



**CAREX**  
CANADA

*Exposure surveillance of environmental and occupational carcinogens for cancer prevention*

## Occupational Exposure Summary

# British Columbia

*This report serves as a summary of CAREX Canada's results on the known or suspected carcinogens that British Columbians are exposed to at work. Assembling various CAREX Canada data, tools, and resources, it provides an overview of the most prevalent exposures for those working in the sector, including solar radiation, night shift work, gasoline engine exhaust, diesel engine exhaust, and polycyclic aromatic hydrocarbons. Our aim is to provide a useful guide for those looking to better understand – and help reduce or eliminate – common carcinogenic exposures in British Columbia (BC).*

## British Columbia's industry overview

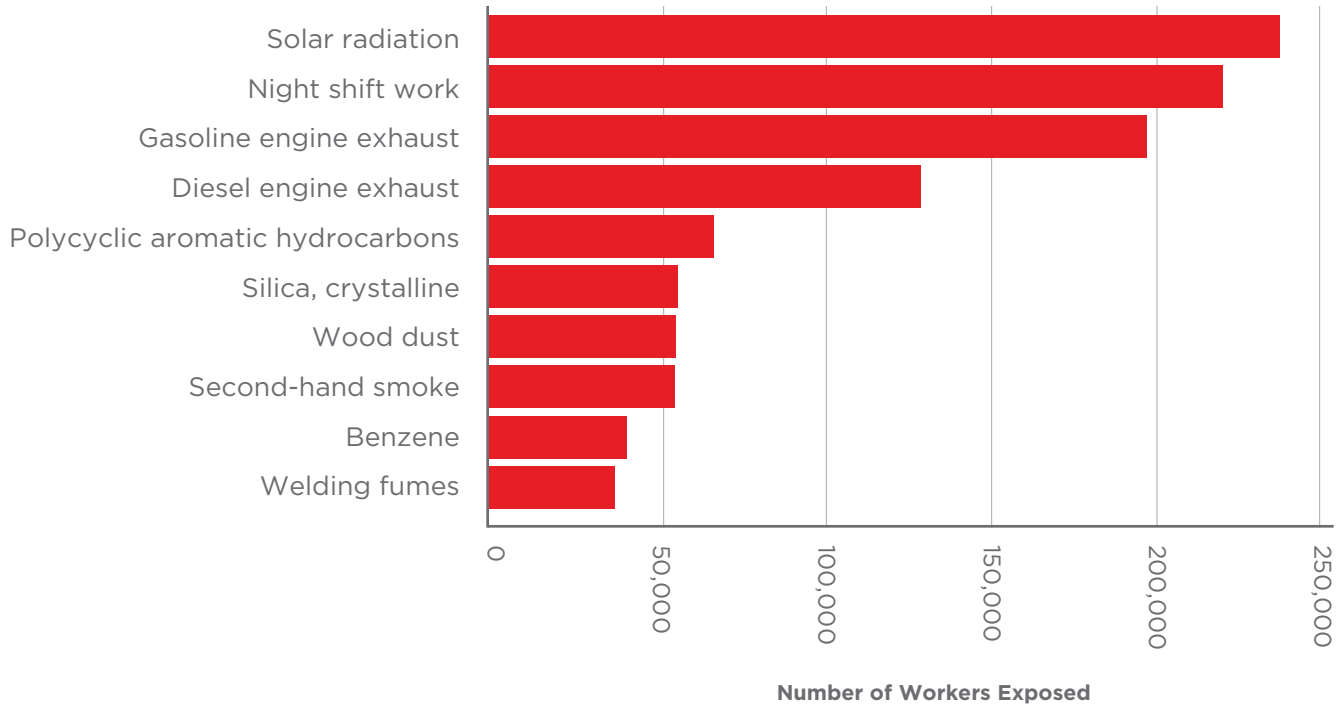
BC's primary resource sectors, such as forestry, fishing, and agriculture, are no longer leading the province's economic growth and employment. In 2016, the sectors with the largest workforce were retail trade (12%), health care and social assistance (11%), and accommodation and food services (9%).

The sectors in BC with the highest exposures to carcinogens, however, are construction, transportation and warehousing, and manufacturing.

# Estimates of prevalent exposures


CAREX Canada estimates of the number of British Columbians exposed to carcinogens at work are summarized in Figure 1. They include solar radiation, night shift work, gasoline engine exhaust, diesel engine exhaust, and polycyclic aromatic hydrocarbons. Exposure level estimates, where available, are summarized in the Carcinogen Profiles below.

