Guidance Document

Connecticut Department of Public Health
Environmental & Occupational Health Assessment Program
Environmental Health Section
410 Capitol Avenue, MS # 11EOH, PO Box 340308
Hartford, CT 06134-0308
Telephone: (860) 509-7740 Fax: (860) 509-7785

Guidance on Maintaining Indoor Air Quality in Indoor Ice Rinks for Managers, Owners and Coaches

Poor indoor air quality in indoor ice rinks can cause potentially dangerous health hazards to the occupants from exposure to carbon monoxide, nitrogen dioxide and particulate matter. These pollutants are released from fuel burning equipment such as ice resurfacing equipment that are operated indoors. It is critical that the ventilation inside these arenas is operated and maintained properly in order to ensure that there is enough fresh air entering the building and that the pollutants are removed.

Carbon Monoxide (CO) is a colorless, odorless gas that can cause headaches, dizziness and nausea. Exposure at high levels can cause death.
Nitrogen Dioxide (NO2) is a toxic gas that can cause irritation to the eyes, nose and throat as well as shortness of breath.
Particulate Matter (PM) is extra fine particles that may contain acids and metals. Inhalation of these particles can result in heart and lung problems.

Standard Operating Procedures
In order to properly maintain a healthy and safe environment inside the ice arena you should:

- Provide continuous ventilation whenever the rink is occupied according to ASHRAE standards.
- Ensure that the fresh air intake is not blocked and is not located near the exhaust from loading docks and outside idling vehicles.
- Keep resurfacing equipment well maintained.
- Keep arena gates open when resurfacing.
- Install a CO detector. (Ask the local fire marshal for guidance on suitable models and proper placement.)

Air Monitoring
Air Monitoring of CO and NO2, in accordance with standard air sampling techniques, should be conducted in all indoor rinks that use combustion resurfacing equipment. Tests should be conducted a minimum of once per week 20 minutes after the use of an internal combustion engine-powered ice resurfacer or edger. Samples are taken at center ice or the perimeter of the ice surface at the center ice line at a height of 3-6 feet above the ice surface. The measuring devices typically used are hand pump & colorimetric gas detector tubes or portable electronic direct-read gas detection devices such as the Draeger Chip Measurement System.

Action Air Levels
If testing results exceed certain limits, immediate corrective measures or evacuation procedures should be instituted.

A single test result of over 20 ppm* for CO and 0.3 ppm* for NO2 should initiate corrective measures that include immediately ceasing operation of the source equipment, increasing the ventilation inside the rink

using appropriate and safe means, continuing to ventilate the rink at above normal rates until an air sample for CO and NO2 is below the corrective action air levels, and taking one or more follow-up air samples in intervals of 20 minutes or less until air samples for CO and NO2 remain below the corrective action air level.

Immediate evacuation of all occupants from the inside of the rink should occur if a single air sample exceeds 83 ppm* for CO and/or 2 ppm* for NO2. The local fire department should be contacted to assist with evacuation, assess the hazard, and to verify acceptable air levels and corrective measures.

Reoccupancy should only occur if: 1. Two consecutive air samples taken within a 3-hour period in accordance with standard air sampling techniques show that the air levels of CO and NO2 are below the correction action levels; 2. Air sample results have been verified by independent measurements by the fire department or local health department; 3. Appropriate long-term corrective measures have been taken to prevent any further incidents.

*Minnesota Department of Health Interim Regulations 4620, updated 5/13

Long-term corrective measures

Appropriate long-term corrective measures should be instituted to prevent a further incident. These include:

- Improving ventilation by increasing the rate of exchange of outdoor/indoor air at the rink;
- Maintaining equipment on a regular basis, e.g., engine tuning, catalytic converters, air monitors, (a service contract is recommended for quarterly maintenance);
- Warming up ice resurfacing equipment outside the building;
- Installing a local exhaust system vented to the outside in the area where equipment is warmed up;
- Reducing edging time; replacing ice resurfacing equipment with new equipment with lower emissions;
- Decreasing the resurfacing schedule to reduce the amount of exhaust gases emitted;
- Switching to non-combustible equipment such as electric resurfacers and battery operated edgers.

Record Keeping
All operators of ice rinks should maintain a log of all air monitoring activities including dates, times, equipment used, results, and any corrective actions taken.

Resources
U.S. Environmental Protection Agency (EPA) Indoor Air Quality and Ice Arenas:

International Ice Hockey Federation (IiHF) Technical Guidelines of an Ice Rink:

American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):

Minnesota Department of Health:

Draeger Tubes & CMS Handbook:

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