Occupational Cancer Research Centre

March 11, 2013

OEL Update Project
Ontario Ministry of Labour
400 University Avenue, 12th floor
Toronto, ON M7A 1T7

Dear Honourable Minister of Labour,

Thank you for opening a public consultation on the *Proposal to Adopt New or Revised Occupational Exposure Limits (OELs) or Listings for Hazardous Chemical Substances under the Occupational Health and Safety Act*. Last year, the Occupational Cancer Research Centre (OCRC) conducted a detailed review of OELs to identify opportunities where Ontario may strengthen its limits. We compared OELs in Ontario, across Canada, and in six other jurisdictions (Table 1) for occupational carcinogens that were previously identified as research priorities by OCRC stakeholders and that were profiled by CAREX Canada (Table 2). Estimates of the number of workers exposed were drawn from CAREX Canada.

The majority of these 79 substances had OELs in Ontario that were similar to the limits in other jurisdictions. However, for several carcinogens, OELs varied considerably across jurisdictions and Ontario's OELs exceeded the others. Based on these research findings, last year we nominated the development of lower OELs for the following carcinogens: chloroform, formaldehyde, wood dust, crystalline silica, refractory ceramic fibres, nickel, and lead. For this year's Proposal, we have augmented our review of these seven substances with two others: diesel engine exhaust and trichloroethylene.

In 2012, the International Agency for Research on Cancer (IARC) re-evaluated the human and animal evidence for diesel engine exhaust and trichloroethylene. Previously thought to be "probable" human carcinogens by IARC, the expert committees assessed recent scientific studies that demonstrated elevated risks of lung cancer in workers exposed to diesel engine exhaust, and an excess of kidney cancer in workers exposed to trichloroethylene. As a result, IARC re-classified diesel engine exhaust and trichloroethylene as "known" human carcinogens. These carcinogens are relevant in Ontario, where nearly 280,000 people encounter diesel engine exhaust on the job and approximately 5,500 workers are exposed to trichloroethylene.

While Ontario's OEL for trichloroethylene is consistent with most other jurisdictions, a more progressive approach can be taken with lowering limits from 10 ppm to 6 ppm as in Germany to provide further protection against occupational cancer. There is currently no OEL for diesel engine exhaust in Ontario and in the other jurisdictions reviewed. Therefore, we urge Ontario to take the lead on developing an OEL for diesel engine exhaust. A summary of OELs for diesel engine exhaust and trichloroethylene is enclosed, with recommendations and descriptions of the supporting evidence used by the jurisdictions that have developed or adopted OELs. The complete report corresponding to the OELs that we recommended last year is available on our website (www.occupationalcancer.ca).

Predictions from studies conducted in other countries suggest that between 500-2300 Ontarians die of workplace cancer each year. It is therefore important that limits for carcinogens are rigorous, up-to-date, and reflect the best possible standards for workers. We are pleased to see that the Ministry of Labour has lowered the OEL for ethyl benzene, a possible human carcinogen to which nearly 77,000

workers are exposed in Ontario. Ontario should advance these efforts by monitoring standards in different jurisdictions and by taking a lead in establishing strong OELs that protect workers from exposure to all occupational carcinogens. Since cancer and other health effects can occur from lower levels of occupational exposure, improving OELs is fundamental towards the prevention, protection, and promotion of workers' health.

The OCRC was established in 2009 to fill the gaps in our knowledge of work-related cancers and to translate these findings to inform preventive programs that control exposures and improve the health of workers. Our activities encompass research that identifies the causes of cancer in the workplace, surveillance of workplace exposures and occupational cancers, and intervention research to develop and evaluate prevention and exposure reduction strategies ultimately aimed towards a cancer-free workplace. The OCRC is jointly funded by Cancer Care Ontario, the Workplace Safety and Insurance Board of Ontario, and the Ontario division of the Canadian Cancer Society, and was developed in collaboration with the United Steelworkers.

Thank you for considering our submission.

