Montréal Symposium on Occupational Carcinogens
Stakeholder Report

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To provide the laboratory services and expertise required to support the public occupational health and safety network.

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Montréal Symposium on Occupational Carcinogens
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IRSST

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The organizing committee of the Montréal Symposium on Occupational Carcinogens was composed of IRSST staff members: Marie-France d’Amours, François Hébert, France Labrèche, Martin Lebeau and Marjolaine Thibeault.

The committee wishes to thank all the people who played a part in delivering this event:

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Martin Lebeau, Scientific Professional, Economist, IRSST
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The IRSST staff members who accepted to act as secretaries for the workshops and panel discussions, as well as the team from the Communications & Knowledge Transfer Division and the Information Technologies Department for their logistical support for the event.

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The Burden of Occupational Cancer in Canada study is the result of a partnership involving the following organizations:
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<th>Description</th>
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<tr>
<td>AIC-silice</td>
<td><em>Approche intégrée construction-silice</em> (integrated preventive approach to silica-related health problems in the construction industry)</td>
</tr>
<tr>
<td>ASP</td>
<td><em>Association sectorielle paritaire</em> (joint sector-based association)</td>
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<tr>
<td>CCSRI</td>
<td>Canadian Cancer Society Research Institute</td>
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<tr>
<td>CISSS de Laval</td>
<td>Centre intégré de santé et de services sociaux (Laval integrated health and social services centre)</td>
</tr>
<tr>
<td>CIUSSS de l’Estrie</td>
<td>Centre intégré universitaire de santé et de services sociaux de l’Estrie (Estrie integrated university health and social services centre)</td>
</tr>
<tr>
<td>CNESST</td>
<td>Commission des normes, de l’équité et de la santé et de la sécurité du travail (Québec’s labour standards, pay equity, and occupational health and safety board)</td>
</tr>
<tr>
<td>CRCHUM</td>
<td>Centre de recherche du Centre hospitalier de l’Université de Montréal (Université de Montréal hospital research centre)</td>
</tr>
<tr>
<td>IARC</td>
<td>International Agency for Research on Cancer</td>
</tr>
<tr>
<td>IRSST</td>
<td>Institut de recherche Robert-Sauvé en santé et en sécurité du travail</td>
</tr>
<tr>
<td>IWH</td>
<td>Institute for Work &amp; Health</td>
</tr>
<tr>
<td>OCRC</td>
<td>Occupational Cancer Research Centre</td>
</tr>
<tr>
<td>PAH</td>
<td>Polycyclic aromatic hydrocarbons</td>
</tr>
<tr>
<td>PIR</td>
<td>Programme d’intervention régional (regional intervention program)</td>
</tr>
<tr>
<td>ROHS</td>
<td>Québec’s Regulation respecting occupational health and safety (CQLR c S-2.1, r 14)</td>
</tr>
<tr>
<td>RPD</td>
<td>Respiratory protective device</td>
</tr>
<tr>
<td>RSPSAT</td>
<td>Réseau de santé publique en santé au travail (Québec’s public occupational health network)</td>
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1. CONTEXT

A research project funded by the Canadian Cancer Society Research Institute (CCSRI) was carried out by the Occupational Cancer Research Centre (the OCRC) and Carex Canada to estimate the number and proportion of new cancer cases and cancer deaths attributable to occupational exposure to carcinogenic agents, and to assess their current economic impact. Québec researchers also collaborated in this project, titled The Human and Economic Burden of Occupational Cancer in Canada (Le fardeau humain et économique des cancers d’origine professionnelle au Canada)\(^1\).

Following this project, knowledge transfer meetings were held with occupational health and safety stakeholders and partners, in Toronto in November 2015 and Vancouver in March 2016. A third meeting was held in Montréal on April 27, 2017.

This document presents the highlights of the presentations and participant discussions at the Montréal meeting.

Objectives

The objectives of the Montréal Symposium on Occupational Carcinogens were as follows:

- raise stakeholder awareness of the human and economic burden of occupational cancers;
- discuss how research results could be used to promote the prevention of exposure to occupational carcinogens, as well as current and potential prevention strategies; and
- mobilize the various actors to undertake prevention activities in their respective industries.

Participants

Eighty-five people attended the event. These stakeholders came mainly from the occupational health and safety partner network: the Commission des normes, de l’équité et de la santé et de la sécurité du travail (CNESST), Réseau de santé publique en santé au travail (RSPSAT), joint sector-based associations (ASPs), management and labour representatives, and the research community.

