

Climate Change

The Impact on Workers

A Guide for Canadian Union of Public Employees Members in the BC Region

Tom McKenna, CUPE Health and Safety Representative (BC Region)
Summer 2022 – Update 1 – BC - Region 1 / Ecozone 1

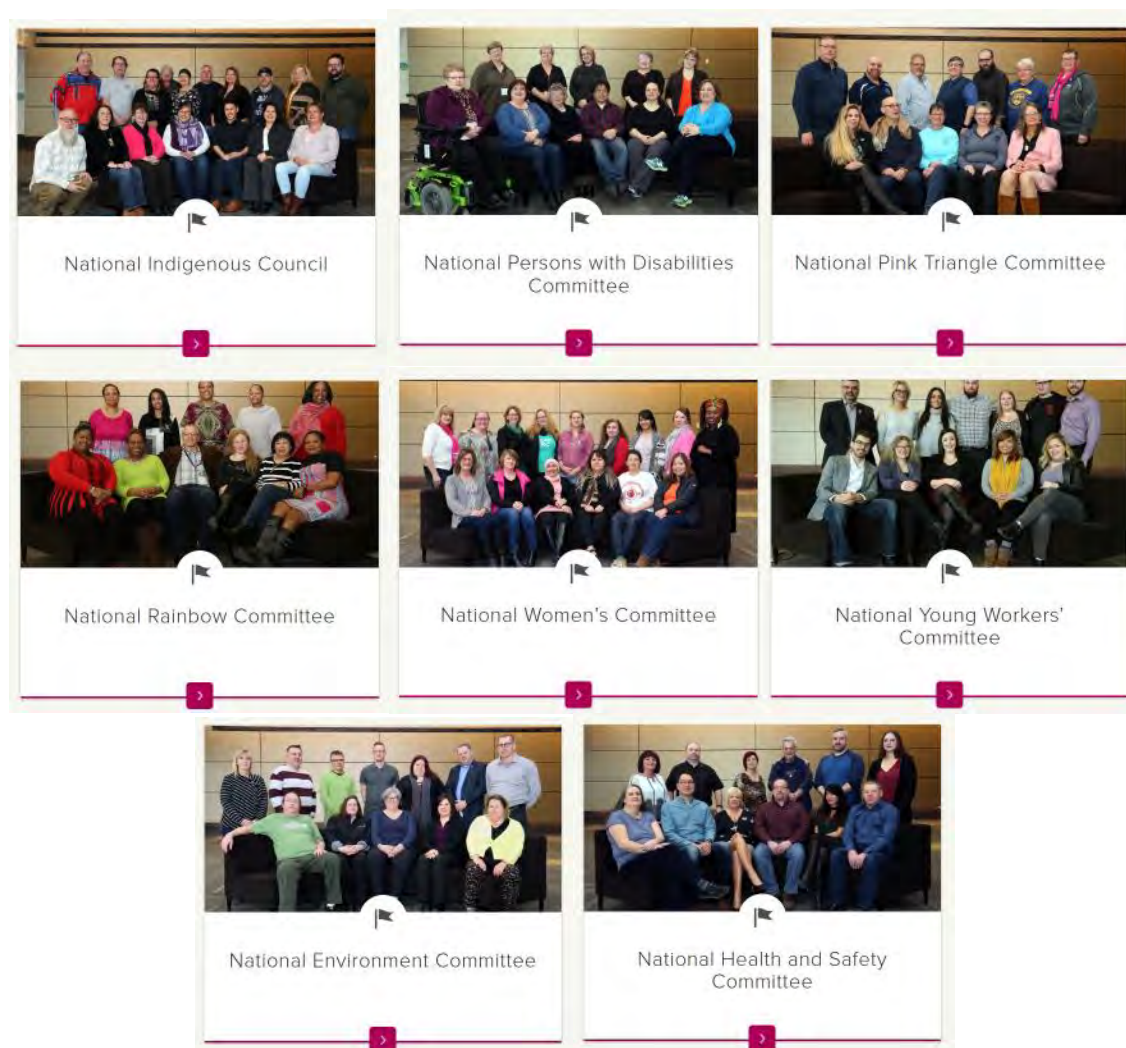


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Sample CUPE Committees 2022.

Preface

Workers are the *canaries in the coal mine of climate change*¹ as per Roelofs and Wegman (2014):

“Workers’ exposures are greater in frequency, duration, and intensity and, thus, represent the ‘sentinel cases’ that sound the alert to the larger society health effects.”

The federal government report Health of Canadians in a Changing Climate (2022) urges governments and organizations to act now:

“Growing climate change impacts worsen socio-economic conditions harmful to health, such as poverty, and amplify health inequities. Combined with increasing rates of chronic diseases, social isolation and an aging population, climate change augments impacts on health. People disproportionately affected by climate change include children; pregnant people; First Nations, Inuit, and Métis peoples; people with chronic illnesses; outdoor workers; low income individuals; and people with disabilities.”

“Health infrastructure, operations, health financing, health care, public health programming, supply chains, and the health workforce can be impacted by extreme weather events and by chronic stresses from longer-term warming, reducing access to and quality of care to Canadians. Health facilities and services in rural and remote areas, and health systems that have not assessed and managed risks, face the greatest threats. Compounding climate change hazards that can arise — for example, when extreme heat occurs with drought and a wildfire — pose severe risks to individuals and the health systems they rely on.”

Climate change is an important issue that affects most workers. This lay person Guide was requested by CUPE members attending the CUPE Convention 2019. CUPE members indicated a need for basic information and practical tools for CUPE workplaces.

¹ Roelofs, C. & Wegman, D. (2014). Workers: the Climate Canaries. Retrieved February 03, 2020 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4167120/>

CUPE is the first Union (or other organization) in North America to create a comprehensive document on the impacts of climate change and provide tools for workers in multiple occupations, sectors and in equity seeking groups.

This Guide is for the BC Region and is being expanded to the rest of Canada. A Guide for all regions / Ecozones will occur. BC was the first stage. The first version was February 2020.

I. The purpose of this Guide is to:

- Review a variety of hazards and risks in various sectors and sample occupations in provinces and territories e.g. BC (including an equity lens, as data availability allows).
- Provide information on what actions Employers, Locals and workers may need to consider in responding to the effects of climate change in the workplace. The focus must always be on prevention and hazard control, as opposed to building worker resiliency or worker adaptation. It should be premised on the Precautionary Principle. Resources and templates are interspersed within the Guide for illustration purposes.
- This Guide is not a scientific, medical, legal, lobbying, human rights or legislative resource. It is only a lay person, worker oriented, health and safety resource and should always be used from that perspective.
- This Guide should be used in conjunction with resources such as the annual Changing Climate: Regional Perspectives Report, Health of Canadians in a Changing Climate (2022) and Indigenous resources such as the BC First Nations Climate Strategy and Action Plan (April 2022).² There are many more.

² BC First Nations Climate Strategy and Action Plan. British Columbia Assembly of First Nations. Press Release. (April 22, 2022). Retrieved May 20, 2022 from <https://www.bcafn.ca/news/bc-first-nations-climate-strategy-and-action-plan-released-earth-day>

FIRST NATIONS LEADERSHIP COUNCIL

News Release

April 22, 2022

BC First Nations Climate Strategy and Action Plan Released on Earth Day

(Xwməθkwəy̓ əm (Musqueam), Skwx wú7mesh (Squamish) and səliwətał (Tsleil Waututh)/Vancouver, B.C. – April 22, 2022). The First Nations Leadership Council (FNLC) is pleased to announce the release of the [BC First Nations Climate Strategy and Action Plan](#) (the Strategy), timed to celebrate and honour Earth Day.

We are experiencing record-setting summer and winter temperatures, warming and rising oceans, droughts, wildfires, damaging storms, floods, and landslides, among other impacts. First Nations and our lands are disproportionately impacted. In recognition of the urgency and the need for immediate action, First Nations leadership in BC mandated the FNLC to develop a First Nations-led Climate Strategy and Action Plan.

"Humanity and Mother Earth are suffering the consequences of human behaviour. Our ancestral lands, communities, and cultural identity depend on immediate climate action," stated Regional Chief Terry Teegee of the BC Assembly of First Nations. "The response from the provincial and federal governments is inadequate and insufficient to address the climate emergency and time is running out for incremental or gradual transitions. We have surpassed the point of no return as the changes to the global climate system are resulting in unbearable emergencies; we cannot recover quickly enough. Governments are also failing to adequately engage and co-develop climate actions with First Nations across the province, so First Nations had to prepare our own climate strategy to fight the climate crisis."

The Strategy presents a vision, guiding principles, and priorities for climate action articulated by leadership and community members from across the province, and is grounded in a First Nations climate lens. The Strategy focuses on ensuring that First Nations' inherent title, rights and treaty rights are recognized and affirmed in climate change planning and response as an essential building block for climate action. Four priority pathways guide the Strategy: *Inherent Title and Rights; Capacity and Leadership; Land and Water Protection; and Climate Response and Preparedness.*

Grand Chief Stewart Phillip, President of the Union of BC Indian Chiefs stated, "Our very existence as Indigenous peoples and our connection to our lands and culture are under threat. Nothing short of transformative societal change can prevent the worst of what will happen to communities everywhere if governments around the world continue to enable the driving forces behind the climate crisis. The Strategy is unique because it represents a vision of a newly restored relationship to the Earth that privileges the health and stability of the lands and waters within our territories over the overexploitation of resources. Governments must recognize that this fight cannot be won without solving the inequities that we face daily."



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The images, figures, inserts
and font can all be enlarged
using the zoom function.

In its entirety, the Strategy contains 27 themes, 63 objectives, and 143 strategic actions, plus a series of recommendations for implementation. The Strategy is accompanied by an [Executive Summary](#) and [20 Urgent Calls for Climate Action](#) which draw on overlapping priority areas that are immediate concerns for First Nations across the province.

Chief Lydia Hwitsum of the First Nations Summit Political Executive added, "The Strategy showcases First Nations' priorities in climate planning. Our leadership is evident in many examples across the province, and the Strategy provides an opportunity for governments to ensure the protection and stability of the Earth for generations to come. The climate emergency requires our collaborative efforts including the full recognition of the inherent rights, title and jurisdiction of First Nations."

