

Occupational exposure limits for carcinogens in Ontario workplaces: Opportunities to prevent and control exposure

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Background

Nearly 160 workplace factors are known, probable, or possible cancer-causing agents in humans (1). Reducing workers' exposure to these workplace factors can help prevent cancer among Canadians.

Occupational exposure limits (OELs) are legal or recommended maximum concentrations of a hazardous substance in a workplace. To help prevent cancer and protect health, it is important that these limits for carcinogens are rigorous, up-to-date, and reflect the best possible standards for workers.

Objectives:

- To compare carcinogen occupational exposure limits in Ontario with limits across Canada and in other jurisdictions
- To make recommendations where Ontario should improve its existing occupational exposure limits

Methods

We began with research priorities identified by Occupational Cancer Research Centre (OCRC) stakeholders in 2009 (2). We then focused on a list of 79 substances profiled on the CARcinogen EXposure (CAREX) Canada website (3). For each of these substances, we identified occupational exposure limits in Ontario, Canada (federal, all provinces and territories), and in six additional jurisdictions. Our final analysis only included the carcinogens which had both higher limits in Ontario and the most different limits across multiple jurisdictions. Estimates of the number of workers exposed were drawn from CAREX Canada.

Results and Recommendations

OCRC stakeholders identified nearly 100 workplace exposures in need of research such as chemicals, respirable dusts and fibres, radiation, pesticides, and shift work (2). The 79 carcinogens profiled on CAREX Canada were mostly consistent with these priorities. Eight substances had higher limits in Ontario and the greatest variability of limits across multiple jurisdictions. These were: chloroform, ethylbenzene, formaldehyde, wood dust, crystalline silica, refractory ceramic fibres, nickel and its compounds, and lead and inorganic compounds (as Pb).

Results and Recommendations

Formaldehyde

Jurisdiction	8 hour OEL (ppm)	15 minute OEL (ppm)	Ceiling OEL (ppm)
Ontario		1	1.5
HRSDC, SK, MB, NL, PE, NS			0.3
BC	0.3		1
AB	0.75		1
QC, YT, NT, NU			2
NB	0.5		1.5
ACGIH			0.3
NIOSH REL	0.016		0.1
Germany (MAK)	0.3	0.6	1
SCOEL	0.2	0.4	
Sweden	0.5		1
Netherlands	0.1	0.4	

Ontario's limits for formaldehyde are among the least rigorous of all jurisdictions. Formaldehyde is known to cause cancer in humans. About 64,000 workers in the province are exposed to this chemical in wood and other industries.

Recommendation: lower Ontario's ceiling limit to at least 0.3 ppm. Reduce or eliminate the 15 minute limit for even greater protection.

Crystalline silica

Jurisdiction	8 hour OEL (mg/m ³)
Ontario	0.05 (cristobalite) (r) 0.1 (quartz) (r)
HRSDC, MB, NL, PE, NS, NB	0.025 (crystalline silica) (r)
BC, AB	0.025 (cristobalite & quartz) (r)
SK	0.05 (cristobalite & quartz) (r)
QC, NT, NU	0.05 (cristobalite) (r) 0.1 (quartz) (r)
YT	150 particles/mL (cristobalite) 300 particles/mL (quartz)
ACGIH	0.025 (cristobalite & quartz) (r)
NIOSH REL	0.05 (quartz) (r)
SCOEL	0.05 (silica dust) (r)
Sweden	0.05 (cristobalite) (r) 0.1 (quartz) (r)
Netherlands	0.075 (crystalline silica) (r)

Ontario's limits for cristobalite and quartz are two to four times less rigorous than the limit of 0.025 mg/m³ used in other Canadian provinces. Exposure is linked to lung cancer, fibrosis (silicosis) and chronic obstructive pulmonary disease. 143,000 Ontario workers are exposed to crystalline silica, mainly in the construction industry.

Recommendation: lower Ontario's limits for cristobalite and quartz to 0.025 mg/m³ (respirable fraction).

Wood dust

Jurisdiction	8 hour OEL (mg/m ³)
Ontario	5 (softwood) 1 (certain hardwoods such as beech and oak)
HRSDC, MB, NL, PE, NS, NB	0.5 (Western red cedar) (i) 1 (all other species) (i)
BC	2.5 (softwood) 1 (hardwood & allergenic)
AB	0.5 (Western red cedar) 5 (softwood & hardwood)
SK	5 (softwood) 1 (certain hardwoods such as beech and oak)
QC	2.5 (Western red cedar) (td) 5 (softwood & hardwood) (td)
ACGIH	0.5 (Western red cedar) (i) 1 (all other species) (i)
NIOSH REL	1 (softwood, hardwood, Western red cedar)
SCOEL	0.5 (td) 1 (i)
Sweden	2 (i)
Netherlands	2 (hardwood) (i)

Ontario's limits for wood dust are the among the least rigorous of all jurisdictions. Wood dust exposure is linked to sino-nasal cancer, respiratory disease, and occupational asthma. Nearly 93,000 Ontario workers are exposed to wood dust.

Recommendation: lower Ontario's softwood and hardwood limits to 1 mg/m³ (inhalable fraction) with a lower limit of 0.5 mg/m³ (inhalable fraction) for Western red cedar and other highly allergenic species.

Results and Recommendations

Additional recommendations for Ontario:

- Chloroform:** Chloroform is a possible human carcinogen that affects reproductive health at levels lower than Ontario's limit (10 ppm). A lower value could protect against both cancer and developmental health effects.
- Ethylbenzene:** ACGIH reduced the limit in 2011 from 100 ppm to 20 ppm. This value has been adopted by BC and was previously recommended in Germany. Levels should be limited to 20 ppm.
- Refractory ceramic fibres:** Ontario's OEL (0.5 f/cc) is the highest of all provinces except Quebec. Like asbestos, exposure to refractory ceramic fibres is linked to lung fibrosis and decreased lung function. The limit should be lowered to at least 0.2 f/cc.
- Nickel and its compounds:** The limits for soluble and insoluble inorganic nickel compounds should be decreased to help reduce the risk of nasal and lung cancers.
- Lead and inorganic compounds (as Pb):** A maximum blood lead level should be implemented since this is more indicative of adverse health effects than the air concentration limit.
- Other occupational carcinogens:** Limits for many carcinogens, such as asbestos and benzene, have decreased in other countries. Ontario should monitor these standards and take a lead in establishing rigorous values. The province should also develop limits for substances with high numbers of workers exposed, such as diesel engine exhaust (275,000 workers) and polycyclic aromatic hydrocarbons (103,000 workers).

Conclusions

Recent evidence indicates cancer and other health effects can occur from lower levels of exposure. Therefore, Ontario's limits for the 8 carcinogens analyzed should be decreased. As Ontario is currently revising its limits, these recommendations can support policy-making.

References

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