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Program

The program (see Appendix) featured a mixed formula of presentations on research results and the exposure reduction strategies implemented by the various partners. Panel discussions were held on four main carcinogens: asbestos, silica, diesel engine exhaust and welding fumes. The day ended with discussion workshops on the prevention priorities to be promoted for each of the carcinogens discussed at the symposium.

These four carcinogens were chosen because they are known to be carcinogenic to humans (Group 1) according to the classification of the International Agency for Research on Cancer (IARC). Welding fumes were added to Group 1 a few weeks prior to the symposium. The large number of workers and economic activity sectors concerned by the occupational carcinogen problem in Québec was also a factor in the choice of carcinogens.
2. THE BURDEN OF OCCUPATIONAL CANCER IN CANADA: AN OVERVIEW OF THE STUDY

Presenter-panelist: Paul A. Demers, Director and Researcher, Epidemiologist, OCRC

The term ‘burden’ refers to the human and economic costs associated with a cause (or group of causes) of disease. The aim of the study is to assess the burden of 27 different cancers attributed to exposure to 44 workplace carcinogens, with the data grouped by sex, province, age group, industry and occupation.

The results of this study are helping identify priority workplace carcinogens and provide quantitative information to support decision makers and occupational health and safety practitioners in their efforts to launch cancer prevention initiatives. By quantifying the cancer burden in terms of human and financial costs, the study results can be used to support more protective occupational exposure limits, promote a reduction in the use of toxic substances and prioritize interventions targeting workers in the highest-risk jobs.

Calculating the Cancer Burden

The human burden is calculated using exposure data for each of the selected carcinogens, the number of people working in the exposed occupations, assessments of the cancer risk associated with each carcinogen and the numbers of newly diagnosed cancer cases and cancer deaths per year in Canada. These data are combined to estimate the number of cancer cases and cancer deaths that could be prevented each year by reducing occupational carcinogen exposure.
The economic burden includes all current and future costs incurred by the affected workers, their families, communities, employers and society at large. These costs include health care and administrative costs paid by society, informal caregiving and out-of-pocket expenses, output and productivity losses (including salary loss and employer costs), and losses of health-related quality of life sustained by workers and their families.

The Burden of Occupational Cancer in Canada Study

This study is the result of a collaboration between researchers at the OCRC, CAREX Canada, the Institute for Work & Health (IWH), University of British Columbia, Université de Montréal, Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST) and Imperial College London.

In the first phase of the study, the researchers collected and analyzed data on Canadians’ cancer risk and their occupational exposures to carcinogens in order to produce preliminary estimates of the burden. The second phase involved using these estimates to generate figures on the economic burden. These human and economic cost estimates then underwent an external scientific review. The third phase of the study involves communicating these results to stakeholders and partners to ensure that they promote cancer prevention initiatives across Canada.

To consult the English version of this presentation, visit  
3. ASBESTOS

Presenters-panelists (as shown in the photo from left to right):

Asbestos Regulations; Josée Provencher-Mandeville, Expert Advisor on Prevention-Inspection, Direction de l'hygiène du travail (occupational health directorate), CNESST

Paul A. Demers, Director and Researcher, Epidemiologist, OCRC

The Burden of Asbestos-related Occupational Cancers in Québec; France Labrèche, Researcher, Epidemiologist, IRSST

The Economic Burden of Asbestos-related Occupational Cancers; Martin Lebeau, Scientific Professional, Economist, IRSST

Photo: Dominique Desjardins

3.1 Presentations

Asbestos is a group of naturally occurring fibrous silicate minerals. The manufacturing and use of asbestos-containing products are restricted in most western countries, including Canada, and are banned in some countries. Due to its heat resistance, tensile strength, friction resistance and insulating properties, asbestos has been used for many commercial applications. It is found primarily in roofing, thermal and electrical insulation, cement pipes and sheeting, flooring, gaskets, friction materials, coatings, plastics, textiles and other products. In terms of health effects, asbestos causes mesothelioma; lung, laryngeal and ovarian cancer; and asbestosis. [https://www.carexcanada.ca/cdn/CAREX_OCRC_Burden_of_Occupational_Cancer_Asbestos_factsheet.pdf](https://www.carexcanada.ca/cdn/CAREX_OCRC_Burden_of_Occupational_Cancer_Asbestos_factsheet.pdf)