Earth Day is an opportunity to celebrate the connections and responsibilities that First Nations have to our lands, and to recognize that our leadership is essential to the collective efforts to pass on a livable world to our grandchildren. The FNLC calls on the provincial and federal governments to meaningfully uphold their commitments towards reconciliation and to support First Nations in their implementation efforts of the Strategy.

The First Nations Leadership Council is comprised of the political executives of the BC Assembly of First Nations (BCAFN), the First Nations Summit (FNS), and the Union of BC Indian Chiefs (UBCIC).

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**"Indigenous communities must no longer be viewed as just
'stakeholders' in discussions about mitigating the risks associated
with climate change"**

**"We are the most at risk during these catastrophic climate events"
(Terry Teegee, BC Assembly of First Nations Regional Chief)**

Vancouver Sun, May 11, 2022

2



CBC News. November 20, 2021. See

<https://newsinteractives.cbc.ca/longform/bc-flooding-2021-timeline-how-once-in-a-century-flooding-unfolded>

II. What information was used to create this Guide:

- This Guide focuses on the impact of climate change over the near term (to 2050) due to scientific uncertainty regarding the precise workers specific changes caused by climate change, the direct and indirect impacts of climate change on workers over the longer term, the regional impacts of climate change and the impact of climate change on equity seeking groups. Many of the longer term impacts of climate change on workers are still unknown. The information in this Guide is based on that.
- Over 783 sources of information were used in preparing the original version of this Guide in 2020 and the update in mid 2022, including Canadian, European, Australian and US resources and studies. Information changes weekly, so this is a working draft.

- The information is not exhaustive – there are potentially thousands of occupations in dozens of sectors that may be affected and the data changes weekly as the climate crisis worsens. Each occupation has its own unique variations from region to region as well. The categories of hazards and risks are expected to change over time. These Guides may be updated as time and resources permit.
- There are numerous references to other parts of Canada and the US (where there was a lack of data from Canadian sources or where there is applicable data) to compare and contrast the highly regional impacts of climate change on workers. Terminology may vary as a result, especially from an equity lens perspective.
- This Guide is accompanied by a short Bulletin summarizing key points and a Power Point for educational purposes. These should always be used in conjunction with the CUPE Constitution and resolutions of Convention.
- This Guide does not refer to federal legislation or regulations pertaining to occupational health and safety or workers compensation. It does not address social, cultural and economic impacts; this Guide looks at the impact on worker's health.
- **Due to a lack of Canadian data, only a limited equality and equity lens was able to be applied to the information in this Guide.** See Gender Equity and Inclusion, page 23, of the BC First Nations Climate Strategy and Action Plan (April 2022), for example (there are additional sections).³
- Terms and definitions may vary according to the data being referred to. For equity seeking groups, the terminology used was from the CUPE BC, CUPE, Human Rights Tribunals and resources documents from which data was extracted. Terminology changes over time and that will need to be reflected in this draft working Guide and other related documents.

³ Retrieved May 20, 2022. See <https://www.bcafn.ca/sites/default/files/2022-04/BCFNCSAP%20Final%20Draft%20%2822April2022%29.pdf>

British Columbia

595 people were killed by heat in B.C. this summer, new figures from coroner show



More than 231 died on June 29 alone, during 'heat dome' that caused record temperatures, data says

Rhianna Schmunk · CBC News · Posted: Nov 01, 2021 9:17 AM PT | Last Updated: November 1, 2021



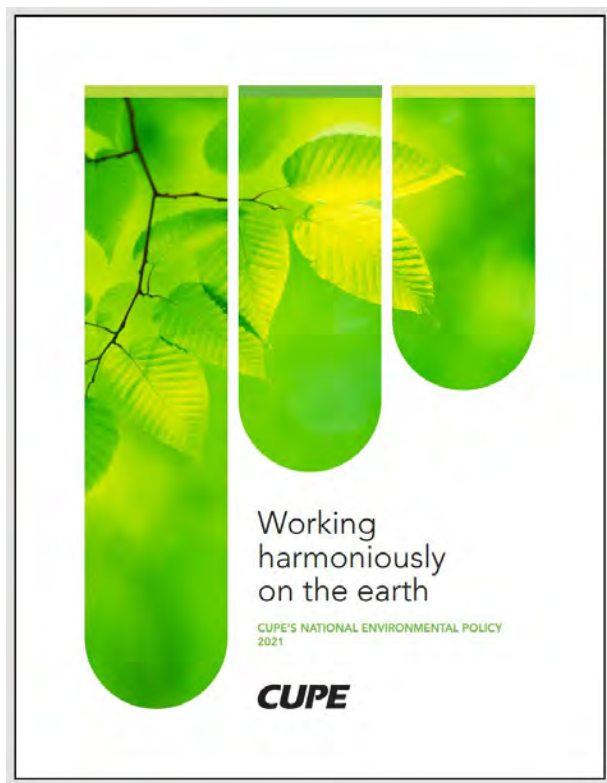
A woman hands out bottled water to residents in the Downtown Eastside neighbourhood of Vancouver on June 28 during the 'heat dome' that led to record-breaking temperatures across B.C. (Ben Nelms/CBC)

CBC News British Columbia. 595 people were killed by heat in BC in 2021. See <https://www.cbc.ca/news/canada/british-columbia/bc-heat-dome-sudden-deaths-revised-2021-1.6232758>. Extreme heat increases deaths in Canadian cities by 2% to 13%.⁴

⁴ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

III. Who should use this Guide and how should they use it:

- **Locals, Joint Health and Safety Committees and workers can use this Guide. The Guide should be seen as a mechanism for creating best practices for addressing the impact of climate change on workers and to empower workers. Please refer to the CUPE Constitution and the CUPE Health and Safety website as well.**
- **This Guide is divided into variety of hazards e.g. heat and solar radiation, the impacts of hazards, actions to take (such as hazard and risk assessments) and resources.**
- **The Guide summarizes information pertaining to climate related hazards for each Ecozone (BC is Ecozone 1) and workers and occupations in that Ecozone.**
- **Templates, illustrations, resources, studies, media information and resource links are interspersed throughout the Guide to aid in explaining the material in the Guide. Inserts, images and figures can be expanded as can the font using the zoom icon.**
- **The Guide contains the relevant health and safety legislation and regulations (BC Region only), templates e.g. hazard assessments and resource links.**
- **There are numerous issues and concerns that have not been fully addressed such as the impact of climate change on equity seeking groups due to a lack of data. This Guide should be used to raise questions and awareness on what needs to occur to protect workers in equity seeking groups. This Guide is the starting point only.**
- **This Guide should always be considered a draft working document.**
- **The Precautionary Principle – not waiting for scientific certainty before taking action to protect workers – is the foundation for health and safety. This should be the foundation for protecting workers from the impacts of climate change, whether the impacts are direct or indirect, short term or long term, slow or sudden, additive, etc.**



CUPE has a number of resources on climate change. Check the CUPE National Health and Safety website at <https://cupe.ca/health-and-safety>

Notes:

1. References are included as footnotes as opposed to formal American Psychological Association format.⁵ This is a lay person Guide as opposed to a formal research paper.
2. Figures and illustrations are not numbered or indexed. They are largely for supplemental information purposes only.
3. Certain terms such as “fire fighters” are not capitalized as per the IAFF and other websites.
4. Various occupation terms such as “Paramedics” are capitalized as per the wording of Local websites e.g. CUPE 873. Studies used in this Guide have used mixed terminology and capitalization. The term “Paramedics” in BC includes Emergency Dispatchers as well. Emergency Dispatchers may be abbreviated as per the studies referred to in this Guide. “EMS” and “Emergency Medical Services” may also be used as per the studies.
5. Terminology for sectors and occupations varies widely from province to province and even within a province.
6. Terminology for equity seeking groups for issues pertaining to equality vary widely.
7. The formatting of this document will change in various electronic versions e.g. converting to Word or PDF versions.

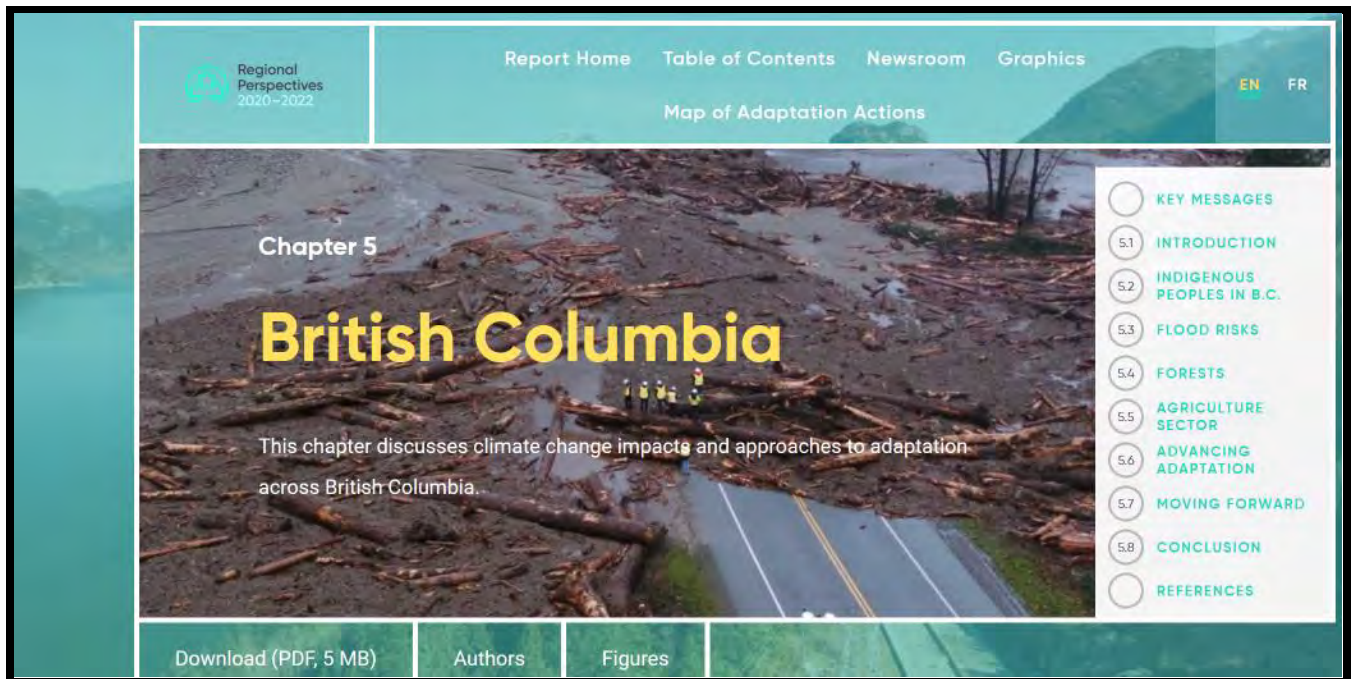
⁵ American Psychological Association. See <https://apastyle.apa.org/products/publication-manual-7th-edition/>

Occupational Health & Safety Manual



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Example of an occupational health and safety manual (for illustration purposes. This Guide does not address the manual's content and compliance with health and safety legislation).



