



POSITION STATEMENT ON PHYSICAL ACTIVITY, AIR QUALITY AND WILDFIRES

**National Federation of State High School Associations (NFHS)
Sports Medicine Advisory Committee (SMAC)**

Background

Air pollution is due to a mixture of solid particles and gases that may result from a variety of sources including wildfires, internal combustion engines, and industrial emissions. In people without lung disease, the immediate effects and long-term consequences of air pollution upon athletic performance are not well understood. There is some evidence to indicate that chronic exposure may adversely affect blood vessels throughout the body, but more studies are needed before making definitive statements. However, air pollution has long been known to worsen the symptoms of respiratory diseases such as asthma. When compared to adults, children may be more susceptible to having problems while exercising in polluted air.

There are two key components of air pollution that cause respiratory problems, especially in people with underlying respiratory problems: ozone and particulate matter. Ozone is found in smog and is often at its worst in the late afternoon and early evening on hot summer days. It forms through a variety of complex chemical interactions, all of which require sunlight as a catalyst. Ozone can travel significant distances and, contrary to conventional wisdom, is more predominantly a rural pollutant.

The particulate matter found in air pollution can be a hazard at any time of the year, especially when the air is still. Particle pollutants can be high near busy roads and factories, and at times when there is smoke in the air from wood stoves, fireplaces, or wildfires. Other potentially harmful air pollutants include carbon monoxide, nitrogen oxides and sulfur dioxide. Smoke from late summer forest and grass fires has very high levels of particulate matter and is of special concern in the western U.S., often causing severe air pollution coinciding with the beginning of the fall sports season.

It is important to realize air pollution may also occur indoors. Potential sources include tobacco smoke in any situation, dust in indoor rodeo arenas, and exhaust fumes from ice resurfacing equipment in ice arenas. Consequently, athletes with asthma should always have their medication available and be especially cautious in these venues.

Recognition and Management

The Air Quality Index (AQI) is a system developed by the US Environmental Protection Agency that describes the general health effects associated with different pollution levels, as well as whatever precautionary steps may need to be taken if air pollution levels rise into an unhealthy range. During times of suspected high air pollution, the AQI should be checked prior to all practices and contests. A particular location's AQI can be found at <https://www.airnow.gov>

The AQI takes into consideration the five major determinants of air pollution: ozone, particulate matter, carbon monoxide, nitrogen dioxide, and sulfur dioxide. The measured pollutant concentrations are then converted into a number on a scale of 0 to 500. Higher numbers correlate to a greater level of air pollution. Under the Clean Air Act, the National Ambient Air Quality Standard is 100. An AQI level greater than 100 indicates that a pollutant is in the unhealthy range. As specific public health department recommendations may vary, it is critical that state associations and schools consult local or state health departments for guidelines on when outdoor activities should be modified or cancelled.

Many western states have additional online resources to track air quality. These websites may use the AQI or a PM2.5 concentration. The PM2.5 describes fine inhalable particulate matter with diameters that are generally less than 2.5 micrometers. As a frame of reference, PM10 is less than the width of a single human hair and is small enough to get into the lungs while matter that is PM2.5 can only be seen with an electron microscope. Because it is so light and small, these tend to stay in the air longer than heavier particles and can penetrate deep into the lung tissue.

Both the AQI and the PM2.5 are reported by a color-coded chart which remains consistent across these different tools. A red “unhealthy” day will be the same whether it is reported as an AQI or a PM2.5 value. The state or local health department is available to serve as a resource to learn more about how this data is reported.

Commercial-grade sensors, such as PurpleAir monitors have expanded the data available beyond the regulatory-grade sensors used by the EPA and DEQ. Unlike the AQI which measures several determinates, most commercial grade sensors only monitor for particulate matter (PM2.5). Due to a high bias toward reporting more PM2.5, they are not as accurate as regulatory-grade monitors. However, they are very precise and can report valuable air quality information closer to your facility location. Ideally, commercial grade sensors are networked into a regional/state system so they can provide a factor to correct for bias.