According to CAREX Canada data, it is estimated that between 27,000 and 29,000 workers are currently exposed to asbestos in Québec. They are employed by companies operating mainly in the following industrial sectors: specialty trade contractors (e.g., foundation, structure and building exterior work), construction of buildings, and automotive repair and maintenance. Again
according to this study, in Québec, 650 lung cancer cases and 140 mesothelioma cases are attributable to asbestos annually. (irsst.qc.ca/Portals/0/upload/misc/2017/forum-cancerogene/02-Forum-2017-04-Labreche-IRSST-fardeau-amiante.pdf)

The study also yielded estimates of the economic burden of lung cancers and mesotheliomas associated with occupational asbestos exposure. These costs were estimated at $2.35 billion annually for Canada as a whole, or an average of approximately $1 million per case. Approximately 65% of these are human costs related to quality of life losses and potential years of life lost. The direct costs (medical and administrative costs) and indirect costs (output and productivity losses) represent 35% of the estimated total costs. (irsst.qc.ca/Portals/0/upload/misc/2017/forum-cancerogene/03-Forum-2017-04-Lebeau-IRSST-fardeau-economique-amiante.pdf)

Ms. Josée Provencher-Mandeville from the CNESST gave a presentation on asbestos regulations. She focussed on Division IX.I of Québec’s Regulation respecting occupational health and safety (ROHS), which contains provisions on the safe management of asbestos, and on subdivision 3.23 of Québec’s Safety Code for the Construction Industry, which deals with work likely to produce asbestos dust emissions.

3.2 Panel: Themes Covered

During this panel session, participants had the opportunity to address their comments and questions regarding asbestos and Mr. Demers’ presentation to the presenters/panelists.

The main points raised about asbestos were as follows:

- The work-related fractions cited in the study for mesotheliomas, i.e., 85% of cases for men and 40% of cases for women, were questioned, as some participants considered them low. The researchers specified that these fractions were based on data from countries with mesothelioma registers and on the scientific literature.

- The proportion of companies with a register on the safe management of asbestos in the buildings under their responsibility seems to vary, depending on whether they are public or private. However, there are no data in this regard. The Québec regulations stipulate that workers have the right to access the data in their employer’s register.

- Some occupations that are very heavily affected by asbestos exposure—insulators, for example—do not appear in the list of occupations mentioned in the asbestos presentation. The answer given was that while a large proportion of these workers are in fact exposed, they are few in number. By contrast, the figures presented at the Montréal Symposium (and by CAREX Canada) on the most heavily affected occupations were based on occupations with the largest number of workers.

- Questions were raised about the estimated costs of cancers occurring mainly in workers who have already left the labour force. The answer given was that the costs related to productivity losses are obviously low for these cancers because these workers are no longer employed. However, the fact of converting quality-of-life losses into dollars nonetheless makes it possible to come up with fairly good estimates of the “severity” of
the cancers, as these human costs are not influenced by people’s presence or not in the labour force.

• Ensuring that workers wear respiratory equipment to prevent asbestos fibre inhalation is a complicated process to manage, and there are too few inspectors on construction sites to ensure compliance with the provisions of the Regulation respecting occupational health and safety.

• The study estimates that it costs approximately $1 million per cancer case. What can this amount be compared to? In studies conducted by the IRSST, the average cost of a compensated injury is approximately $50,000. The cost for occupational diseases is higher than that for industrial accidents.²

• It would be preferable if decision makers knew the results of cost-related research because these costs have impacts on society as a whole. What should be done to ensure that employers take the human costs into account when developing and implementing prevention strategies appropriate for their workplace?

The main general comments made and questions raised were as follows:

• In urban environments where smog episodes are increasingly frequent, do we know the effects of poor air quality on the incidence of lung cancer? The answer: Air pollution is considered a carcinogen by the IARC, but this is based on studies of the general population. There are studies on urban environments, but they rarely concern workers.

• With regard to the data on skin cancers, do they cover reported cases or cases accepted for compensation? The answer: The study is based entirely on the number of cases of cancer diagnosed and registered in Québec’s cancer registry, or Registre québécois du cancer (this number is higher than the number of cases accepted for compensation).