Regional Perspectives 2020-2022. Chapter 5. British Columbia. Retrieved May 20, 2022, from <https://changingclimate.ca/regional-perspectives/chapter/5-0/>



Tornadoes in Victoria (2020) and Vancouver (2021).

I. Introduction:



I.I. Climate Change – Is this a “Real” Problem:⁶

Workers have been referred to as the canaries in the coal mine of climate change impacts. Climate change is considered a “threat multiplier”. The hazards⁷ (including exposures) and risks (chance of a hazard occurring) associated with climate change have become more pronounced each year with an overall 30% increase in rain in winter and 50% reduction in rain in summer, for example. In many parts of Canada, there has been an increase in precipitation and a shift toward less snowfall and more rainfall.⁸ Climate models project that temperatures across Canada will continue to increase, with the largest warming occurring in the winter.⁹

⁶ (No author). (2017). Science Narrative. Climate Change Impacts the Health of Canadians. Health Canada Poll. Retrieved February 03, 2020 from http://publications.gc.ca/collections/collection_2017/aspc-phac/HP5-122-2017-eng.pdf

⁷ Government of Canada. "Hazard" is the actual or potential harm that something can cause. The harm may be adverse effects, physical injury, damage to health, property and/or the environment. Hazard is an intrinsic or "built-in" characteristic. "Risk" is the likelihood of the occurrence of that hazard (harm) and the severity of the harm, including but not limited to harm to people, property or the environment. Exposure is the extent to which people or objects are subjected to the hazard. Usually risk is calculated by multiplying the hazard (both the nature and seriousness of the hazard) by the exposure period. See <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/occupational-health--safety/whmis-quick-facts-risk-versus-hazard-health-canada-2008.html>

⁸ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

⁹ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

The impacts of climate change on workers are happening now – these are not speculative health and safety issues. They affect nearly all workers, including equity seeking groups. Indigenous peoples have thousands of years of knowledge regarding the changing climate of BC (and Canada).¹⁰ Canadians are concerned about climate change impacts on health. In 2017, 93% of Canadians who accept the reality of climate change indicated that it is either a health risk now (53%), or will be in the future (40%) and over half (55%) felt personally vulnerable to its impacts (EnviroNics, 2017).¹¹ A few examples of these effects on workers in BC (as an example as this series of Guides began in Ecozone / Region 1), beyond seasonal and natural variability, include:¹²

- More extreme heat
- Longer durations of heat events
- Droughts
- Less extreme cold in some areas and record cold temperatures in others
- Shorter snow and ice cover seasons
- Snow at unusual times of the year
- Earlier spring peak streamflow
- Flooding
- Thinning glaciers
- Thawing permafrost
- Extreme winds including frequency of windstorms
- Severe storms and frequency of storms

In May 2022, it was estimated that the cost of hardening communities in BC would be more than 13 billion dollars.¹³ The exposures and health outcomes are significant as per the next figure (The Impacts of Climate Change on Human Health in the United States).

¹⁰ Regional Perspectives. (2022-2022). Chapter 5. British Columbia. Section 5.2. Indigenous Peoples in B.C. are experiencing and adapting to climate change. Retrieved May 20-21, 2022 from <https://changingclimate.ca/regional-perspectives/chapter/5-0/>

¹¹ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

¹² Changes in sea ice, lake ice, river ice, sea levels and permafrost are not addressed in the BC Ecozone

¹³ Vancouver Sun. (May 15, 2022). Retrieved June 04, 2022 from <https://vancouversun.com/news/local-news/bc-ottawa-not-shifting-from-disaster-response-to-prevention>

	Climate Driver	Exposure	Health Outcome	Impact
 Extreme Heat	More frequent, severe, prolonged heat events	Elevated temperatures	Heat-related death and illness	Rising temperatures will lead to an increase in heat-related deaths and illnesses.
 Outdoor Air Quality	Increasing temperatures and changing precipitation patterns	Worsened air quality (ozone, particulate matter, and higher pollen counts)	Premature death, acute and chronic cardiovascular and respiratory illnesses	Rising temperatures and wildfires and decreasing precipitation will lead to increases in ozone and particulate matter, elevating the risks of cardiovascular and respiratory illnesses and death.
 Flooding	Rising sea level and more frequent or intense extreme precipitation, hurricanes, and storm surge events	Contaminated water, debris, and disruptions to essential infrastructure	Drowning, injuries, mental health consequences, gastrointestinal and other illness	Increased coastal and inland flooding exposes populations to a range of negative health impacts before, during, and after events.
 Vector-Borne Infection (Lyme Disease)	Changes in temperature extremes and seasonal weather patterns	Earlier and geographically expanded tick activity	Lyme disease	Ticks will show earlier seasonal activity and a generally northward range expansion, increasing risk of human exposure to Lyme disease-causing bacteria.
 Water-Related Infection (<i>Vibrio vulnificus</i>)	Rising sea surface temperature, changes in precipitation and runoff affecting coastal salinity	Recreational water or shellfish contaminated with <i>Vibrio vulnificus</i>	<i>Vibrio vulnificus</i> induced diarrhea & intestinal illness, wound and blood-stream infections, death	Increases in water temperatures will alter timing and location of <i>Vibrio vulnificus</i> growth, increasing exposure and risk of water-borne illness.
 Food-Related Infection (<i>Salmonella</i>)	Increases in temperature, humidity, and season length	Increased growth of pathogens, seasonal shifts in incidence of <i>Salmonella</i> exposure	<i>Salmonella</i> infection, gastrointestinal outbreaks	Rising temperatures increase <i>Salmonella</i> prevalence in food; longer seasons and warming winters increase risk of exposure and infection.
 Mental Health and Well-Being	Climate change impacts, especially extreme weather	Level of exposure to traumatic events, like disasters	Distress, grief, behavioral health disorders, social impacts, resilience	Changes in exposure to climate- or weather-related disasters cause or exacerbate stress and mental health consequences, with greater risk for certain populations.

Report: The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.¹⁴ See

<https://data.globalchange.gov/report/usgcrp-climate-human-health-assessment-2016>

¹⁴ Report. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. (2016). U.S. Global Change Research Program. Retrieved June 06, 2022 from <https://data.globalchange.gov/report/usgcrp-climate-human-health-assessment-2016>

The changes can be a slow impact (droughts) or sudden impact (hurricanes). There are examples of climate change as per the Government of Canada “Canada’s Changing Climate Report”:¹⁵

“Extreme hot temperatures will become more frequent and more intense. This will increase the severity of heatwaves and contribute to increased drought and wildfire risks. While inland flooding results from multiple factors, more intense rainfalls will increase urban flood risks.”

“The changing frequency of temperature and precipitation extremes can be expected to lead to a change in the likelihood of events such as wildfires, droughts, and floods.”

There are at least 48 studies on the occupational hazards and risks posed by climate change. Almost all the studies only thoroughly address a narrow range of hazards and risks or they topically address many,¹⁶ do not specifically address CUPE members and do not address all sectors or all occupations. Most studies also do not provide practical tools for workers.

Climate change is not only increasing the prevalence and severity of known occupational hazards and risks but is also causing the emergence of new ones. There are dozens of examples of increased hazards and risks across multiple sectors and hundreds of occupations. Sectors that may be particularly vulnerable to threats from climate change include municipal workers, emergency responders, health care, fire fighters, certain areas of indoor work, transportation and utilities. There are numerous others.

For equity seeking groups and workers in precarious employment, the effects of climate change may be more severe due to increased risk factors such as insufficient or lack of worker orientations, lack of personal protective equipment, lack of procedures, lack of knowledge of health and safety rights, lack of entitlements under Collective Agreements, etc.

¹⁵ Government of Canada. Canada’s Changing Climate Report. (CCCR 2019). Retrieved from https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR_FULLREPORT-EN-FINAL.pdf

¹⁶ Applebaum, K.M., Graham, J., Gray, G.M., LaPuma, P., McCormick, S.A., Northcross, A., & Perry, M.J. (2016). An Overview of Occupational Risks from Climate Change. *Current Environment Health Reports*. 2016, March 3(1). Retrieved February 10, 2020 from <https://www.ncbi.nlm.nih.gov/pubmed/26842343>

With growing precarity of work, the impacts of climate change are even more severe. The BC Federation of Labour (“BCFed”) has stated that climate change is a defining problem:¹⁷

“The two defining problems of our time are climate change and inequality, BC FED President Irene Lanzinger told a crowd”

The studies appear to indicate that workers in BC may be most affected by temperature (heat), air quality and pathogens. For example, for workers in BC, the intergovernmental Panel on Climate Change (“IPCC”) stated that with current climate change trends, high temperatures and humidity would probably compromise outdoor worker safety.¹⁸ While these may be the primary impacts on workers, all potential impacts need to be assessed.

When looking at the potential hazards, it is recommended that a biopsychosocial approach be used.¹⁹ This model is based on multiple overlapping areas including biological, psychological, social, environment, etc. A sample is contained on the next page. There are many different versions of this. The models and approaches used should be adapted to the workplace being assessed.