**Figure 1.** Top 10 prevalent carcinogen exposures in British Columbia, CAREX Canada, 2016



*Note: High prevalence does not necessarily indicate a high cancer risk. For more information or assistance interpreting the data in this table, please contact us at [info@carexcanada.ca](mailto:info@carexcanada.ca).*

We classify carcinogens based on evaluations made by the [International Agency for Research on Cancer \(IARC\)](#). Most of the agents listed in Figure 1 are classified as known carcinogens (IARC 1), where there is sufficient evidence linking the agent with cancer in humans.

 More information, including detailed carcinogen information, exposure estimates, methods, and references, is available under the Carcinogen Profiles tab of our website

## Carcinogen profiles

The CAREX Canada website contains detailed information on use, regulations and guidelines, production and trade, exposure routes, and health effects for the top ten carcinogen exposures in British Columbia listed above. A sample of these are summarized below.

# Solar Radiation

KNOWN CARCINOGEN  
(IARC 1)



## What is solar radiation?

The sun, or solar radiation, is the **main natural source of exposure to ultraviolet radiation**, and is a type of non-ionizing radiation. The southern prairies are the sunniest place in Canada, receiving approximately 2,400 hours of bright sunshine per year.

## What are its health effects?

**Cancer:** Solar radiation is the most important cause of **skin cancer** and the most common cancer worldwide. Additional studies identify associations between solar radiation and melanoma of the eye and non-Hodgkin lymphoma.

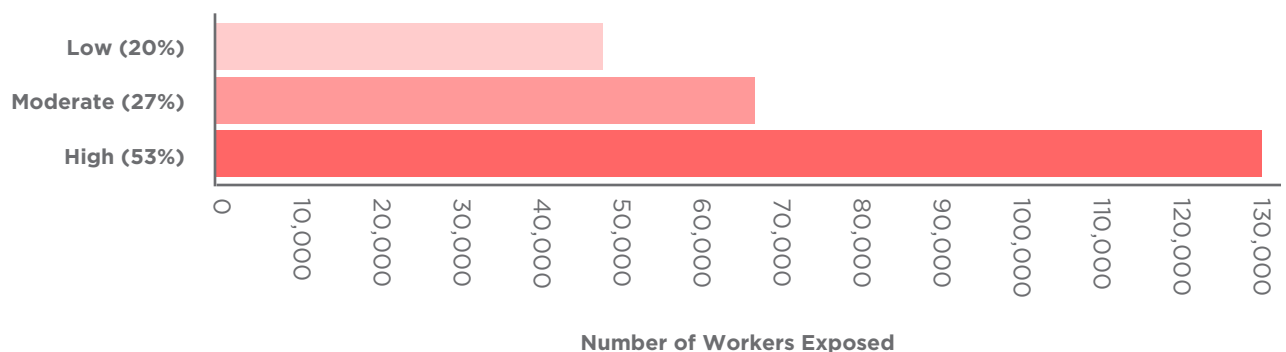
**Non-cancer:** Exposure to solar radiation can cause eye damage (e.g. cataracts) and skin damage (e.g. premature aging and actinic keratoses). It can also suppress the immune system, weakening the skin's ability to protect against foreign invaders.

## Occupational exposure to solar radiation

Exposure to solar radiation can occur via skin or eyes. Levels of exposure vary depending on conditions related to geography, seasonality, time of day and meteorology, as well as time spent out of doors and the amount of exposed skin surface. All outdoor occupations have a potential for exposure to solar radiation.

Approximately **238,000 workers are exposed to solar radiation in British Columbia**. The industries with the largest number of exposed workers in this province include construction; agriculture, forestry, fishing and hunting; and transportation and warehousing. The occupations with the largest number of exposed workers include construction trades helpers and labourers, landscaping and grounds maintenance labourers, and heavy equipment operators.

**Workers exposed to solar radiation in British Columbia by exposure level**



# Night Shift Work

KNOWN CARCINOGEN  
(IARC 2A)



## What is night shift work?

Shift work is **working time organized to cover more than the usual 8-hour workday**, up to a 24-hour period. Some people perform shift work on rotation while others perform regularly scheduled evening or night shifts. Research shows that shift work at night (generally between the hours of 12am and 5am) is the most disruptive to internal circadian rhythms, or the internal biological ‘clock’ that generates the sleep-wake cycle in humans. Circadian disruption suppresses melatonin, disrupts sleep patterns and food digestion, and affects genes related to cancer.

