

Ice Rinks & Indoor Air Quality

Indoor ice arenas or rinks can become sources of harmful air pollutants such as carbon monoxide (CO) and nitrogen dioxide (NO₂). These pollutants pose serious health risks and can be fatal. This fact sheet provides important information on CO and NO₂, along with critical operator procedures to ensure the health and safety of all occupants.

Who's at Risk?

Although CO and NO₂ exposure poses a risk to everyone, certain groups are more vulnerable including:

- Children and Athletes:
 - Shorter height puts them closer to the ice surface where CO and NO₂ can accumulate.
 - Faster breathing rates and higher metabolic demands increase their uptake.
- Rink staff (e.g., Zamboni driver).
- Elderly and other people with pre-existing illness or chronic health conditions, including:
 - Heart disease.
 - Lung conditions (e.g., asthma and emphysema).
- Pregnant women:
 - Most harmful to the developing fetus.



CO
One-Hour
Exposure
Limit:
25 ppm

NO₂
One-Hour
Exposure
Limit:
1 ppm

Note: An exposure limit identifies the highest amount of a harmful substance that is considered safe for an adult. PPM (Parts Per Million) shows how many molecules of CO or NO₂ are in a million air molecules.

CO Poisoning Symptoms:

- Headache
- Dizziness
- Weakness
- Nausea
- Shortness of breath
- Confusion
- Blurred vision
- Loss of consciousness

NO₂ Poisoning Symptoms:

- Cough
- Shortness of breath
- Chest pain or tightness
- Wheezing
- Irritation of the eyes, nose, and throat

Recommended Actions:

- Inform rink staff.
- Leave the rink and move to fresh air.
- Seek medical attention if symptoms are severe or persist.
- Inform your local Public Health Inspector.

With adequate ventilation, indoor levels of CO and NO₂ should be as close to zero as possible. High levels of CO and NO₂ can be fatal if not addressed promptly.

Individuals experiencing symptoms can call the Saskatchewan Health Authority HealthLine at 811 to speak to a registered nurse. HealthLine is available 24 hours a day.

Reduce the Risk! Important Procedures for Ice Rink Operators

- In public buildings where internal combustion engines (e.g., Zambonis and edgers) are used, operators must continuously run and maintain natural or mechanical ventilation systems to prevent or reduce health hazards.
- Ice rink operators play a crucial role in maintaining good indoor air quality by maintaining rink equipment, regularly testing for pollutants, and ensuring the ventilation systems function properly.

Sources of Pollutants in Ice Rinks

- **Ice Resurfacers (e.g., Zambonis) and Edgers:**
 - Powered by internal combustion engines (propane, natural gas, gasoline, diesel).
 - Emit air pollutants such as CO, NO₂, fine and ultrafine particulate matter, and volatile organic compounds (VOCs) due to incomplete fuel combustion.
- **Other Pollutant Sources:**
 - Heaters above spectator stands.
 - Cooking equipment in rink kitchens or canteens.
 - Infiltration of outdoor pollutants into the building (e.g., car idling).

Managing Pollutants in Ice Rinks: Problems and Solutions

Problem	Solution
Insufficient Ventilation: Poor air circulation and temperature inversion from the cold ice surface can trap pollutants near the ice surface.	✓ Operate the ventilation system for at least 10 minutes every hour, or continuously for smaller systems. ✓ Increase ventilation on high-resurfacing days (e.g., during tournaments). ✓ Install programmable timers for ventilation scheduling. ✓ Improve air circulation by turning on ceiling fans and opening Zamboni garage doors and louvered vents. Vents should be aimed at the ice surface to prevent exhaust gas buildup. ✓ If it's safe, open the gates around the ice surface to improve ventilation when resurfacing. ✓ When possible, connect continuous air monitors with mechanical ventilation to activate when pollutant levels are high.
Inadequate Equipment Maintenance: Neglecting equipment maintenance can lead to inefficient fuel burning and gas leaks, causing harmful gas buildup.	✓ Conduct equipment checks and maintenance before the busy season starts. ✓ Follow the manufacturer's maintenance schedules for ice resurfacers, edgers, heaters, and other fuel-burning equipment. Record all maintenance activities. ✓ Equip propane, natural gas, gasoline, and diesel-fueled equipment with three-way catalytic converters to reduce NO₂ and CO levels. Ensure these converters are regularly maintained and replaced when necessary. ✓ Ensure the equipment is warmed up in a well-ventilated area, such as with the garage door open, or in a room equipped with powered drop hoses connected to the exhaust, venting outdoors. Warm up the equipment for at least 10 minutes so the catalytic converter works properly. ✓ Ensure the ice resurfacers' exhaust pipe extends above the rink's glass barrier and is directed away from center ice while driving.

Fuel Type: Propane, natural gas, gasoline, and diesel engines produce higher levels of CO and NO₂ due to incomplete combustion.	✓ Regularly tune engines to ensure they are operating efficiently and producing fewer emissions. Record all maintenance activities. ✓ Consider using propane or natural gas instead of gasoline or diesel, as they generally produce fewer emissions. ✓ Equipment must not give off visible smoke or offensive odours. ✓ Use edgers only when the ventilation system can be run for an extended or continuous time. Ice edging usually creates more pollution than regular ice maintenance. It may take several hours of continuous ventilation to reduce the pollution. ✓ Switch to an electric ice resurfacer to eliminate emissions and improve air quality.
Lack of Monitoring: Without regular monitoring with sensors and alarms, operators might miss increased emissions from malfunctioning equipment or changes in ventilation. Pollutant levels can change a lot depending on how often ice resurfacers are used.	✓ Monitoring CO and NO₂ is crucial. Take samples about one meter above the ice surface, which is the breathing zone for children who are most susceptible to health effects. ✓ Monitor spectator areas that have natural gas or propane heaters. ✓ Install and maintain CO and NO₂ alarms throughout the rink. ✓ Ensure monitors are regularly maintained and calibrated according to the manufacturers' schedules. ✓ CO and NO₂ monitoring devices must be available on-site; offsite housing (e.g., with the fire department) is not acceptable. ✓ Secondary sampling can be coordinated with external agencies, like the fire department, to confirm exceedances. However, immediate action must be based on the facility's monitoring devices. For example, if alarms sound during a tournament, act immediately (i.e., evacuate the rink) do not wait for external confirmation. ✓ Record all sampling levels, monitor maintenance, and calibration details. Also, document any exceedances and the follow-up actions taken.

Note: Rinks using tractors for ice resurfacing typically produce higher emissions, requiring enhanced ventilation and additional emission control measures to ensure safe indoor air quality.

For more information:

- Further Guidance:
 - Contact your local [Public Health Inspection office](#).
- Additional Resource:
 - [Government of Canada. Best practices for improving air quality in ice arenas.](#)