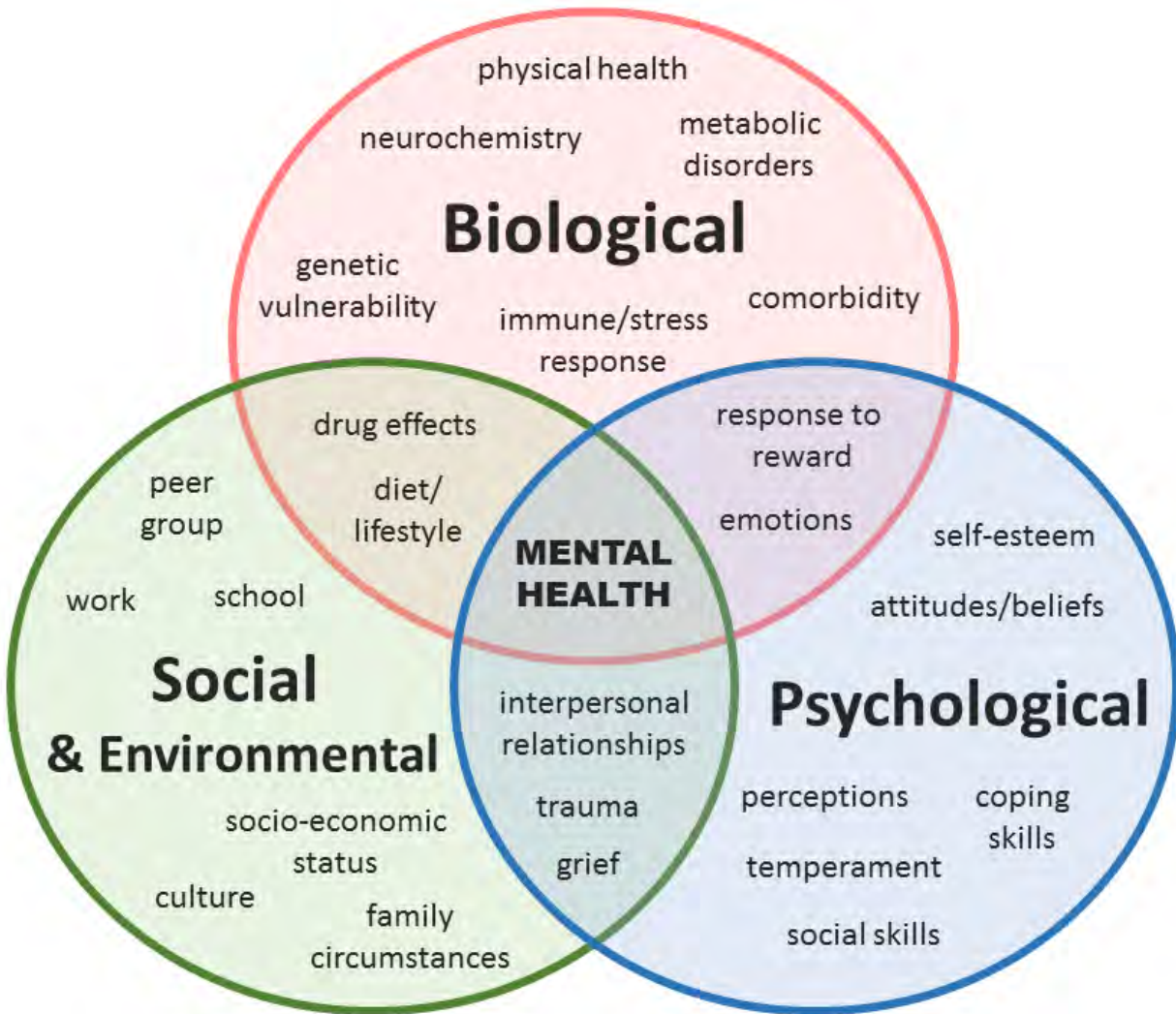
Most workers cannot be grouped into one category of risk. Many workers may be from equity seeking groups and may be in precarious employment. As an example, there may be a new, young worker who is from multiple equity seeking groups (e.g. persons with disabilities and racialized persons) and is also an auxiliary worker (worker in precarious employment). Hazard and risk assessments must consider these types of scenarios. Almost none of the studies and resources to date have addressed this.

This Guide does not address trauma informed approaches or practices.

¹⁷ Sherlock, T. (April 6, 2018). BC Fed President Irene Lanzinger calls climate change and inequality ‘defining problems of our time’. *Canada’s National Observer*. Retrieved October 29, 2019 from <https://www.nationalobserver.com/2018/04/06/news/labour-leaders-explore-solutions-climate-change-wont-impoverish-workers>

¹⁸ Moda, H., Filho, W.L., & Minhas, A. (2019). Impacts of Climate Change on Outdoor Workers and Their Safety: Some Research Priorities. *International Journal of Environmental Research and Public Health*. 2019 September 16. Retrieved February 24, 2020 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6765781/>

¹⁹ OpenLearn. Retrieved May 20, 2022 from https://www.open.edu/openlearn/mod/oucontent/view.php?id=77496&extra=thumbnailfigure_idm109



Sample biopsychosocial model diagram.

Note: The impacts of climate change on workers are based on a very complex system linked to ecology, epidemiology, climate change, changes in land use, gaps in surveillance and gaps in data. This affects modelling. Climate change needs to become a priority to address these.



Milken Institute of Public Health. (2017). The George Washington University. Hazard Zone: The Impact of Climate Change on Occupational Health.²⁰

²⁰ Milken Institute of Public Health. (2017). The George Washington University. Hazard Zone: The Impact of Climate Change on Occupational Health. Retrieved February 16, 2020 from <https://publichealthonline.gwu.edu/blog/impact-of-climate-change-on-occupational-health/>



I.II. Myths about the Impact of Climate Change on Workers (this Guide does not address the origins of climate change, the impact of human activities on climate change or government policy. The focus of this Guide is the health and safety of workers):

The presence of an impact of climate change is not a myth. There are a number of misconceptions and misunderstandings about the present threat of climate change to workers. These include the following:

- The effects of climate change will not be felt for decades or are slow to occur
- Climate change affects other places, not Canada, and “it will not affect me”
- Climate change is something that is vague and non-specific
- There is nothing we can do about the impact of climate change on workers or on the workplace – we can only adapt and become more resilient
- The chance of climate change related hazards and risks are low
- Very few workers and / or workplaces will be affected by climate change



CUPE. Climate change is a health and safety issue. November 29, 2019.

Here are a few examples of what is known (which is changing all the time):

- The effects of climate change will not be felt for decades

Climate change is being felt in Canada in terms of droughts, more precipitation, increased temperature extremes, increased duration of temperature extremes, increased forest fires, increased range and prevalence of pathogens and the vectors that carry them, increased pollen counts, etc. As per the City of Vancouver:²¹

“In the 2050s, our region will have twice as many summer days above 25°C compared to today. With hotter, drier summers and decreasing snowpack on local mountains, water conservation will become increasingly important.”

²¹ City of Vancouver. Climate Change Adaptation Strategy. Retrieved February 13, 2020 from <https://vancouver.ca/green-vancouver/temperature-climate.aspx>

- Climate change affects other places, not Canada

Climate change is affecting every province and territory in Canada, with some areas and cities seeing more pronounced effects than others. For example, more severe winter weather in the Maritimes as opposed to wetter and warmer winters in BC with increased flooding. Diseases that used to be thought of as “tropical diseases”.

- Climate change is something that is vague and non-specific

Climate change is having very specific measurable effects. This includes increased average ambient air temperatures in summer, increased ranges of ticks carrying Lyme disease, increased flooding in the spring in BC, increased duration and severity of droughts in summer in BC and increased forest fires and poor air quality in BC.

- There is nothing we can do about the impact of climate change on workers

The effects of climate change on workers and on the workplace can be mitigated. Examples include the use of personal protective equipment during periods of poor air quality, snow tires on municipal vehicles during the winter and inoculations and testing for workers exposed to diseases. There are hundreds of examples.

- The chance of a climate change related hazard or risk occurring is low

Climate change hazards and risks are now occurring during every season of the year in all areas of Canada. Air quality has become a major issue in BC during the frequent, prolonged forest fire “seasons”. The number of heat advisory days could be 60 days per year in Ontario by the end of the century. In Chicago, an eight hour drive from Toronto, there may be 60 days over 100 degrees Fahrenheit by the end of this century.

- Few workers and workplaces will be affected by climate change

Most workers will be affected in some way. Workers who have a pre-existing respiratory condition such as asthma or a cardiovascular condition e.g. heart disease will be affected by decreases in air quality related to forest fires, ground level ozone, etc. Workers who spend the majority of their day outside in the summer will see prolonged temperature increases above 29 degrees Celsius and exposure to UV radiation.²²

The perception, understanding and opinions of climate change may vary among demographic groups. When discussing the occupational health and safety impacts of climate change consider the audience – who are you speaking to and why. Remember that mitigation and adaptation are never the primary hazard and risk control mechanisms.

A pervasive myth is that climate change has to be uniformly occurring all over Canada or the planet to prove it is actually occurring. Climate change is highly regional. In February 2019 a very powerful windstorm struck Horseshoe Bay, BC.²³ Several kilometers away in English Bay, there was only a slight breeze. While there is no evidence that the storm was a direct consequence of climate change, it is an example of the highly regional nature of weather. Heat domes, tornadoes and other extreme weather events are examples.

²² Healthline. Hot and Cold: Extreme Temperature Safety. Retrieved February 13, 2020 from <https://www.healthline.com/health/extreme-temperature-safety>

²³ Bennett, J. (February 02, 2019). Windstorm wreaks havoc at Horseshoe Bay. *Global News*. Retrieved February 13, 2020 from <https://globalnews.ca/video/4944924/windstorm-wreaks-havoc-at-horseshoe-bay>



As per Global News (2019):

“A powerful winter windstorm caused chaos at Horseshoe Bay on Saturday, forcing the cancellation of ferries and causing damage to a local marina.”

Workers in construction, forestry, transportation, utility maintenance, municipal workers, firefighting and other emergency services are usually among the first to experience the effects of climate change and are more impacted by it. As per Moda et al. (2019), these impacts are exacerbated by the need to wear protective clothing, which can lead to heat stress.²⁴ This is an example of an indirect, additive effect of climate change that may occur on a regional basis.