Sincerely,

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Table 1: Jurisdictions and supporting documentation included in analysis

Jurisdiction	Supporting documentation
Ontario	Ontario Occupational Health and Safety Act. R.R.O. 1990, Regulation 833: Control of Exposure to Biological or Chemical Agents. Last Amendment: O. Reg. 419/10.
Canada	Canada Occupational Health and Safety Regulations SOR/86-304. Minister of Justice.
British Columbia	Occupational Health and Safety Regulation Guideline G5.48-1: Table of Exposure Limits.
Alberta	Alberta Occupational Health and Safety Act. Alberta Occupational Health and Safety Code 2009.
Saskatchewan	Occupational Health and Safety Regulations, 1996, O1-1R1.
Manitoba	The Workplace Safety and Health Act (CCSM c. W210). Workplace Safety and Health Regulation 217/2006.
Quebec	Occupational Health and Safety Act Schedule 1: Permissible Exposure Values for Airborne Contaminants.
Nova Scotia	Occupational Health Regulations made under Section 74 of the Health Protection Act SNS 2004, c. 4, OIC 76-1510 (December 21, 1976), NS Reg. 112/76.
New Brunswick	Regulation 91-191 under the Occupational Health and Safety Act (OC 91-1035).
Prince Edward Island	Chapter O-1.1: Occupational Health and Safety Act, General Regulations. 31 October 2008.
Newfoundland and Labrador	Regulation 70/09. Occupational Health and Safety Regulations, 2009 under the Occupational Health and Safety Act (OC 2009-233). 7 August 2009.
Northwest Territories and Nunavut	Safety Act. General Safety Regulations RRNWT 1990,c.S-1.
Yukon Territories	Yukon Occupational Health Regulations.
American Conference of Governmental Industrial Hygienists (ACGIH)	ACGIH 2011 Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices.
National Institute of Occupational Safety and Health (NIOSH)	Recommended Exposure Limits from the NIOSH Pocket Guide to Chemical Hazards.
Scientific Committee on Occupational Exposure Limits (SCOEL)	Recommendation from the Scientific Expert Group on Occupational Exposure Limits for Chloroform. (SEG/SUM/30). SCOEL, 1995. Recommendation from the SCOEL for Formaldehyde (SCOEL/SUM/125). SCOEL, 2008. Recommendation from SCOEL: Risk Assessment for Wood Dust (SCOEL/SUM/102 final). SCOEL, 2003. Recommendation from SCOEL for Silica, Crystalline (respirable dust) (SCOEL/SUM/94). SCOEL, 2003.

	Recommendation from the SCOEL on occupational exposure limits for nickel and inorganic nickel compounds (SCOEL/SUM/85). SCOEL, 2011. Recommendation from SCOEL for lead and its inorganic compounds (SCOEL/SUM/83). SCOEL, 2002. Recommendation from the SCOEL for trichloroethylene (SCOEL/SUM/142). SCOEL, 2009. Binding Occupational Exposure Limits. http://ec.europa.eu/social/main.jsp?catId=153&langId=en&internal_pagesId=684&moreDocuments=yes&tableName=INTERNAL_PAGES
Germany	Recommended (MAK) and legally-binding (AGW) values from GESTIS: International limit values for chemical agents.
Sweden	Provisions of the Swedish Work Environment Authority on Occupational Exposure Limit Values and Measures against Air Contaminants (AFS 2005:17).
Netherlands	Social and Economic Council of the Netherlands (SER). OEL Database.

Table 2: Known and suspected carcinogens listed in the CAREX Canada profiles and estimates (n=79)