School personnel should locate the air monitors closest to practice and competition venues at <https://www.airnow.gov> Not all schools and venues will have a nearby monitor, and weather variation (wind) and geographic features (hills and valleys) can account for large differences between relatively close locations. Therefore, anyone assessing air quality must be familiar with the 5-3-1 Visibility Index Method. Based on previous air pollution research, we know that there is a correlation between air quality and visibility.

The 5-3-1 Visibility Index Method is a simple way to use visibility to estimate air quality and health effects and is particularly useful with rapidly changing weather conditions, like smoke from wildfires. The key to successful use is preparation, as it requires knowledge of large landmarks visible from the venue. Using an online satellite map, locate three landmarks that can be seen from a specific venue. The landmarks you choose should be 1 mile away, 3 miles away and 5 miles away. If you use multiple venues, you will need to do this for each separate location. Standing with the sun behind you, look at the three objects and when the outline of the landmark can no longer be seen, then the visibility range is less than the distance marker. When the air is smoky and hazy, monitoring the AQI or the Visibility Index should be done at least hourly during competitions and practices as conditions can change quickly.

Some students may be more susceptible to the health effects of poor air quality. The Preparticipation Physical Examination helps to identify those students with underlying ailments that make them more affected by poor air quality. Conditions that put students at risk include asthma, recent respiratory infection, and chronic heart or lung disease.

All schools must have an Emergency Action Plan (EAP) in place for every practice and competition venue in case of respiratory or other medical emergencies. Students diagnosed with asthma should have an Asthma Action Plan that they follow if symptoms occur during or after exercise. If poor air quality persists over several days, at risk students will have symptoms triggered more easily than those without pre-existing conditions.

Schools should investigate whether their state has any additional regulations regarding heat and air quality for school employees. Many states in the Western US have passed ***Occupational Safety and Health Administration (OSHA) Rules*** in regards to exposure to wildfire smoke and heat.

If the health effect category is in a zone where your state or local health department discourages outdoor activity, all practices and contests should be moved indoors or cancelled. If activities are moved indoors, you must check with the maintenance staff to ensure existing HVAC systems provide properly filtered indoor air. If the HVAC system cannot appropriately manage the burden of pollutants in the air, indoor air quality **MAY BE WORSE** than the outdoor air and it is not appropriate to practice or workout indoors. Furthermore, when moving indoors, Heat and Hydration Guidelines must be followed as temperatures may be hotter inside a gymnasium on a hot summer day than outside. If indoor practices are not an option, practices may be held earlier in the day to avoid warmer temperatures or moved to a location with better air quality.

Please note that all of the above principles are not limited to athletic events and should also be followed for physical education classes, marching band, and other outdoor activities involving physical activity in order to protect both students and staff.

References

Giorgini P1, Rubenfire M, Bard RL, Jackson EA, Ferri C, Brook RD. Air Pollution and Exercise: A review of the cardiovascular implications for health care professionals. J Cardiopulm Rehabil Prev. 2016 Mar-Apr;36(2):84-95.

Qin F, Yang Y, Wang ST, Dong YN, Xu MX, Wang ZW, Zhao JX. Exercise and air pollutants exposure: A systematic review and meta-analysis. Life Sci. 2019 Feb 1;218:153-164.

April 2023

April 2019

DISCLAIMER – NFHS Position Statements and Guidelines

The NFHS regularly distributes position statements and guidelines to promote public awareness of certain health and safety-related issues. Such information is neither exhaustive nor necessarily applicable to all circumstances or individuals and is no substitute for consultation with appropriate health-care professionals. Statutes, codes or environmental conditions may be relevant. NFHS position statements or guidelines should be considered in conjunction with other pertinent materials when taking action or planning care. The NFHS reserves the right to rescind or modify any such document at any time.