² Editor’s note: According to the latest figures (in 2011 dollars), the average cost of a workplace injury is $52,406, of an accident is $41,829 and of a disease is $211,594. Figures taken from IRSST Report R-963, Lésions professionnelles indemnisées au Québec en 2010-2012. Profil statistique par industrie – catégorie professionnelle (in French only).
4. SILICA

Presenters-panelists (as shown in the photo from left to right):

**Controlling Quartz Exposure in the Granite Industry in Estrie: a Constant Challenge;** Christian Gaulin, Occupational Health Physician, CIUSSS de l’Estrie

Integrated Preventive Approach to Silica-related Health Problems in the Construction Industry *(AIC-silice)*; Sylvie Charron, Industrial Hygienist, CISSS de Laval, and member of the RSPSAT provincial silica committee

**The Burden of Silica-related Occupational Cancers in Québec;** Jérôme Lavoué, Researcher, Occupational Exposure Assessment, CRCHUM, and Université de Montréal

4.1 Presentations

Silica is a naturally occurring mineral found in soil, sand and rocks. Work processes such as the breaking, grinding and sawing of these materials release crystalline silica dust into the air. Workers in certain trades are frequently exposed to crystalline silica due to its presence in many of the materials they handle, such as concrete, mortar and bricks. Silica can cause lung cancer, silicosis and chronic obstructive pulmonary disease, as well as other health effects. [https://www.carexcanada.ca/cdn/CAREX_OCRC_Burden_of_Occupational_Cancer_Silica_fact_sheet.pdf](https://www.carexcanada.ca/cdn/CAREX_OCRC_Burden_of_Occupational_Cancer_Silica_fact_sheet.pdf)

Based on CAREX Canada data, an estimated 78,000 workers are currently exposed to silica in Québec. They work primarily in the following industrial sectors: construction, mines and quarries, smelters and metallurgy. Every year in Québec, 170 cases of lung cancer can be attributed to silica. ([irsst.qc.ca/Portals/0/upload/misc/2017/forum-cancerogene/04-Forum-2017-04-Lavoue-UdeM-fardeau-silice-cristalline.pdf](https://irsst.qc.ca/Portals/0/upload/misc/2017/forum-cancerogene/04-Forum-2017-04-Lavoue-UdeM-fardeau-silice-cristalline.pdf))
The AIC-silice program (an integrated preventive approach to silica-related health problems in the construction industry) has been in place throughout Québec since 2014. The aim of this CNESST-RSPSAT partnership is to prevent diseases related to crystalline silica exposure in construction workers by targeting the tasks that generate the highest exposures. Sylvie Charron of the CISSS de Laval presented an assessment of this intervention to date and of the challenges that lie ahead. (irsst.qc.ca/Portals/0/upload/misc/2017/forum-cancerogene/05-Forum-2017-04-Charron-RSPSAT-aic-silice-approche-preventive.pdf)

Control of quartz exposure in the granite industry in Québec’s Estrie region has been monitored for over 30 years. The concerted and sustained efforts of the health network and the CNESST with companies in the region through the regional intervention program (PIR) have paid off. While the challenge is ongoing, Christian Gaulin of the occupational health team at the CIUSSS de l’Estrie reports decreased worker exposure to this carcinogen.

4.2 Panel: Themes Covered

During this panel session, participants had the opportunity to address their comments and questions to the presenters/panelists. The main points raised were the following:

- We cannot simply rely on the absence of “haze” in a sandblasting area to enter the area; measurements must be taken. Silica-free abrasives can also be used.

- A change in culture, particularly in small companies, requires great effort. It takes time and requires solid, compelling arguments. Companies and the CNESST have been involved in the two preventive actions of the health network that were presented.

- The question was asked whether the link between silica and lung cancer has been established in the absence of silicosis. Yes, according to the IARC, silica is associated with lung cancer not only when silicosis is present, but also when it is absent.

- The CNESST’s silica-related mortality statistics appear to represent only 10% of the reality at best. Regarding silica in the construction industry, up to 90% of tasks involving silica appear to be associated with higher-than-permissible exposures.