## What are its health effects?

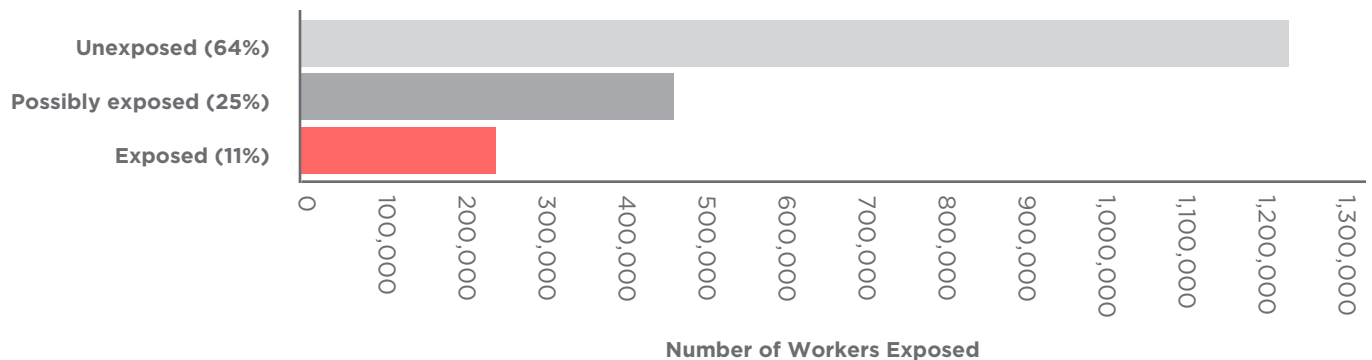
**Cancer:** Evidence of carcinogenicity is sufficient in animals and limited in humans. Epidemiological studies observed an increased risk of **breast cancer** among those working high-intensity shifts over long durations compared to those who do not work at night. Some studies suggest that **prostate** and **colorectal cancer** may also be associated with night shift work.

**Non-cancer:** Night shift work is associated with changes in mental and physical performance at work, fatigue, stress, disruption to family and social life, depression, and anxiety. Other effects include digestive disorders such as indigestion, heartburn, nausea, and loss of appetite, as well as cardiovascular disorders such as hypertension. It may aggravate previous health conditions such as asthma, diabetes, and epilepsy and is linked to reproductive health problems in women.

## Occupational exposure to night shift work

Approximately **221,000 British Columbians work night shifts**. The industries with the largest number of exposed workers in British Columbia include trade, health care and social assistance, and accommodation and food services.

**Workers exposed to night shift work in British Columbia by exposure level\***



\*Exposed = regular night or rotating shift

Possibly exposed = regular evening, split shift, on call, irregular schedule, or other

Unexposed = regular day

# Gasoline Engine Exhaust

POSSIBLE CARCINOGEN (IARC 2B)



## What is gasoline engine exhaust?

Gasoline engine exhaust, produced when gasoline fuel combusts, is a **complex mixture of gases** (e.g. carbon monoxide, nitrogen oxides, and volatile organic compounds) and **particulate matter** (e.g. elemental and organic carbon, ash, sulfate, and metals).

## What are its health effects?

**Cancer:** IARC has classified gasoline engine exhaust as possibly carcinogenic to humans, based on inadequate evidence of carcinogenicity in humans and sufficient evidence of **lung cancer** in experimental animals.

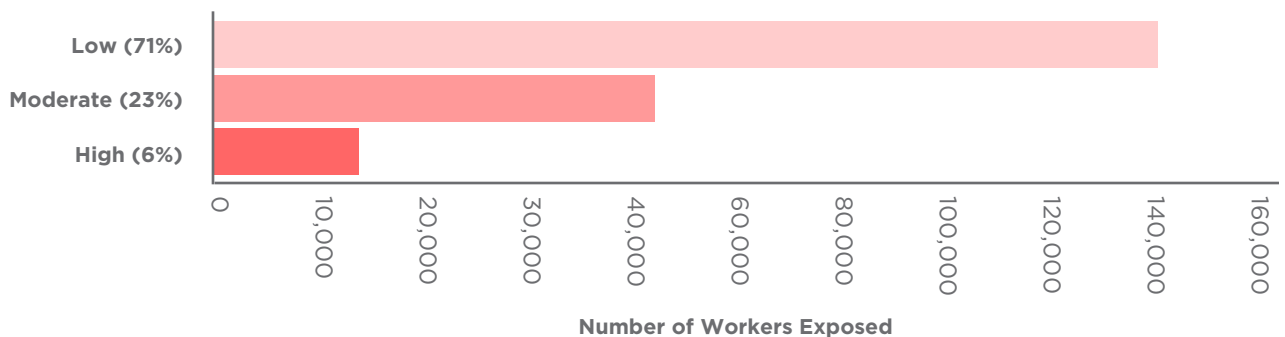
**Non-cancer:** Short-term exposure to gasoline engine exhaust may irritate the eyes, nose, or throat, aggravate allergies, and lead to headache, light-headedness, or tingling extremities. Long-term health effects include impacts to the respiratory and cardiovascular systems.

