, associate professor in the Department of Microbiology, Immunology, and Pathology at Colorado State University's (CSU) College of Veterinary Medicine and Biomedical Sciences, in Fort Collins.

"Extreme events are the outliers, and what we're worried about is this long-term repeated and multifactorial exposure," she says. "Each horse's work intensity and amount influence their tidal volume (amount of air per breath) and, therefore, how much air pollution they inhale. We used to think most of the pollution comes from large particulate matter that gets trapped in the lungs. Problems that we're seeing now are with particles that are small enough to penetrate the bloodstream, which can upregulate systemic inflammation and cause long-term health impacts. Teasing out how to control the things we can is an important part of the puzzle, which includes how, when, and where we train horses."

Duncan's colleague, Katie Seabaugh,

DVM, MS, Dipl. ACVS, ACVSMR, assistant professor on the Equine Sports Medicine Team at CSU, emphasizes the horse owner's role in promoting equine respiratory health, starting in the barn.

"Smoke is a concern and is believed to have a significant effect on respiratory health, but there are so many other things that can influence respiratory health—dust within the hay, dust within the barn," she says. "Long before we started to recognize that smoke played a role, we've been dealing with the effect of other air particulates. We must realize that smoke will amplify a problem that already exists. We can't just say, 'Oh, it's just because of the smoke,' and ignore the right steps for appropriate respiratory health."

Equine Airway Health Starts in the Barn

Improving air quality and minimizing irritants starts by assessing barn management protocols. Ventilation, air quality monitors, bedding, feed, arena footing, turnout,



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Ventilation, bedding, feed, arena footing, turnout, exercise, and cleaning schedules are tangible areas owners can control.

exercise, and cleaning schedules are tangible areas owners can control. Ventilation inside a barn begins with good airflow. Open windows, doors, and access to outside runs ensure air circulates. Fans enhance circulation, too, driving stale air and irritants away from stabled horses.

Seabaugh says affordable air quality monitors encourage owners to evaluate what their stabled horses are breathing. “Put an air quality monitor in the barn, and then make a management change and look at how air quality in a barn changes when certain things are done,” she says.

Tufts University researchers found that by using a laser monitor they could measure how many particulates are present in air quality samples. Another method collects dust particles by drawing air through a “cyclone” and determining whether endotoxins are present.

Trimble also stresses the importance of the owner’s role in mitigating toxins and irritants inside the barn.

“There are bedding types lower in dust

content, such as paper,” she says. “Try to move (horses) outside before you begin cleaning. Avoid straw. Never clean the barn (especially with a leaf blower) when the horses are inside. Don’t let the ammonia build up from urine, as ammonia is a major irritant. Stalls should be cleaned daily.”

Dipping hay flakes or a full haynet into clean water and removing it immediately coats the hay with enough moisture to remove particulates without affecting carbohydrate, vitamin, or mineral content.

“Many owners wet down hay to decrease dust right before feeding to a horse with asthma,” says Trimble. “You can also steam hay or switch to pelleted feeds. Make sure horses have access to fresh, clean water at all times.” Again, keeping the airways moist can help facilitate the clearance of inhaled particulate matter.

In a landmark European study published in the *Journal of Veterinary Medicine* in 2018, researchers collected data about bedding and forage (dry, moistened, or steamed hay, or haylage) and studied its

effects on lower airway inflammation. They found the degree of inflammation was higher for horses housed indoors with straw bedding versus shavings. They also found that steamed hay significantly reduced cases of equine asthma.

Take-Home Message

Wildfire events and associated smoke can linger for weeks. “My recommendation would be if you feel fine being outdoors, then that’s probably a good indication it’s okay for your horses as well,” says Pinkerton. “Don’t be doing anything that increases their level of activity that would cause them to breathe in more air and, thus, more particles.”

Evaluating and improving air quality inside and outside the barn requires daily diligence, regardless of smoke presence. Assessing ventilation, exercise, feeding, bedding, barn management, and even how much clutter like old tack contributes to air quality is necessary to correct problems and help horses breathe easier. **SM**