- Cases of fibrosis (asbestosis/silicosis) are easier to distinguish, and their link with silica or asbestos is quite clear, given the characteristic X-ray images. However, it is impossible to distinguish a silica-induced lung cancer from another cancer with a different cause. The decisive evidence therefore comes from the individual worker’s occupational history.
5. DIESEL ENGINE EXHAUST

Presenters-panelists (as shown in the photo from left to right):

**Assessing Exposure to Diesel Particulates**; Simon Aubin, Chemist, Industrial Hygienist, IRSST

**The Burden of Occupational Cancers Associated with Diesel Engine Exhaust in Québec**; France Labrèche, Researcher, Epidemiologist, IRSST

Photo: Dominique Desjardins

5.1 Presentations

The combustion of diesel fuel in engines produces emissions containing a complex mixture of gases and particulate matter. This mixture can contain other known and suspected carcinogens such as benzene, polycyclic aromatic hydrocarbons (PAHs), metals and particulate matter. The composition of the mixture depends on a number of factors, such as the type of engine (for a heavy- or light-duty vehicle), type of fuel and oil, sulphur levels, speed, load transported and emission control system. Exposure to diesel engine emissions can cause lung cancer; eye, throat and bronchial irritation; and various other health effects.


Based on CAREX Canada data, it is estimated that between 180,000 and 195,000 workers are currently exposed to diesel engine emissions in Québec. The most heavily affected occupations are truck drivers, delivery drivers, bus drivers/subway operators and other public transit operators, as well as heavy equipment operators. It is also estimated that 175 cases of lung cancer are attributable to diesel engine exhaust annually in Québec. Lung cancers occur in workers in the following sectors: mining and oil/gas extraction (36%), transportation and
warehousing (23%), wholesale trade and retail trade (10%), manufacturing (9%) and other sectors (22%).

Québec's Regulation respecting occupational health and safety in mines (CQLR c. S-2.1, r. 14) stipulates that the level of worker exposure to diesel engine exhaust may not exceed the time-weighted average exposure value of 0.4 mg/m³. To support the mining industry in its efforts to prevent the risks associated with exposure to the particulate matter in diesel engine exhaust and to implement control measures, Simon Aubin presented the sampling and analytical method developed by the IRSST’s Laboratory Division specifically for this industrial sector.

5.2 Panel: Themes Covered

During this panel session, participants had the opportunity to address their comments and questions to the presenters/panelists. The main points raised were the following:

• The observation was made that efforts to reduce diesel engine emissions often increase other types of emissions. For example, biodiesel fuels help reduce hydrocarbon and fine particulate matter emissions, but increase emissions of other compounds. Some filter systems significantly reduce biodiesel emissions, but they are very expensive.

• There are limitations to using only total carbon as an indicator as it is not specific to diesel engine exhaust. The literature is making increasing reference to elemental carbon as opposed to total carbon. A few years ago, respirable dusts were being used as an indicator, whereas today it is total carbon, and eventually it will be elemental carbon.

• It was also mentioned that elemental carbon is quite specific to diesel engine exhaust and that the regulation (CQLR c.S-2.1, r.14, s. 102a) should refer to it.

• Questions were raised about the added value of taking measures. The answer given was that we reduce adverse effects by having a permissible exposure value; it is a means of prevention. The aim is to reduce exposure to the lowest possible levels, and this requires measuring in order to ascertain levels. These data are useful for epidemiologists and during compensation investigations conducted 30 years after exposure.
6. WELDING FUMES

Presenters-panelists (as shown in the photo from left to right):

**Means of Reducing Worker Exposure to Welding Fumes;** Caroline Godin, Engineer, Technical Advisor, MultiPrévention

**The Burden of Occupational Cancers Associated with Welding Fumes in Québec;** Jérôme Lavoué, Researcher, Occupational Exposure Assessment, CRCHUM, and Université de Montréal

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**6.1 Presentations**

Welding is a process used to join materials together (usually metals or thermoplastics) through fusion bonding. The operation of welding machines and brazing equipment is also included in the category of welding processes. Welding fumes contain a mixture of very fine metallic oxide particles, silicates and fluorides from the electrode (welding rod) and the material being welded. In addition, the presence of coatings or other residues on the metal being welded influences fume composition. The fume mixture may also contain known and presumed carcinogens such as nickel, chromium VI (hexavalent chromium), cadmium, polycyclic aromatic hydrocarbons (HAPs), benzene and particulate matter. High levels of ultraviolet radiation (UV rays) are also produced during arc welding. Health effects include lung cancer (welding fumes), chronic bronchitis, metal fume fever, and melanoma of the eye (ultraviolet radiation).