## Occupational exposure to gasoline engine exhaust

Inhalation is the primary route of occupational exposure to gasoline engine exhaust. Assessing exposures to gasoline engine exhaust is complex because it is difficult to separate the effects of diesel and gasoline engine exhaust.

Approximately **198,000 British Columbians are exposed to gasoline engine exhaust at work**. The industries with the largest number of exposed workers in this province include transportation and warehousing, construction, and public administration. The occupations with the largest number of exposed workers include transport truck drivers, real estate agents and salespersons, and delivery and courier service drivers.

Workers exposed to gasoline engine exhaust in British Columbia by exposure level





## Exploring the CAREX Canada estimates

Our eWORK Tool allows users to explore CAREX exposure data by carcinogen, sector, occupation, province, sex, and exposure level. We offer two versions of the eWORK Tool: eWORK Online and eWORK Excel. eWORK Online is for users who prefer quick, accessible, yet high-quality statistics on occupational exposures to various carcinogens. eWORK Excel uses a Microsoft Excel PowerPivot interface that allows users to search for – and visualize – exposures of interest.

 eWORK Online and eWORK Excel are available under the Resources tab of our website.

## Reducing exposures

CAREX Canada’s resources and estimates can be used to inform programs, policies, and practices related to carcinogen exposures. Identifying the priority exposure scenarios and substances for exposure reduction can help guide agenda- and priority-setting for cancer prevention.

As outlined by the **Canadian Centre for Occupational Health and Safety** (CCOHS), a variety of strategies can help protect workers from exposures to harmful substances such as carcinogens. These strategies are listed in order of effectiveness in controlling a risk.



**Elimination** is the most effective way to control a risk; it involves removing the hazard from the workplace. This process may also involve substitution. *An example of substitution is using lead-free paints and glazes instead of those that contain lead.*



**Engineering controls** minimize risk of exposure through strategic designs or modifications, which include process controls, enclosure/isolation of the source, and ventilation. *An example of a process control is using wet methods instead of dry when grinding or drilling to reduce dust.*



**Administrative controls** alter the way the work is done through rules or policies. *An example of an administrative control is shorter work times in areas where exposure may occur.*



**Personal protective equipment (PPE)** provides a barrier between the worker and the hazard. *Examples of PPE include respirators, eye protection, face shields, gloves, and footwear.*

