



April 30, 2015

Dr. Serge Déry
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NRBHSS
P.O. Box 900
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Dear Sir:

Ref. no.: Institution #: 001397072 – Municipal buildings, Kangiqsualujjuaq

Subject: Occupational-health report: air quality in the Kangiqsualujjuaq arena

On April 16 and 17, 2015, as industrial-hygiene technician and regional nurse coordinator for occupational health of the Nunavik Department of Public Health, we visited the Kangiqsualujjuaq arena at your request to investigate an event of respiratory poisoning that affected the players and spectators during a hockey tournament on April 11, 2015.

Observation of the situation

Sampling for CO (carbon monoxide) and NO₂ (nitrogen dioxide) was performed on April 16 and 17, 2015.

The present report contains:

- A. General information on the sources of CO and NO₂;
- B. Instrumentation used;
- C. Methodology used;
- D. Sampling conditions;
- E. Norms for exposure to CO and NO₂ in arenas;
- F. Results;
- G. Recommendations.

A. General information on the sources of CO and NO₂

The quality of indoor air in arenas is always of concern, as each year, incidents of poisoning with CO and NO₂ are reported to the departments of Public Health in Québec.

The principal sources of CO and NO₂ in an arena are ice resurfacers and edgers with engines that run on fuel such as propane, gasoline, natural gas or diesel. Heating systems that run on fuel such as natural gas or propane can also be sources of contamination, particularly radiant panels used as supplementary heating in several arenas.

B. Instrumentation used

- Fluke 975 direct-read instrument for CO
- Dragër PAC 7000 personal dosimeter for CO
- Dragër CMS mechanical suction pump with chip for NO₂
- Dragër manual pump with graduated tubes for NO₂
- Gastec manual pump with graduated tubes

C. Methodology used

Inspections and tests were performed at the arena:

- Resurfacer area, CO and NO₂ detectors on the ice and in the ventilation control room;
- Readings were taken for CO and NO₂ at the resurfacer's exhaust while in operation, to establish a reference value;
- The Fluke instrument and the Gastec manual pump were then placed at roughly 1.52 m (5 feet) from the resurfacer on the exhaust side;
- Readings for CO and NO₂ were taken after 10, 20 and 30 minutes of the resurfacer's operation.

D. Sampling conditions

- Sampling for CO and NO₂ were performed in the resurfacer area (roughly 5 m x 4 m x 3 m).
- Only the occupational-health personnel were present;
- The doors to the area were kept closed during the sampling;
- The area's ventilation system was turned on in order to exhaust the CO and NO₂ present before the readings were taken;
- The outer door was opened to set the instruments at 0 ppm¹ for CO and NO₂.

¹ ppm = parts per million

E. Norms for exposure to CO and NO₂ in arenas²

The tables below present the norms for exposure:

Measures to take in case CO levels are exceeded when readings are taken with portable detectors not linked to the arena's ventilation system

Random readings for CO concentration		
Maintain activity	Cease activity	Close arena
[CO] ≤ 20 ppm	20 ppm < [CO] ≤ 75 ppm	[CO] > 75 ppm
		[CO] > 35 ppm for more than 20 minutes
		[CO] > 20 ppm for more than 60 minutes

Random readings for NO ₂ concentration		
Maintain activity	Cease activity	Close arena
[NO ₂] ≤ 0.5 ppm	0.5 ppm < [NO ₂] ≤ 2 ppm	[NO ₂] > 2 ppm
		[NO ₂] > 0.5 ppm for more than 20 minutes

Measures to take in case CO levels are exceeded when readings are taken with fixed detectors linked to the arena's ventilation system

Constant readings for CO concentration		
Maintain activity	Cease activity	Close arena
[CO] ≤ 20 ppm	20 ppm < [CO] ≤ 75 ppm for more than 20 minutes	[CO] > 75 ppm
20 ppm < [CO] ≤ 75 ppm for less than 20 minutes		[CO] > 35 ppm for more than 40 minutes
		[CO] > 20 ppm for more than 80 minutes