(irsst.qc.ca/Portals/0/upload/misc/2017/forum-cancerogene/FICHE-SOUDEAGE.pdf)

Based on data from The Human and Economic Burden of Occupational Cancer in Canada study, it is estimated that 20,000 workers in Québec with the job title of welder are currently exposed to components of welding fumes. However, the IARC working group has estimated that only around 10% of workers actually exposed to welding fumes have this job title. Again according to the study data, welders are found mainly in the following industrial sectors: manufacture of metal products, machines and transportation equipment; repair, maintenance
and construction. In Québec, every year, 100 lung cancer cases are attributable to welding fumes and 14 eye cancer cases are associated with exposure to UV radiation.


Over the years, MultiPrévention, a joint sector-based association operating in several economic activity sectors (manufacture of metal and electrical products; printing; garment industry), has developed an expertise in the reduction of exposure to welding fume components at the source. Caroline Godin explained that a number of welding parameters can be adjusted to reduce exposure while also improving welding quality, two incentives worth considering when introducing new prevention practices.

6.2 Panel: Themes Covered

During this panel session, participants had the opportunity to address their comments and questions to the presenters/panelists. The main points raised were the following:

- Mr. Lavoué mentioned that in IARC discussions on welding fumes (in which he participated), the focus was on flame cutting or brazing; yet only welding fumes have been recognized as carcinogens. The IARC also discussed the composition of fumes, but there are infinite possibilities, and epidemiological studies on welders do not find significant differences between individual components of the fumes.

- It was asked whether the training offered to welding students includes concepts related to process optimization. The answer was that it would appear so, but that few companies actually apply these concepts. However, interest is growing because their application can lead to cost savings.

- The manufacturer’s technical data sheet is useful, but inadequate. The most efficient way to find out whether welding parameters are optimal is to use verification equipment (to determine the intensity of the electric current used, for example).
7. PREVENTION PRIORITIES

This section synthesizes the workshop discussions on each carcinogen. The exchanges between participants focused on two questions:

- Which preventive actions should be given priority for each carcinogen?
- How should the results of the Burden of Occupational Cancer in Canada study be used to promote prevention or preventive action?

Each workshop had to come up with one suggestion for each question. Two workshops were held for each carcinogen.

7.1 Asbestos

**Priority preventive actions**

- Complete the register of asbestos materials in buildings and make it accessible to the public.
- Adapt the *AIC-silice* program to asbestos, for use in the construction and public works sector.

**Other suggested preventive actions:**

- Improve respiratory protection: offer more training and awareness-raising activities on respiratory protective devices (RPDs); improve the mandatory respiratory protection program and make sure it is applied.
• Strengthen the CNESST’s action: more inspectors to ensure that the regulatory provision concerning the register is applied, better inspector training on how to assess sample quality and the use of RPDs, strengthen the legislation (statements of offence).

• Train workers and employers about the risks, health effects and consequences of long-term asbestos exposure.

• Ensure better identification of high-risk worksites.

• Ensure better control of asbestos-contaminated construction materials (control at the source) and better disposal of waste (materials) containing asbestos.

• Set a maximum number of permissible hours of asbestos exposure, per day and per week.

• Analyze all samples using electron microscopy.

Prioritized strategies for using results

• Support concrete actions to make the register accessible to the public; the estimate of the economic burden may lend weight to the process.

• Develop a partnership between the joint sector-based associations, RSPSAT, prevention mutuals, CNESST, and management and labour associations to raise awareness of the full economic burden (not simply compensation costs) among both workers (who “pay” the human costs) and employers. It is also very important to build this awareness into the training of future workers. The message has to get across, particularly in the construction and public works sector.

7.2 Silica

Priority preventive actions

• Develop awareness-raising tools with messages adapted for the different target audiences.

• Apply the water/exhaust ventilation combination to other situations.

Other suggested preventive actions

• Improve respiratory protection in the construction and public works sector: minimize regional differences in the application of the mandatory respiratory protection program; improve the respiratory protection of exposed workers, but also of workers in their vicinity; facilitate the process of choosing appropriate respiratory protective devices (RPDs) and itemize problems with RPDs (having a beard, for example).

• When a sectoral program is being prepared in the construction and public works sector, promote an approach by occupation (e.g. bricklayer).
• Promote product substitution in the industrial sector wherever possible. Assess the benefits versus dangers of water recycling (whose aerosolization causes recirculation of silica).

• Raise awareness in the municipal sector of materials containing silica and the health effects.

• Involve employers to ensure a sustainable impact.