1,2-Dichloroethane
1,3-Butadiene
1,4-Dioxane
2,4-D
2-Nitropropane
Acetaldehyde
Acrylamide
Acrylonitrile
Adriamycin
Antimony Trioxide
Antineoplastic agents
Arsenic
Artificial UV Radiation
Asbestos
Benzene
Benzo[a]pyrene
Benzo[b]fluoranthene
Benzo[k]fluoranthene
Benz[a]anthracene
Beryllium
Bitumens
Bromodichloromethane
Cadmium
Carbon black
Carbon tetrachloride
Chlorambucil
Chlorination by-products
Chloroform
Chlorothalonil
Chromium (hexavalent)
Cisplatin
Coal Tar and Coal-Tar Pitches
Cobalt
Creosotes
Crystalline Silica
Cyclophosphamide
Dichloromethane
Dichlorvos
Diesel Engine Exhaust
Environmental Tobacco Smoke
Epichlorohydrin
Ethylbenzene
Ethylene Oxide
Formaldehyde
Gasoline
Hydrazine
Indeno[1,2,3-cd]pyrene
Indium Phosphide and Other Indium Compounds
Ionizing radiation
Lead
Lindane
Magnetic Fields
MCPA
MCPP
Melphalan
MOCA
Naphthalene
Nickel and its compounds
Nitrobenzene
PAHs
para-Dichlorobenzene
Particulate Air Pollution
Pentachlorophenol
Phthalates
Polychlorinated Biphenyls
Propylene Oxide
Radon
Refractory Ceramic Fibres
Shiftwork
Solar Radiation
Styrene and Styrene-7,8-Oxide
Sulfuric Acid Mists
Tetrachloroethylene
Titanium Dioxide
Toluene Diisocyanates
Trichloroethylene
Vanadium Pentoxide
Vinyl Chloride

Carcinogens in **bold** have been nominated by the OCRC to the Ministry of Labour for OEL improvements

Diesel Engine Exhaust

Diesel engine exhaust is a complex mixture of gases and other particulate matter that are produced from the combustion of diesel fuel in a compression ignition engine. Some of the gases that can be found in diesel engine exhaust include carbon dioxide, water vapour, oxygen, and sulfur and nitrogen compounds, among others. Diesel particulate matter can be made up of elemental carbon, organic compounds (including polycyclic aromatic hydrocarbons, or PAHs), metals, and other substances present in smaller amounts. Diesel particulate matter is very small, and as such, nearly all of it is respirable.

In 1989 IARC classified diesel engine exhaust as a "probable" human carcinogen (Group 2A) (1). As diesel engine exhaust became a priority carcinogen for research since then, recent studies were initiated involving large numbers of exposed workers primarily from the mining and transportation sectors. In 2012, IARC re-evaluated the carcinogenicity of diesel engine exhaust and classified it as a "known" human carcinogen (Group 1) in light of sufficient evidence for lung cancer and limited evidence for bladder cancer in humans (2). Other health effects associated with diesel engine exhaust are wide-ranging and include irritation of the eyes, throat, and bronchi; decreases in lung function; light-headedness; nausea; and, allergic reactions.

Diesel engine exhaust is a significant cause for concern in Ontario workers. CAREX Canada estimates that of the 804,000 Canadians that are occupationally exposed to diesel engine exhaust, nearly 280,000 (35%) are in Ontario (3). The vast majority of exposed workers are male. The largest exposed industrial groups exposed are truck transportation and auto repair and maintenance, and the largest exposed occupational groups are truck drivers, bus drivers, and heavy equipment operators. The highest levels of exposure to diesel engine exhaust often occur in the mining industry (2).

There are currently no OELs for diesel engine exhaust in Ontario, across Canada, and in the other jurisdictions studied in this analysis. Previous attempts to protect workers from the harmful health effects of diesel engine exhaust have been made, albeit with no legislative outcome. In 2002, the ACGIH Notice of Intended Changes proposed an 8-hour OEL of 20 $\mu g/m^3$ for "diesel exhaust particulate as elemental carbon" (4). However, this proposed limit was withdrawn, and the ACGIH and other scientific and governing bodies in this report presently do not have any recommended or mandated limits.

Recommendation

Ontario should take the lead in developing an OEL for diesel engine exhaust that prevents cancerous, respiratory, and other health effects observed in workers.

References

1. IARC. Diesel and gasoline engine exhausts and some nitroarenes. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 46. Lyon: IARC, 1989.
2. Benbrahim-Tallaa L, Baan RA, Grosse Y, Lauby-Secretan B, El Ghissassi F, Bouvard V, Guha N, Loomis D, Straif K, on behalf of the International Agency for Research on Cancer Monograph Working Group. Carcinogenicity of diesel-engine and gasoline-engine exhausts and some nitroarenes. The Lancet Oncology 2012;13(7):663-664.
3. CAREX Canada. Diesel engine exhaust. http://www.carexcanada.ca/en/diesel_engine_exhaust/. [Accessed 6 March 2013].
4. ACGIH. 2002 TLVs and BEIs based on the documentation of the threshold limit values for chemical substances and physical agents & biological exposure indices. Cincinnati: ACGIH, 2002.