Constant readings for NO ₂ concentration		
Maintain activity	Cease activity	Close arena
[NO ₂] ≤ 0.5 ppm	0.5 ppm < [NO ₂] ≤ 2 ppm for more than 20 minutes	[NO ₂] > 2 ppm
0.5 ppm < [NO ₂] ≤ 2 ppm for less than 20 minutes		[NO ₂] > 0.5 ppm for more than 40 minutes

² According to the "Critères de monoxyde de carbone et de dioxyde d'azote et surveillance de la qualité de l'air dans les arenas," June 2014, MSSS.

F. Results

In light of the results obtained, we can state that the poisoning among the individuals at the Kangiqsualujjuaq arena was caused by NO₂ produced by the resurfacer:

For CO:

- between 7 and 11 ppm during operation for 30 minutes.

For NO₂:

- between 2 and 30 ppm during operation for 30 minutes.

G. Recommendations

Ideally, the current resurfacer, which runs on propane, should be replaced with an electric one.

In case the above replacement is not possible, perform the following:

1. Have the resurfacer's carburetor adjusted by a specialized technician according to the manufacturer's recommendations (**the resurfacer must not be used before being adjusted**). Said adjustment should be performed at least twice per season: before the hockey season and before the scheduled tournaments;
2. Forward a copy of the certificate of compliance issued by the specialized technician to the Department of Public Health;
3. Check and calibrate the detectors;
4. Install the detectors behind a grill instead of inside a closed container;
5. Ensure that the ceiling detector in the arena is for NO₂. If not, install an NO₂ detector;
6. Turn on the ventilation system manually before using the resurfacer;
7. Take a few readings (2 or 3) around the rink (stands, penalty box) for CO and NO₂ with the Gastec manual pump and tubes to ensure that concentrations are within the norms;
8. Set the ventilation system to automatic (roughly 30 minutes after the resurfacer is turned off).

Conclusion

We would like to thank the Kangiqsualujjuaq fire department for the loan of respiratory-protection equipment during the sampling.

The recommendations proposed in the present report aim for a maximum reduction in the health and safety risks for the workers, spectators and players in the arena.

Should you require further information, please do not hesitate to contact us.

Yours truly,



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Industrial-Hygiene Technician-Consultant



Robert Ladouceur
Regional Nurse Coordinator,
Occupational Health

c.c. Elena Labranche, Assistant to the Director of Public Health, NRBHSS
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APPENDIX – PHOTOS OF THE LOCATIONS SAMPLED

RESURFACER

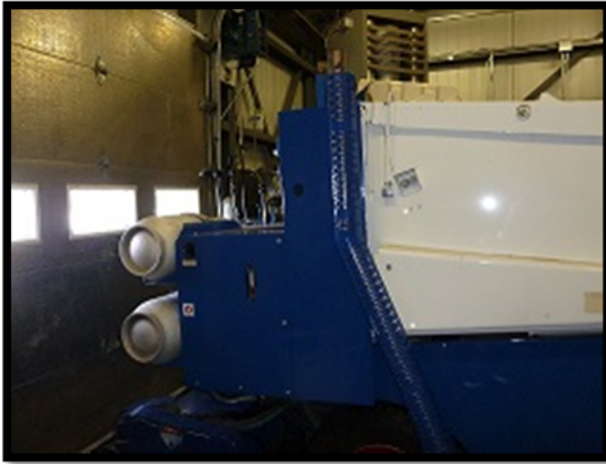


Photo 1



Photo 2



Photo 3

VENTILATION SYSTEM IN THE RESURFACER AREA



Photo 4

CEILING DETECTOR, IDENTIFIED AS CO BUT SHOULD BE NO₂?



Photo 5

CO DETECTOR AT PENALTY BOX



Photo 6