• Work together with the CNESST toward the same goal, and ensure that the CNESST uses its power to issue statements of offence to both employers and workers.

• Strengthen the message to workers and the general population (drawing inspiration from messages on lockout/tagout, falls from heights, etc.) because silica-related cancer is less well known and elicits less concern than that associated with asbestos. Cite the number of occupational cancers to convey the message to a broader audience. Raise public awareness.

• Increase awareness in the medical sector of the importance of obtaining the worker’s occupational history.

Prioritized strategies for using results

• Develop awareness-raising tools adapted to different audiences: emphasize the human costs for workers and productivity costs for employers, and explain to the public/to society at large that it is ultimately both workers and employers who pay the price.

• Disseminate the study results to vocational training schools.

7.3 Diesel Engine Exhaust

Priority preventive actions

• Promote changes in equipment over the long term (e.g., electric engines, ventilated cabs) and new technologies (TIER 2, TIER 3, TIER 4)\(^3\).

• Standards should be set for diesel engine emissions (permissible exposure limits and carcinogenicity) in Québec’s Regulation respecting occupational health and safety (ROHS), which would induce workplaces to implement means of reducing exposure, such as local exhaust systems during maintenance operations.

Other suggested preventive actions

\(^3\) Editorial note: The TIER standards developed by the Environmental Protection Agency (EPA) in the United States target pollutants associated with diesel-powered combustion engines.
Implement conventional means of prevention until a large portion of the current equipment inventory is replaced by technologies that offer better worker protection or are less polluting:

- Promote remotely operated diesel-powered machinery so as to limit worker presence near machinery.
- Adapt processes: optimize the transfer of heavy materials so as to limit the need for machinery (e.g., plan for several operations to be performed on heavy parts at one location rather than moving the parts from one work station to another).
- Apply purchasing policies aimed at acquiring less polluting machinery.
- Introduce filtration mechanisms (e.g., engines with a urea-based catalytic converter).
- Apply engineering controls such as:
  - Local exhaust ventilation
    - Easily adaptable in mechanics shops, where vehicles are in a fixed location and are not moved. This approach is harder to implement with moving vehicles.
    - In garages, install exhaust capture systems at the source.
  - General ventilation
    - Machinery with cabs.
    - Optimization/redirection of ventilation in a way that optimizes the power of the existing system (mines).
- Promote administrative measures:
  - Methods of working/training/raising awareness/developing a prevention culture
    - Reduce the warm-up time for vehicle motors (e.g. in garages, during winter, a number of vehicles are started up simultaneously and left to idle for 15 minutes to warm up the engines and cabs before they are taken outside).
    - Train employees, and when integrating new workers, promote the transfer of prevention knowledge and skills and ensure follow-up (e.g. avoid running engines for no reason). Raise awareness of the health effects to strengthen worker motivation to accept preventive measures.
    - Perform preventive maintenance on vehicles.
  - Demarcate safer zones or monitoring areas.
**Prioritized strategies for using results**

- Highlight the fact that the number of cancer cases attributable to diesel engine exhaust is nearly as high as that associated with silica, even if only one case has been compensated in 10 years. Publicize the human and indirect costs to strengthen prevention strategies.

- Disseminate these results as widely as possible to raise awareness among decision makers and the population at large.

**Other strategies for using results**

- Make use of the triennial planning process for the sectoral health programs carried out by the occupational health network to incorporate the results of the Burden of Occupational Cancer study into the programs.

- It is recommended that occupational health physicians emphasize the IARC’s Group 1 classification of diesel (carcinogenic to humans) in the workplaces concerned. Monitoring could be carried out for diesel exhaust, as it is for carbon monoxide and nitrogen oxides.

### 7.4 Welding Fumes

**Priority preventive actions**

- Train students, engineers, professional associations, and suppliers in ways to optimize welding parameters that reduce exposure and improve welding quality.

- Promote a structured and integrated intervention to be implemented by all stakeholders, while raising awareness in workplaces (including very small businesses) of the carcinogenicity of welding fumes.

**Other suggested preventive actions**

- Revise the permissible exposure limit for welding fumes, which is not appropriate for implementing means of cancer prevention. Apart from manganese, the RSPSAT representatives mentioned that the permissible exposure limit is not exceeded very often, with the result that they have no means of applying pressure to improve welders’ working conditions. Since the particles in welding fumes are ultra-fine (almost like nanoparticles), it might be wiser to take more adapted samples (using a cyclone collector) to collect the respirable fraction and to develop a permissible exposure limit for the respirable fraction.

