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Invisible Hazards and How to Protect Against Them

by Kathleen Norlien

Out of sight is out of mind — but it shouldn't be! Even if an ice arena has not experienced recent problems with air quality, safety must be a constant priority to arena managers. Without attention paid to maintenance of good air quality, arena managers place themselves in a situation where they could be held liable for incidents that might occur. *Air quality incidents are preventable.*

Today's ice arenas are being built "tight" to conserve energy and allow for a controlled climate. Tight buildings, in conjunction with today's high-tech all-in-one ice resurfacers that scrape and resurface the ice with a single driver at the helm, have contributed to the potential to cause poor air quality in indoor ice arenas.

The first major technical paper to document poor air quality in ice arenas, "Problems Created for Minnesota Ice Arenas by Resurfacer Engine Exhaust" (by Darrell Anderson, an engineer formerly with the Minnesota Department of Health), was published in January 1971 in the *Journal of the American Industrial Hygiene Association*. As a result of this information regarding hazards within ice arenas and to protect their patrons, three states promulgated rules and regulations to require air testing in arenas: Massachusetts, Minnesota and Rhode Island. Both Massachusetts and Minnesota require air monitoring for carbon monoxide (CO) and nitrogen dioxide (NO 2), while Rhode Island requires air testing only for carbon monoxide. Of these states, only Minnesota also governs the broader category of sports arenas, which includes non-ice events such as go-carting, monster trucks and other racing/demolition activities where internal combustion engines are used indoors.

But safety must remain a top priority to protect the health of skaters and spectators using indoor arenas even if a state does not require air monitoring. Although much time has passed since the publication of that landmark paper, the problem of poor indoor air quality remains in some enclosed arenas.

CO and NO 2 are formed during the burning of fuels such as gasoline, kerosene, propane and liquefied petroleum gas (LPG) used in powered engines, furnaces, water heaters and wood stoves.

The hazards of carbon monoxide are more widely documented than those of nitrogen dioxide, perhaps because it is much easier to measure, both in the air and in the body. Despite this fact, nitrogen dioxide is another product of combustion that also needs to be taken seriously. To protect yourself and others from these contaminants, it is important to understand their chemical properties and the health effects from exposure to them.

Carbon monoxide is an odorless, colorless, tasteless gas. It is formed by incomplete combustion of carbon-containing fuels (almost any fuel except battery- or electric-powered machines), particularly when there is a condition of inadequate oxygen supply for combustion. CO resembles oxygen in its size, molecular weight and diffusion capacity. Because the density of CO is close to that of air, CO generally mixes well in air. Exposure to CO most often produces symptoms such as headaches, dizziness, nausea, weakness and shortness of breath.

Nitrogen dioxide is a brown, acidic and highly corrosive gas that can be a byproduct of high-temperature fuel combustion. Exposure to NO 2 can cause eye, nose and throat irritation; produce severe cough, chest pain and pulmonary edema (accumulation of fluids causing swelling in

the lungs); reduce sensory perception; and contribute to an increased risk of respiratory infections. Asthmatics and people with chronic obstructive pulmonary disease (COPD) are considered particularly susceptible to the respiratory effects of NO 2 exposure. In addition to adverse health effects, NO 2 reacts with surfaces and furnishings, and can fade and discolor fabric.

Regularly testing the air in enclosed sports arenas can provide an indication that the air quality is deteriorating or is bad. Testing devices range from billows pumps with colorimetric tubes, alarms that will sound when levels of dangerous gas exceed safety standards and hand-held measurement devices that can have detection elements for both carbon monoxide and low levels of nitrogen dioxide.

To improve the air quality, the following measures may be employed:
1. Regular equipment checkups and maintenance of all combustible equipment (including heaters) to ensure optimal operating condition
2. Increased ventilation to provide fresh make-up air before, during and after any fuel-burning equipment is operated indoors
3. Changing fuel-burning equipment, including ice resurfacers and edgers, to battery-powered or electric equipment that does not produce CO and NO 2 emissions indoors

It is important to recognize the symptoms of exposure to the “invisible hazards” in indoor sports arenas. Take action now to protect yourself and others.

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