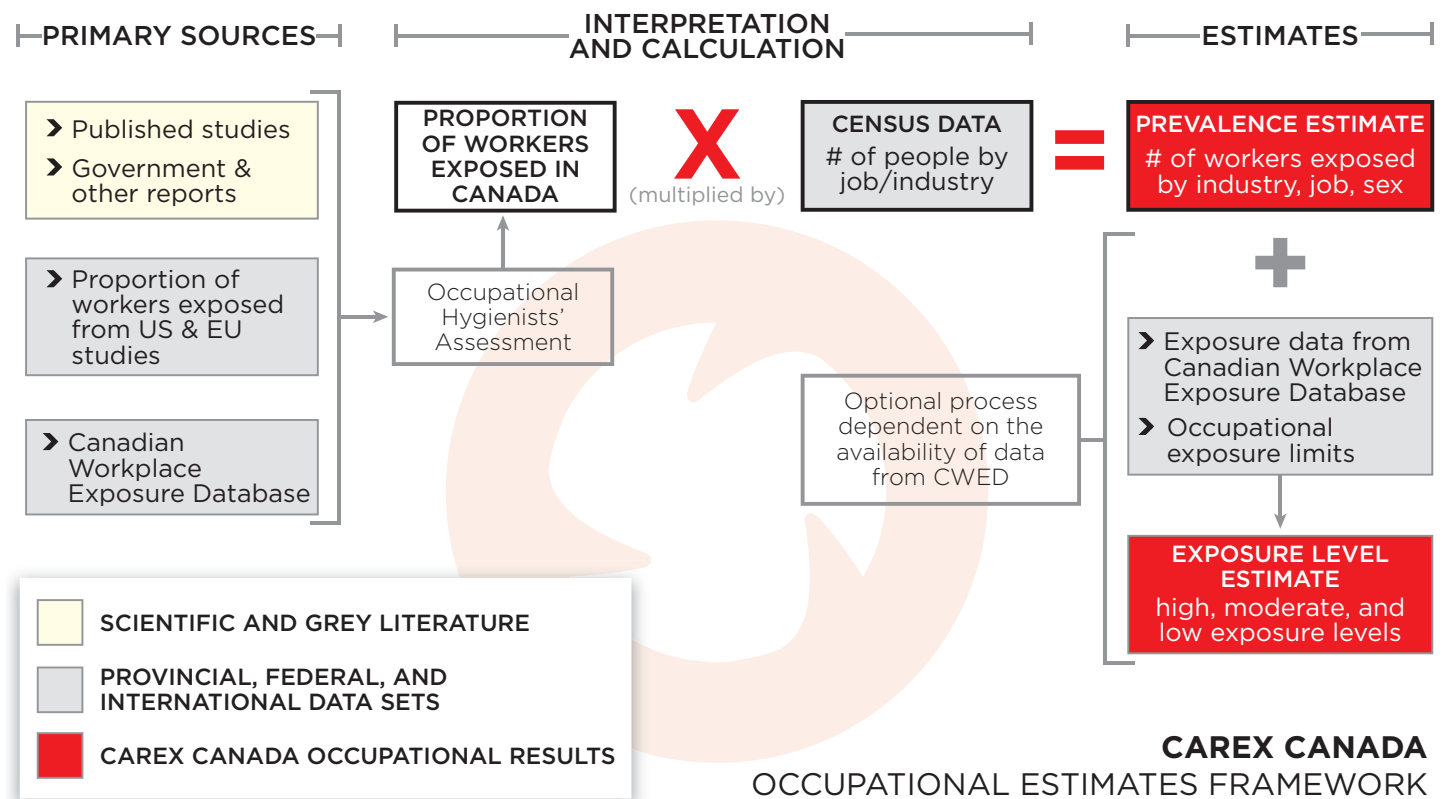
 A compilation of additional exposure reduction resources, including the Canadian Partnership Against Cancer’s Prevention Policies Directory and the Canadian Cancer Society’s Cancer Information portal, is available on our website.

# Methods

The goal of the CAREX Canada project is to estimate Canadians' potential exposures to known and suspected carcinogens in the workplace, prioritizing agents that are most relevant to Canadians. Estimates of the numbers of workers exposed to these agents are calculated by sector, occupation, province, sex, and level of exposure (where data are available). They are developed using information gathered in a scientific literature review, data included in the Canadian Workplace Exposure Database (CWED), information from previous CAREX projects in Europe, Canadian-specific information on exposure from government and other sources, and CAREX occupational hygienists' expert assessment. Most of our estimates use the 2016 Census of Population, with some exceptions noted in our documentation. CAREX Canada's general approach to producing occupational prevalence and exposure level estimates is summarized in Figure 2.

 More information on our methods and data is available under the Carcinogen Profiles tab on our website

**Figure 2.** CAREX Canada's occupational estimates framework



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## Relevant publications and reports

**IARC Monographs Volume 105: Diesel and Gasoline Engine Exhausts and Some Nitroarenes** | International Agency for Research on Cancer, 2013.

**IARC Monographs Volume 100C: A Review of Human Carcinogens: Arsenic, Metals, Fibres, and Dusts** | International Agency for Research on Cancer, 2012.

**IARC Monograph Volume 98: Painting, Firefighting, and Shiftwork** | International Agency for Research on Cancer, 2010.

**Prevalence and recent trends in exposure to night shift work in Canada** | Rydz E, Hall AL, Peters CE. Ann Work Expo Health 2020;64(3):270-281.

**CAREX Canada: An enhanced model for assessing occupational carcinogen exposure** | Peters CE, Ge CB, Hall AL, Davies HW, Demers PA. Occup Environ Med. 2015;72(1):64-71.




**Prevalence of exposure to solar ultraviolet radiation (UVR) on the job in Canada** | Peters CE, Nicol AM, Demers PA. Can J Public Health 2012;103(3):223-26.

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## Where can you learn more?

-  Visit our website at [www.carexcanada.ca](http://www.carexcanada.ca)
-  Follow us on Twitter [@CAREXCanada](https://twitter.com/CAREXCanada)
-  Email us at [info@carexcanada.ca](mailto:info@carexcanada.ca)

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