- Pay particular attention to welder-assemblers, who are sometimes difficult to reach.

- The risks needs to be better documented and the exposure characterized, especially in terms of frequency and duration. The ergonomic risk also needs to be considered.
Prioritized strategies for using results

- Disseminate the results in laymen’s terms, adapt the messages to different audiences and carry out broader information campaigns.
- Use the results to properly “document” the carcinogen problem for stakeholders.

Another strategy for using results

- Raise awareness in the occupational health network, but also in the Ministère de la Santé et des Services sociaux (Québec's health and social services ministry) and among physicians in the network.
APPENDIX
MONTRÉAL SYMPOSIUM
April 27, 2017

Occupational CARCINOGENS

Program (translation of the original program)
To promote the exchange of ideas and experiences, the program for this symposium includes short presentations on research results and the exposure reduction strategies that have been implemented by various partners. These presentations will be followed by panel discussions on four carcinogens:

- asbestos
- silica
- diesel engine exhaust
- welding fume components.

Discussion workshops will wind up the day. When you register, you are invited to indicate your choice of workshop, by carcigen (1st and 2nd choices).

Background to the Montréal Symposium on Occupational Carcinogens
A research project was conducted by the Occupational Cancer Research Center (of Cancer Care Ontario, a department of the Ontario Ministry of Health) and funded by the Canadian Cancer Society Research Institute (CCSRI) to estimate the number and proportion of new cancer cases and cancer deaths attributable to occupational exposure to carcinogenic agents, and to assess their current economic impact. Researchers from the Institute de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST) and the Université de Montréal collaborated in this project, titled The Human and Economic Burden of Occupational Cancer in Canada.

Two knowledge transfer meetings then took place, the first in Toronto and the second in Vancouver. The Montréal Symposium on Occupational Carcinogens to which you have been invited is the third such meeting.

8:00 a.m. Welcome Remarks
8:30 a.m. Opening Addresses and Context
Marie Larue, IRSST; Paul Demers, OCRC; Suzanne Dubois, Canadian Cancer Society – Québec Division
8:50 a.m. Preventing Occupational Cancer
• The Burden of Occupational Cancer in Canada: An Overview of the Study
  Paul Demers, OCRC
9:10 a.m. Asbestos
• The Burden of Asbestos-related Occupational Cancers in Québec
  France Labrèche, IRSST
• The Economic Burden of Asbestos-related Occupational Cancers
  Martin Lebeau, IRSST
• Asbestos Regulations
  Josée Provencher-Mandeville, CNESST
• Panel discussion: questions and answers
10:25 a.m. Break
10:45 a.m. Silica
• The Burden of Silica-related Occupational Cancers in Québec
  Jérôme Lavoué, CRCHUM and Université de Montréal
• Integrated Preventive Approach to Silica-related Health Problems in the Construction Industry (AIC-silice)
  Sylvie Charron, CISSS de Laval
• Controlling Quartz Exposure in the Granite Industry in Estrie: a Constant Challenge
  Christian Gaulin, CIUSSS de l’Estrie
• Panel discussion: questions and answers
11:45 a.m. Lunch on Site
1:00 p.m. Diesel Engine Exhaust
• The Burden of Occupational Cancers Associated with Diesel Engine Exhaust in Québec
  France Labrèche, IRSST
• Assessing Exposure to Diesel Exhaust Particulates
  Simon Aubin, IRSST
• Panel discussion: questions and answers
1:45 p.m. Welding Fume Components
• The Burden of Occupational Cancers Associated with Welding Fume Components in Québec
  Jérôme Lavoué, CRCHUM and Université de Montréal
• Means of Reducing Worker Exposure to Welding Fumes
  Caroline Godin, MultiPrévention
• Panel discussion: questions and answers
2:25 p.m. Break and Move to Rooms for Workshop Discussions
2:45 p.m. Prevention Priorities
  Workshop discussions on each carcinogen:
  • Which preventive actions should be given priority?
  • How should the results of the Burden of Occupational Cancer in Canada study be used to promote prevention or preventive action?
3:45 p.m. Roundtable Discussion during a Plenary Session
4:15 p.m. Closing Addresses
  France Labrèche and François Hébert, IRSST
4:30 p.m. Closing Remarks

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