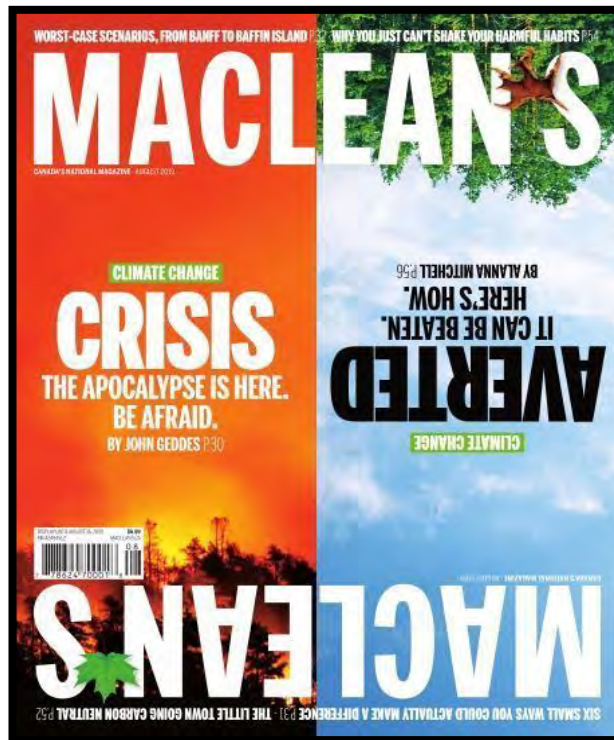
²⁴ Moda, H., Filho, W.L., & Minhas, A. (2019). Impacts of Climate Change on Outdoor Workers and Their Safety: Some Research Priorities. *International Journal of Environmental Research and Public Health*. 2019 September 16. Retrieved February 24, 2020 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6765781/>

What climate change is – these have already occurred in BC:





It is important to clarify what is an effect of climate change as opposed to natural phenomena. Some studies show Millennials as being more concerned about climate change²⁵ but they may be less likely to discuss climate change with family and friends.²⁶ Studies show that younger generations do not perceive the impacts of climate change differently or have differing levels of support than other generations.²⁷ Health and safety is a multi-generational issue, regardless of cause.



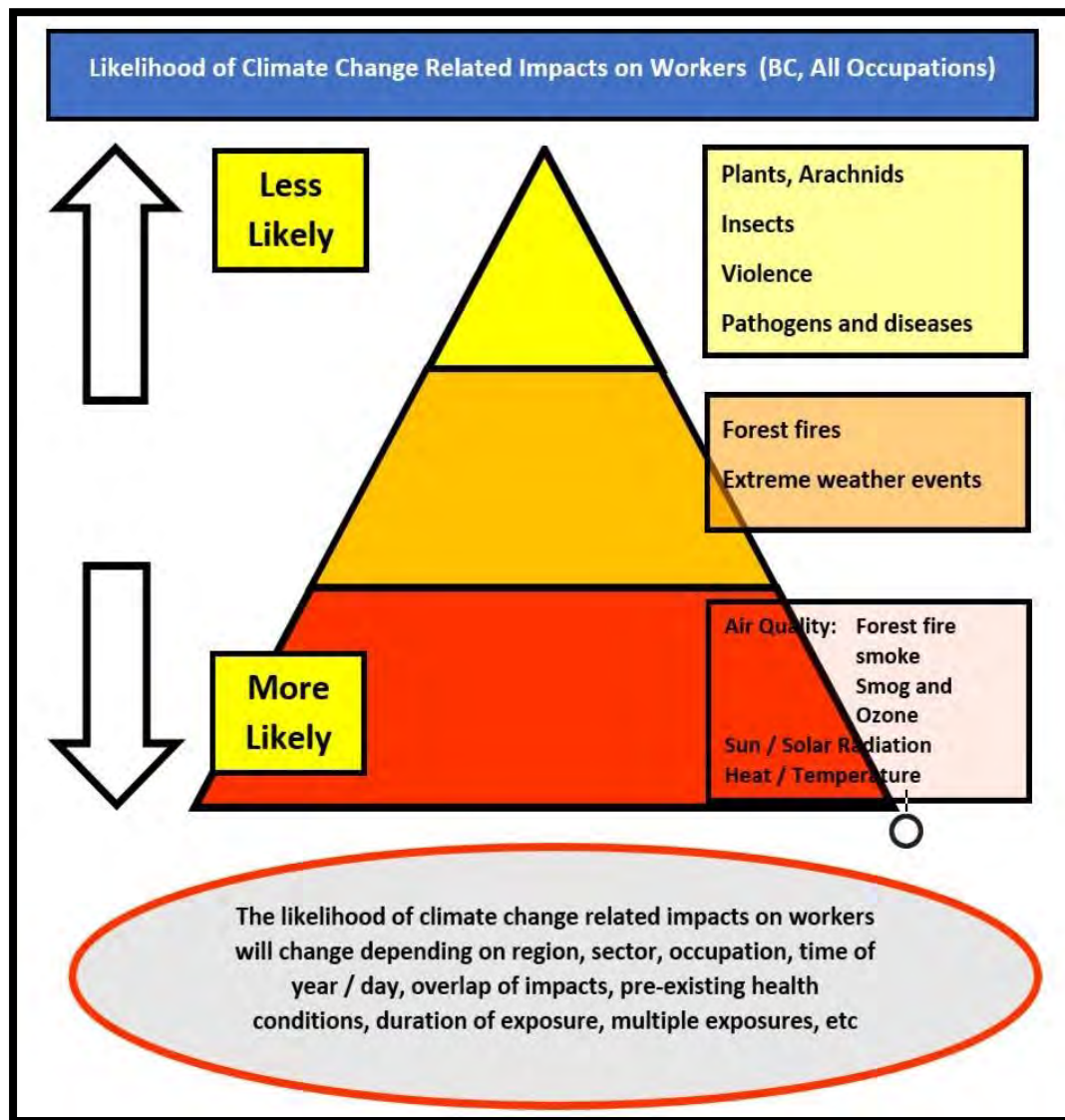
MacLean's Magazine. Climate Change Crisis.
The Apocalypse is Here. Be Afraid.
Climate Change Averted. It Can Be Beaten. Here's How.

²⁵ O'Keefe, K.T.V. (2019). The Impact of Younger Generations on Climate-Change Discourse. *ACS Publications*. Retrieved February 24, 2020 from <https://pubs.acs.org/doi/pdf/10.1021/bk-2019-1313.ch011>

²⁶ (No author). (2018). Do Millennials See Climate Change as More Than Just a Meme? *Johns Hopkins Sheridan Libraries*. Retrieved February 24, 2020 from <https://scholarship.library.jhu.edu/handle/1774.2/59878>

²⁷ Gray, S., Raimi, K.T., Wilson, R., & Arvai, J. (2019). *Journal of Environmental Management*. Volume 242. Retrieved February 24, 2020 from <https://www.sciencedirect.com/science/article/pii/S0301479719305389>

The hazards and risks caused by climate change will vary considerably, depending on hundreds of variables. The following simplified chart was created to illustrate generalized potential impacts on CUPE members (all sectors, all occupations, Canada). If this chart was adapted to other provinces or to the year 2030 it might look very different.





I.III. Direct and Indirect Effects of Climate Change:

Climate change has the potential to both directly and indirectly affect worker health. The most likely climate change related health threats in BC include exposure to heat, UV radiation, poor air quality, pathogens / infectious diseases, weather extremes and forest fires. While outdoor workers (such as in construction), workers in transportation, municipalities, Paramedics and firefighting are often among the first to be affected by climate change, there are countless other occupations that may be affected. Most studies have focused on several hazards and risks – either topically or exhaustively for a limited number of occupations or sectors.²⁸ This needs to be expanded to address the current and future hazards and risks facing CUPE members that also include both direct and indirect effects of climate change (including threat multipliers and additive effects).

²⁸ Schulte, P.A., Bhattacharya, A., Butler, C.R., Chun, H.K., Jacklitsch, B., & Jacobs, T. (2016). Advancing the framework for considering the effects of climate change on worker safety and health. *Journal of Occupational and Environmental Hygiene*. Volume 12, 2016, Issue 11. Retrieved February 12, 2020 from <https://oeh.tandfonline.com/doi/full/10.1080/15459624.2016.1179388#.XkSk8GhKjFg>

There is no definition for “direct” and “indirect” climate change effects because the terms will change depending on innumerable variables. This Guide attempts to provide tools to address direct and indirect impacts on workers across a wide spectrum of hazards and risks in Section III of this Guide. This contrasts to the following approach from the Milken Institute of Public Health.

As per Milken Institute of Public Health direct hazards and risks include the following:²⁹

“Heat

Climate change related heat increases pose risks to outdoor and indoor workers across a range of industries, from factory workers to those cleaning up oil spills. Higher heat levels leave workers vulnerable to illnesses like heat stroke and heat exhaustion.

Ozone

Rising temperatures cause higher concentrations of ground-level ozone and other pollutants. Chronic exposure to ozone is associated with serious respiratory issues, such as lung damage, pneumonia and chronic obstructive pulmonary disease (COPD).

Pathogens and Vector-Borne Diseases

Extreme rain events caused by climate change can create ideal breeding conditions for certain pathogens. People who work closely with the natural environment will be at an increased risk of exposure to vector-borne diseases like Lyme disease and West Nile Virus.

²⁹ Milken Institute of Public Health. (2017). The George Washington University. Hazard Zone: The Impact of Climate Change on Occupational Health. Retrieved February 16, 2020 from <https://publichealthonline.gwu.edu/blog/impact-of-climate-change-on-occupational-health/>

Polycyclic Aromatic Hydrocarbons

Exposure to PAHs — chemicals that are released from burning things like coal, oil, gasoline, trash and wood — is common for those working in coal and oil industries. It is linked to serious conditions such as lung, liver and skin cancers.

Workplace Violence

Multiple studies have found a link between heat and crime. Heat has been tied to a higher likelihood that police officers will deploy deadly force and that people will exhibit.

