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# INFORMATION

## Saskatchewan Arena Air Quality Program

### Air Quality Standards

These standards apply for all internal combustion engines (propane, gasoline, or diesel fuelled) used in indoor arenas.

1. During every hour that the ice is used by the public, the average carbon monoxide level is not to exceed 25 parts per million (ppm). The average nitrogen dioxide level is not to exceed 1 ppm.
  - The Canadian Residential Indoor Air Quality Guideline for carbon monoxide is 25 ppm for one hour periods. Carbon monoxide levels even slightly above 25 ppm can affect vision and balance. This could cause children to have serious accidents while skating.
  - The Canadian Residential Indoor Air Quality Guideline for nitrogen dioxide is 0.25 ppm for one hour periods. From experience in rinks, proper engine tuning and adequate ventilation can keep nitrogen dioxide levels below 1 ppm with any type of fuel (propane, gasoline or diesel). Nitrogen dioxide levels below 1 ppm should not cause any breathing difficulty.
2. During any eight hour work period, no worker's exposure shall exceed an average of 25 ppm carbon monoxide or 3 ppm nitrogen dioxide.
  - A worker may be exposed to a concentration of carbon monoxide higher than 25 ppm when using edgers and other equipment. Exposure to nitrogen dioxide levels above 3 ppm is unlikely. However, levels may rise slightly above 1 ppm during equipment operation.
  - To prevent workers from becoming sick, any exposure to carbon monoxide above 25 ppm or to nitrogen dioxide above 3 ppm must be "balanced off". That means, workers must spend enough time working at lower gas levels so that their total daily average exposure is less than 25 ppm of carbon monoxide and less than 3 ppm of nitrogen dioxide.
3. An internal combustion engine used in an arena must not give off visible smoke and residual odours must be inoffensive.
  - This may be more difficult to achieve with diesel fuelled equipment than with propane or gasoline fuelled internal combustion engines.

4. Users of the ice should only be allowed on the ice surface if the arena operator can ensure that the carbon monoxide and nitrogen dioxide standards will be met within 30 minutes.
  - The written Saskatchewan Arena Air Quality Program is to indicate situations where time lags are required before the ice surface is to be used by the public following ice maintenance. Time lags will likely be required following the use of ice edgers.

### Recommendations for Controlling Exhaust Emissions

These recommendations will help arena operators to meet arena air quality standards.

1. Extend vehicle exhaust pipes up at least one foot above the top of the rink plexiglass safety barrier. Exhaust given off behind a vehicle will build-up on the ice surface.
2. Equip propane and gasoline fuelled vehicles with catalytic converters. These are a cost effective way of lowering carbon monoxide levels. Converters must be maintained and replaced as soon as they fail.
3. Warm-up equipment in a well ventilated room or in a room equipped with powered drop hoses attached to the vehicle exhaust. Vehicles must be warmed-up before most catalytic converters will work properly.
4. Provide adequate mechanical ventilation. High volume fans (15,000 cubic feet per minute [cfm] or greater) may only need to be run during, and for a few minutes after, ice maintenance. Smaller volume fans may have to be run constantly to meet the air quality standards. The location of the exhaust fan(s) is not as important as the location of the fresh air intakes. Louvred vents are the most common source of fresh air. These should be aimed at the ice surface so that exhaust gases are prevented from building-up on the ice. Ceiling circulation fans mounted above the ice surface will help prevent exhaust gases from building-up on the ice surface. A separate rheostat is advised for each fan so that all fans can be made to run at the same speed.

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5. Use ice edgers only when the ventilation system can be run for enough time to reduce exhaust gas levels to the required standards. Ice edging usually creates more pollution than regular maintenance. It may take several hours of continuous ventilation to reduce this contamination to the levels required.
6. Frequently service all internal combustion equipment. For propane fuelled equipment, the maximum carbon monoxide in the exhaust should be 0.5% by volume. For gasoline fuelled equipment, the maximum carbon monoxide in the exhaust should be 2% by volume. Exhaust gas analysers will be needed to determine the correct engine tuning. Gas detector tubes cannot be used to directly measure carbon monoxide and nitrogen dioxide levels at the tail pipe of vehicles. Special cooling probes are needed to first cool the exhaust gases to room temperature. These probes are expensive.
7. Keep rink gates open during ice resurfacing. This will allow for better air circulation and less exhaust gas build-up on the ice. Take precautions to prevent children from playing near the open gates.
8. Test the arena air for carbon monoxide and nitrogen dioxide to check that the Air Quality Program is working. If the exhaust gas standards are not being met, find out why.

Note: See the Saskatchewan Health bulletin, Air Testing Guidelines for further information on a Saskatchewan Arena Air Quality Program.