Trichloroethylene

Trichloroethylene is an industrial chemical that is used as a solvent and degreaser. An estimated 5500 Ontario workers are exposed to trichloroethylene on the job (1). The major industrial groups that are exposed to trichloroethylene are metal manufacturing, printing and related support activities, and textile finishing and product mills. In these industries, degreasing is a part of jobs with the largest number of workers exposed (e.g. metalworking machine operators). Historically, trichloroethylene was a solvent that was frequently used in dry cleaning but now only approximately 200 workers are exposed through dry cleaning (1).

Trichloroethylene (CAS No. 79-01-6)	8 hour OEL (ppm)	15 minute OEL (ppm)
ON	**10**	**25**
HRSDC, BC, MB, NL, PE, NS	10	25
NB, SK, AB	50	100
QC	50	200
YT, NT, NU	100	150
ACGIH	10	25
NIOSH REL	25*	2**
Germany	11† 6††	
SCOEL	10 20 mg trichloroacetic acid/1 L urine	30
Sweden	10	25

*10-hour limit during all non-anesthetic usage exposures
**60-minute ceiling limit during usage as an anesthetic agent
†Corresponds to proposed tolerable cancer risk limit of 4:1000
††Corresponds to proposed preliminary acceptable cancer risk limit of 4:100,000 (by 2018). The interim acceptable cancer risk is 4:10,000.

The 8-hour OEL that was most frequently enforced or recommended by the jurisdictions included in this analysis was 10 ppm. Many jurisdictions also specified a short-term (15-minute) OEL of 25 ppm. The most protective 8-hour OEL was 6 ppm in Germany, based on a proposed preliminary acceptable cancer risk limit of 4 cancer cases per 100,000 people. This OEL is anticipated to be enforced no later than 2018. Only one jurisdiction, SCOEL, had a biological limit value. Ontario's 8-hour and 15-minute OELs are consistent with most other jurisdictions and are more protective than the 8-hour and 15-minute limits in seven other Canadian provinces. Nevertheless, there remains opportunity for improvement. For example, Ontario's 8-hour limit was over 1.5 times higher than the limit of 6 ppm in Germany. This is important considering that trichloroethylene was recently re-classified by the IARC as "carcinogenic to humans" (Group 1) (2). This evaluation was based on sufficient human evidence for kidney cancer. There is limited human evidence that trichloroethylene is associated with increased risks of leukemia and/or lymphoma, as well as liver and bile duct cancers. Increased evidence for the carcinogenicity of trichloroethylene is what prompted the IARC to upgrade its previous 1995 evaluation of this substance as a "probable" (Group 2A) human carcinogen (3). In addition, data demonstrating other health effects such as dizziness, cognitive decrements, and renal toxicity has contributed to the progressive lowering of ACGIH limits over time (4).

Recommendation

The evidence linking trichloroethylene exposure to kidney cancer is well-established. Studies suggest that other cancer sites may also be involved. As IARC has classified trichloroethylene as carcinogenic to humans, Ontario should strengthen its OEL to better protect workers from this health effect.

References
1. CAREX Canada. Trichloroethylene. http://www.carexcanada.ca/en/trichloroethylene/. [Accessed 6 March 2013].
2. Guha N, Loomis D, Grosse Y, Lauby-Secretan B, El Ghissassi F, Bouvard V, Benbrahim-Tallaa L, Baan R, Mattock H, Straif K, on behalf of the International Agency for Research on Cancer Monograph Working Group. Carcinogenicity of trichloroethylene, tetrachloroethylene, some other chlorinated solvents, and their metabolites. The Lancet Oncology 2012; 13(12):1192-1193.
3. IARC. Dry cleaning, some chlorinated solvents, and other industrial chemicals. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 63. Lyon: IARC, 1995.
4. ACGIH. 2012 TLVs and BEIs with 7th edition documentation (CD-ROM). Cincinnati: ACGIH, 2012.