Extreme Weather

As wind patterns, temperature and levels of moisture change, more frequent and intense weather events and natural disasters occur. Workers responsible for rescue and cleanup efforts are exposed to conditions that can lead to traumatic injury.”

When considering the impact of climate change on workers (both direct and indirect effects), immediate and long term hazards and risks need to be assessed. Direct and indirect effects of climate change include the following (also see Section II Extent of the Problem):

I.III.I. Direct Effects

- Increased ambient air temperatures e.g. heat stress, heat exhaustion, heat stroke
- Decreased air temperatures e.g. frost bite, hypothermia
- Air pollution including smoke, ozone, smog, volatile organic compounds
- Ultraviolet radiation / solar exposure e.g. skin cancer, sun burns, sun stroke
- Extreme weather events
- Wind, including wind chill (which overlaps with air temperatures and extreme weather)

- Precipitation leading to flooding
- Landslides
- Avalanches
- Turbulence when working on commercial aircraft
- Diseases e.g. Zika, West-Nile virus and other mosquito borne diseases; tick borne diseases such as Lyme disease
- Increased mould and micro-organisms in HVAC systems due to changes in temperature and humidity e.g. *Aspergillus*
- Types of vectors, concentrations of vectors and expanded vector ranges
- Electrical hazards e.g. due to increased storms
- Being struck by objects e.g. debris from increased storms
- Insects e.g. mosquitos, ticks, Asian hornets, yellow jacket wasps, fire ants
- Arachnids e.g. hobo spider, black widow spider, etc.
- Wildlife encounters e.g. bears due to changing vegetation growth patterns and ranges
- New types of poisonous plants e.g. hogweed and expanded ranges or numbers of noxious plants e.g. poison ivy and poison oak
- Allergic reactions due to pollen from changing flowering periods

I.III.II. Indirect Effects:

Indirect effects can take many forms. When considering both direct and indirect threats posed by climate change, the concept of threat multiplier³⁰ needs to be applied. The indirect effects are also more likely to be additive in their effect (especially over longer periods of time) as per the following example:

“The most exposed workers are essentially those working in industries where the jobs are performed outside and require intense physical activities during the summer months, or those working at high indoor temperatures or who experience increased body heat due to the nature of their tasks [for a review, see 28]. The fact of wearing protective equipment can also aggravate the effect of heat on certain groups of workers.”³¹

The following is a non-exhaustive list of indirect effects:

- Changing work patterns such as shift work to adapt to temperature extremes
- Equipment aggravating heat conditions e.g. generating heat, etc.
- Injuries from equipment e.g. increased risk of errors, unsafe safe handling and operation of machinery (this can be both direct and indirect)
- Lack of climate controlled workplaces (direct or indirect e.g. power grid failures resulting in lack of climate control)
- Malfunctioning climate controlled workplaces leading to respiratory illnesses
- Effects of climate change on the public e.g. increase on social services with more members of the public being affected by cold, heat, disease or increased violence

³⁰ The exacerbation of existing hazards and risks. This includes direct and indirect hazards and risks

³¹ The Institut de recherche Robert-Sauvé en santé et en sécurité du travail (“IRSST”). See

<https://www.irsst.qc.ca/media/documents/PubIRSST/R-775.pdf>

- Damage to infrastructure and resulting hazards to workers (both direct and indirect)
- Chemicals and pathogens in flood waters e.g. fecal coliform counts (this can be both direct and indirect)
- Chemical spills due to floods and fire (this can be both direct and indirect)
- Pesticide use to control increased or new types of insects and pathogens
- Vehicular accidents caused by weather (this can be both direct and indirect)
- Additional toxicant exposure through inhalation and skin contact (this can be both direct and indirect)
- Increases in sweat and skin blood flow can lead to more efficient transcutaneous absorption of toxicants at high temperatures
- Accelerated dispersion of pesticides and increase the density of airborne particles³²
- Violence / aggression (including domestic violence) related to increases in heat
- Violence related to climate action protests, vandalism, assaults, etc.

Health outcomes related to climate change (such as impacts on mental health), remain difficult to model because of complex and dynamic drivers or data limitations. There are significant knowledge gaps about climate change impacts on health and vulnerabilities.

The table below (see next three pages) outlines some of the direct and indirect effects of climate change:³³

³² Schulte, P.A., Bhattacharya, A., Butler, C.R., Chun, H.K., Jacklitsch, B., & Jacobs, T. (2016). Advancing the framework for considering the effects of climate change on worker safety and health. *Journal of Occupational and Environmental Hygiene*. Volume 12, 2016, Issue 11. Retrieved February 12, 2020 from <https://oeh.tandfonline.com/doi/full/10.1080/15459624.2016.1179388#.XkSk8GhKjFg>

³³ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

Overview of Climate Change Impacts of Natural Hazards on Health

HEALTH IMPACT OR HAZARD CATEGORY	CLIMATE-RELATED CAUSES	POSSIBLE HEALTH EFFECTS
Temperature extremes and gradual warming	• More frequent, more severe and longer heatwaves • Increased urban heat island effect • Combined climate-related hazards (e.g., heat, wildfires, drought, flooding) • Decrease in cold extremes and averages • Long-term warming and heatwaves	• Increase in direct heat-related illnesses (e.g., heat edema, heat rash, heat exhaustion, heat stroke) and deaths, especially for workers • Increase in respiratory disorders • Increase in cardiovascular disorders, especially for seniors and people with chronic diseases • Perinatal care complications (such as miscarriage, premature birth, congenital complications) • Increase emergency visits for mental health problems • Psychosocial impacts • Possible changed patterns of illness and death due to gradually warming temperatures (e.g., due to increased outdoor activity levels) • Impacts on health infrastructure • Impacts on health and social services • Potential decrease in cold-related morbidity and mortality • Increased risk of zoonotic infectious diseases directly transmitted from animals and arthropod vectors; and acquired by inhalation from environmental sources

HEALTH IMPACT OR HAZARD CATEGORY	CLIMATE-RELATED CAUSES	POSSIBLE HEALTH EFFECTS
Extreme weather events and natural hazards	• More frequent, longer, and more violent thunderstorms, more severe hurricanes and other types of severe weather • Increased extreme precipitations and related flooding events, except for spring flooding events which will decrease • Landslides and avalanches • Increased coastal flooding, coastal erosion, and storm surge episodes • Increased drought especially in the Prairies, Quebec, and Interior British Columbia • Increased damage to the natural and built environments • Increased frequency, severity, and area burned of wildfires • Combined or cascading climate-related hazards (such as heat, wildfires, drought, flooding)	• Deaths, injuries and illnesses from violent storms, floods, and other hazards • Increase mortality and respiratory illnesses related to wildfire smoke • Psychological health effects, including mental health effects and stress-related illnesses due to extreme events (such as flood, wildfire, drought) • Physical and mental health impacts of food insecurity and/or water shortages • Illnesses related to drinking and recreational water contamination (mostly infectious) • Deaths, illnesses, and injuries due to evacuation or displacement of populations, and related pressures on civil protection, emergency shelters, and health infrastructure • Indirect health impacts from ecological changes, infrastructure damage and interruptions in health services from extreme events

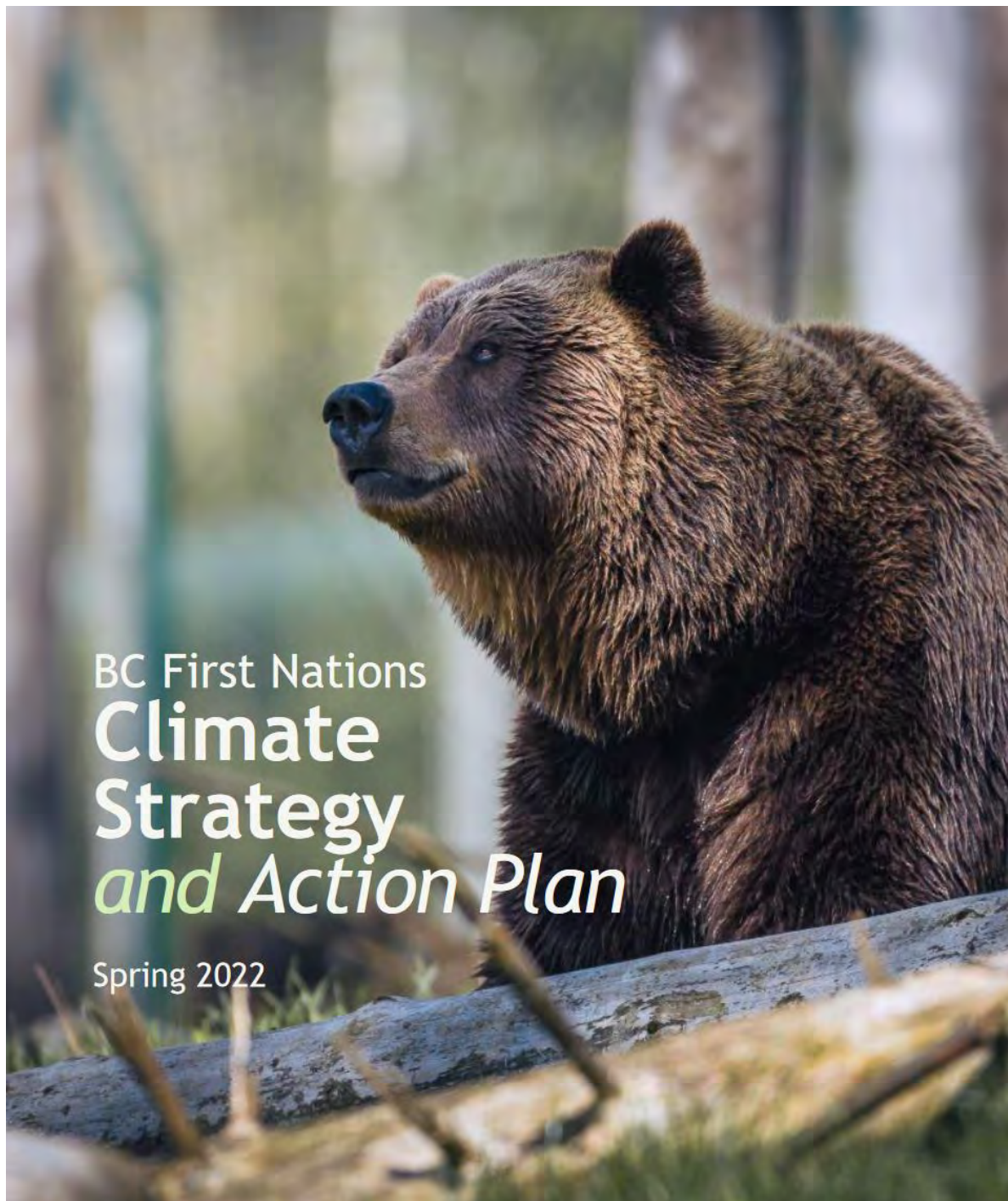
HEALTH IMPACT OR HAZARD CATEGORY	CLIMATE-RELATED CAUSES	POSSIBLE HEALTH EFFECTS
Extreme weather events and natural hazards (continued)		• Exacerbation of chronic and infectious diseases and injuries due to infrastructure damage (such as to housing, water, sanitation, health facilities) • Poorer health outcomes due to restrictions on travel for health and emergency services, delayed supply of essential pharmaceuticals and medical supplies, and compromised patient safety • Epidemics of mosquito-borne diseases

Numerous hazards and risks remain unknown. As per Moda et al. (2019):³⁴

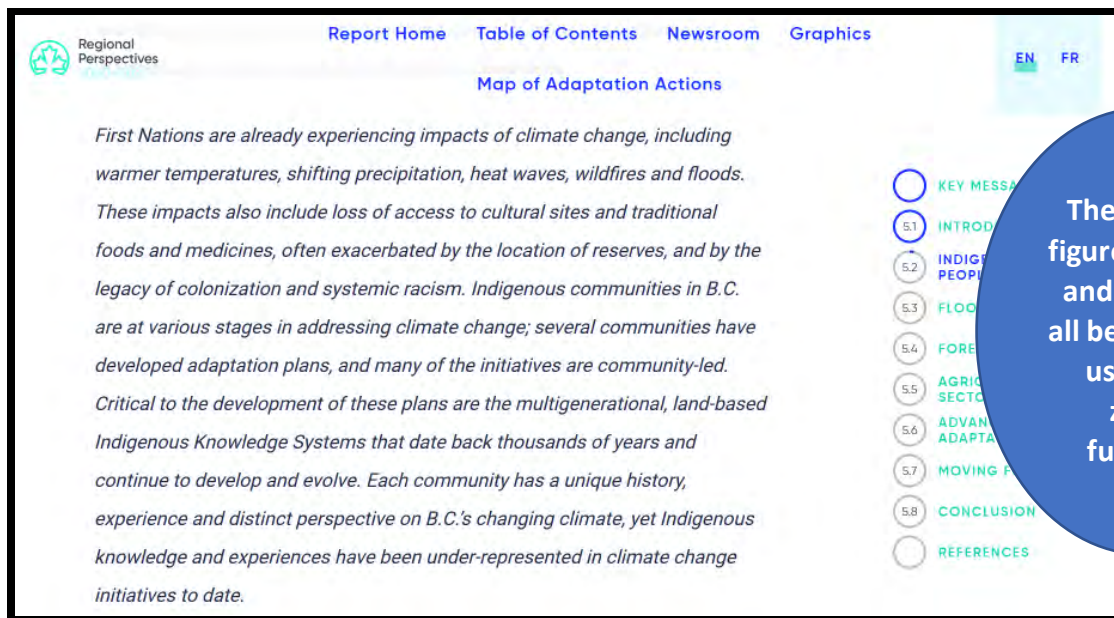
“In addition to this, the presence and exposure of legacy pollutants (persistent substances like DDT, dioxins, PCBs, mercury, etc.) that have accumulated in environmental reservoirs (such as surface soils, sediments, and forests), especially among workers in certain occupations (Table 4), could be influenced by climate change. These pollutants impact health, including, but not limited to, cancer, adverse reproductive outcomes, impaired neurodevelopment, and disruption of the endocrine and immune systems.”

This does not even address the unique hazards and risks of equity seeking groups.

³⁴ Moda, H., Filho, W.L., & Minhas, A. (2019). Impacts of Climate Change on Outdoor Workers and Their Safety: Some Research Priorities. *International Journal of Environmental Research and Public Health*. 2019 September 16. Retrieved February 24, 2020 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6765781/>



BC First Nations Climate Strategy and Action Plan. Spring 2022. See <https://www.bcafn.ca/news/bc-first-nations-climate-strategy-and-action-plan-released-earth-day>



I.IV. Impacts on Equity Seeking Groups (also see the Hazard and Risk Assessments Section):

Climate change adversely impacts equity seeking groups more than other segments of society.^{35,36,37,38} Research shows that the populations most affected by many climate change hazards include older persons, racialized populations, individuals with chronic health conditions and Indigenous peoples.³⁹ There are others; this Guide is not a comprehensive analysis. While there is a lack of detailed information on the effects of climate change on equity seeking workers in Canada, there is some data from the US and other jurisdictions.⁴⁰

³⁵ EPA. (September 02, 2021). EPA Report Shows Disproportionate Impacts of Climate Change on Socially Vulnerable Populations in the United States. Retrieved June 04, 2022 from <https://www.epa.gov/newsreleases/epa-report-shows-disproportionate-impacts-climate-change-socially-vulnerable>

³⁶ CUPE BC. Racialized Workers Committee. Retrieved June 06, 2022 from https://campaigns.cupe.bc.ca/workers_of_colour_committee

³⁷ CUPE BC. Persons with Disabilities Committee. Retrieved June 06, 2022 from <https://www.cupe.bc.ca/committee/persons-with-disabilities-committee/#:~:text=The%20CUPE%20BC%20Persons%20with,the%20CUPE%20BC%20Executive%20Board>

³⁸ CUPE. Indigenous peoples. Retrieved June 06, 2022 from <https://cupe.ca/indigenous#:~:text=CUPE%20is%20committed%20to%20equality,and%20defend%20their%20rights%20broadly>

³⁹ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

⁴⁰ Barna, M. EPA. US minorities most at risk of climate-driven extreme weather. The Nations Health. (November / December 2021). Retrieved June 05, 2022 from <https://www.thenationshealth.org/content/51/9/7.1>

This section briefly reviews data from other jurisdictions pertaining to several equity seeking groups including: Indigenous peoples, racialized minorities, persons with disabilities.⁴¹ There are other groups that have not been included due to a lack of Canadian information.

It is imperative that hazard and risk assessments include equity seeking groups. Remember that the impacts of climate change that must be considered include: direct or indirect, short term or long term, slow or sudden, additive, etc. There are many aspects to hazards.

Equity seeking outdoor workers that are impacted by climate change include:

- Agricultural workers
- Construction workers
- Emergency responders
- Transportation workers
- Municipal workers, etc.⁴²

This is not an exhaustive list and will change as climate change worsens. Most, if not all workers in Canada will be affected by climate change in some way over the long term.

⁴¹ Kiefer, M., Rodriguez-Guzman, J., Watson, J., van Wendel de Joode, B., Mergler, D., & Soares da Silva, A. (2016). Worker health and safety and climate change in the Americas: Issues and research needs. Retrieved June 05, 2022 from https://www.researchgate.net/publication/312063010_Worker_health_and_safety_and_climate_change_in_the_Americas_Issues_and_research_needs

⁴² Kiefer, M., Rodriguez-Guzman, J., Watson, J., van Wendel de Joode, B., Mergler, D., & Soares da Silva, A. (2016). Worker health and safety and climate change in the Americas: Issues and research needs. Retrieved June 05, 2022 from https://www.researchgate.net/publication/312063010_Worker_health_and_safety_and_climate_change_in_the_Americas_Issues_and_research_needs

Indoor workers are also affected. Increased air pollution and increased heat (in the absence of air conditioning) can affect workers in:

- Factories
- Migrant workers
- Workers in precarious employment
- Day-labourers⁴³

This is not an exhaustive list.

Specific impacts on equity seeking workers include (not an exhaustive list):

- Heat exposure
- Humidity exposure
- Exposure to poor air quality
- Decreased chemical tolerance
- Fatigue
- Increased injuries, occupational diseases and deaths due to reduced cognitive functioning e.g. falls, myocardial infarctions, chemical exposures
- Chronic diseases such as ischemic heart disease and respiratory diseases
- Aggravation of pre-existing conditions
- Injuries from damaged infrastructure e.g. powerlines
- Exposure to diseases e.g. West Nile, Dengue, malaria, Chikungunya, Lyme disease, etc.

⁴³ Terminology as used in the report by Rodriaguez-Guzman et al.

“Preparing for climate change requires addressing determinants of health and ongoing health inequities. It also requires that Indigenous Peoples’ rights and responsibilities over their lands, natural resources, and ways of life are respected, protected, and advanced through Indigenous-led climate change mitigation, adaptation, policy, and research.”

(Health of Canadians in a Changing Climate (2022))

I.IV.I. Indigenous Peoples:^{44,45,46}

Indigenous peoples are uniquely sensitive to the impacts of climate change given their close relationships to land, waters, animals, plants and natural resources as well as the potential to live in geographic areas undergoing rapid climate change, especially Northern Canada.⁴⁷ The information on the impacts on Indigenous peoples is just beginning to be collected. There was very little information on the impact on Indigenous workers specifically, and even less on other equity seeking groups within Indigenous peoples e.g. gender diverse workers (including Two-Spirited persons), older workers, workers with disabilities, etc.

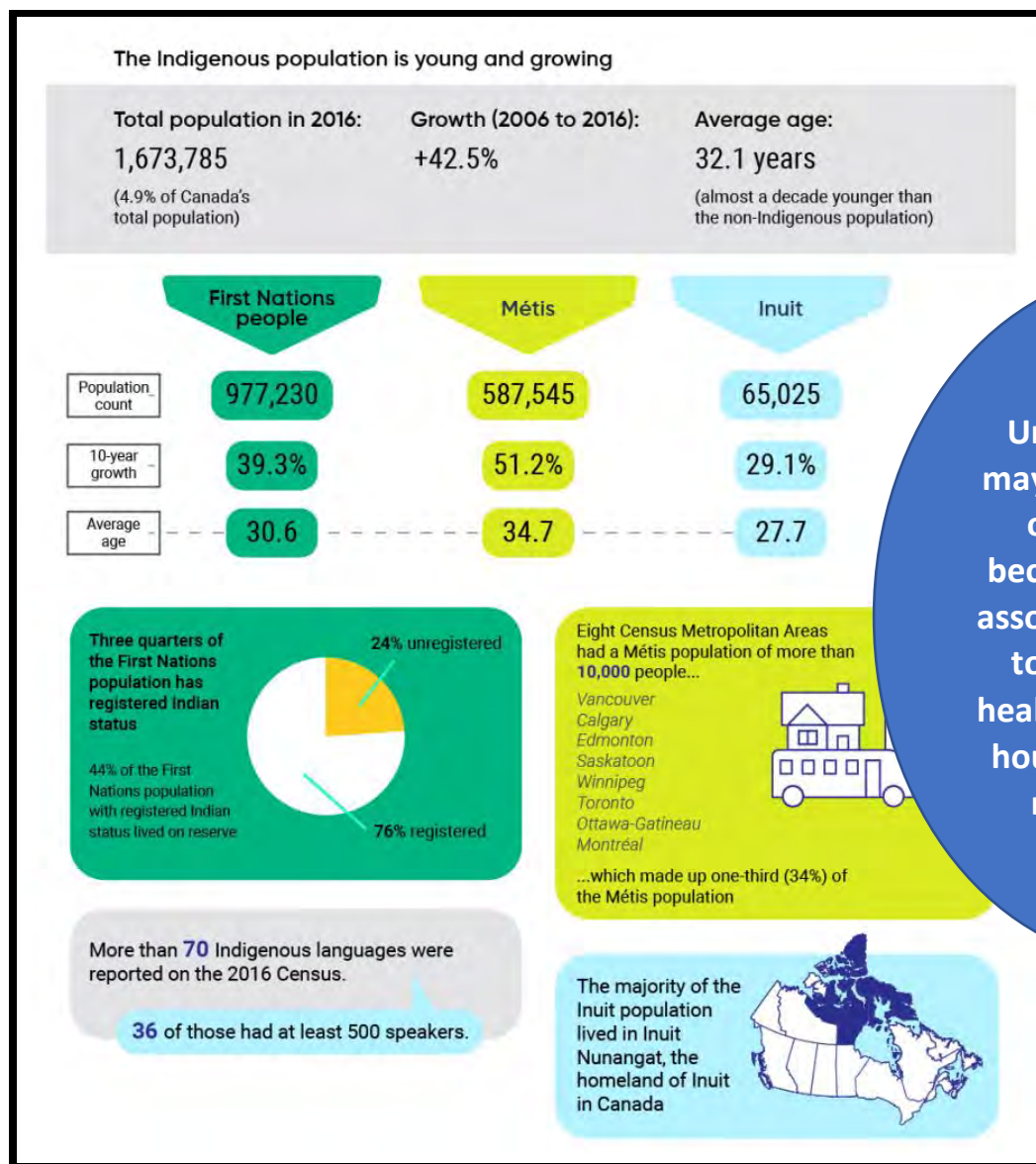
⁴⁴ BC First Nations Climate Strategy and Action Plan. (Spring 2022). Retrieved May 20, 2022 from <https://www.bcafn.ca/sites/default/files/2022-04/BCFNCSAP%20Final%20Draft%20%2822April2022%29.pdf>

⁴⁵ Regional Perspectives. (2022-2022). Chapter 5. British Columbia. Section 5.2. Indigenous Peoples in B.C. are experiencing and adapting to climate change. Retrieved May 20-21, 2022 from <https://changingclimate.ca/regional-perspectives/chapter/5-0/>

⁴⁶ Crawford, T. (May 20, 2022). BC must move faster on climate change: report. Further adaptation planning should involve more Indigenous-led solutions. *The Vancouver Sun*. Retrieved May 20, 2022. See <https://www.bcafn.ca/sites/default/files/2022-04/BCFNCSAP%20Final%20Draft%20%2822April2022%29.pdf>

⁴⁷ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

In 2016, the Indigenous population was 4.9% of the population in Canada (though it may be as high as 7%).⁴⁸ Note: The terms used below are from the Health of Canadians in a Changing Climate (2022) report and not the author of this Guide. These figures are for illustration purposes only.



Urban populations may be at greater risk of extreme heat because of inequities associated with access to health services, health status, poverty, housing and political marginalization

⁴⁸ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

Indigenous peoples are affected by climate change in many ways as per the table on the next page.⁴⁹

There are significant gaps in the data and findings in this table and in the Guide generally. It is included for illustration purposes only. These gaps and issues include:

- **Lack of knowledge**
- **Not using Indigenous knowledge and expertise**
- **Under-estimates**
- **Generalizations**
- **Lack of cultural awareness**
- **Data is provided by non-Indigenous persons**
- **Lack of community partnerships**
- **Locations where data was from**
- **The need for the creation of best practices**
- **Ensuring research is respectful, relevant, reciprocal and responsible, etc.**
- **Impacts of colonialism and colonization**

There are many others. This list is for example purposes only, and in of itself, reflects the issues noted above. This applies to other equity seeking groups as well.

⁴⁹ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

Overview of Climate Change Impacts on the Health and Well-Being of First Nations, Inuit, and Métis Peoples in Canada

HEALTH IMPACT OR HAZARD CATEGORY

CLIMATE-RELATED CAUSES

POSSIBLE HEALTH EFFECTS

Impacts on First Nations, Inuit, and Métis peoples and communities

- Increased wildfire, drought, and flooding events
- Instability and melting of permafrost and changes to ground snow cover, sea ice extent and thickness
- Changes to sea levels and weather patterns
- Higher exposure to climate risks in relation to natural and built environments (such as poor housing, water, sanitation, and environmental contaminants)
- Decreased availability, quality, quantity, and safety of traditional food sources
- Melting and damage to ice roads
- Effects of warming and changes to precipitation patterns that affect survival and transmission of disease-causing organisms

- Exacerbation of health and socio-economic inequities
- Air quality health impacts (such as respiratory and cardiovascular diseases)
- Increased water and foodborne diseases
- Mental health impacts (such as stress, anxiety, and post-traumatic stress disorder)
- Exacerbation of chronic and infectious diseases
- Increased injuries and deaths from accidents (e.g., natural hazards and extreme weather events)
- Increased direct and indirect health impacts from permafrost-related infrastructure damage
- Decreased opportunities for transmission of Indigenous knowledges and land skills, particularly among youth, affecting sense of identity, mental well-being, and cultures

Climate change has contributed to an increased number of extreme heat events and droughts, and to proliferation of pests such as the mountain pine beetle, which is increasing the prevalence, magnitude and intensity of wildfires

Extreme weather events can result in injuries, disease, aggravation of pre-existing conditions, fatalities, temporary or long-term evacuations from traditional territories, infrastructure damage, restricted access to health systems and supplies, resilience, cultural cohesion and opportunities for the transmission of Indigenous knowledges and mental health issues.⁵⁰

Several factors increase risks to Indigenous persons from climate change impacts, including:⁵¹

- Close cultural connection and dependence on the natural environment
- Historic and ongoing burdens of colonialism
- Vast distances between communities
- Smaller service centres
- Harsher climates
- Remoteness and isolation
- Infrastructure vulnerabilities



Permafrost degradation, heavy storms and coastal erosion can result in the destruction of places that have cultural significance, with potential mental health impacts

As per the Regional Perspectives report:⁵²

“Approximately one third of all First Nations communities in Canada—more than 203 communities—are located in B.C. (Government of Canada, 2010). There are seven language families comprising 34 distinct First Nations languages in B.C. and this high level of language diversity is unique in Canada (First Peoples’ Cultural Council, 2018). First Nations territories in B.C. span diverse lands, water and marine ecosystems.”

⁵⁰ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

⁵¹ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

⁵² Regional Perspectives. (2022-2022). Chapter 5. British Columbia. Section 5.2. Indigenous Peoples in B.C. are experiencing and adapting to climate change. Retrieved May 20-21, 2022 from <https://changingclimate.ca/regional-perspectives/chapter/5-0/>

Based on the findings of the Global Assessment Report on Biodiversity and Ecosystem Services the United Nations is calling for Indigenous leadership and guidance to help address climate change. All equity seeking groups have knowledge to contribute.

Under CleanBC, BC held 10 regional sessions in 2019 and 2020 to discuss issues related to climate change, and to work towards co-producing the provincial adaptation strategy as per the Government of BC and Indigenuity Consulting Group Inc. in 2020. This occurred due to recognition of numerous significant shortcomings that were identified in the *Preliminary Strategic Climate Risk Assessment for British Columbia*. Indigenous knowledge systems have identified almost twice as many climate change impacts as Western or scientific knowledge have. These systems provided observations about sociocultural, health and safety impacts (there are many others). There are thousands of years of knowledge that can contribute to our understanding of the impacts of climate change on communities and workers e.g. the Peavine Métis Settlement's FireSmart Program. The Regional Perspectives⁵³ report states that:

“Indigenous communities are at various stages in addressing climate change; some have produced and are implementing climate change adaptation plans, such as the following: the Ahousaht, Hesquiaht, and Tla-o-qui-aht Community-based Climate Change Adaptation Plan (Lerner, 2011); Gitgaa'at value-based climate change adaptation planning (Reid et al., 2014); Tsleil-Waututh's climate change planning (see Case Story 2.5 in Cities and Towns chapter); and the Toquaht Nation's Coastal Adaptation Plan (Toquaht Nation, 2018).”

And,

“At the provincial level, the Chiefs-in-Assembly of the BC Assembly of First Nations and the Union of British Columbia Indian Chiefs have passed resolutions instructing these organizations to develop a First Nations Climate Change Strategy and Action Plan identifying actions that will lower greenhouse gas (GHG) emissions, reduce vulnerability to the impacts, and build capacity and resilience, as well as identifying low-carbon economic opportunities arising from adaptation.”

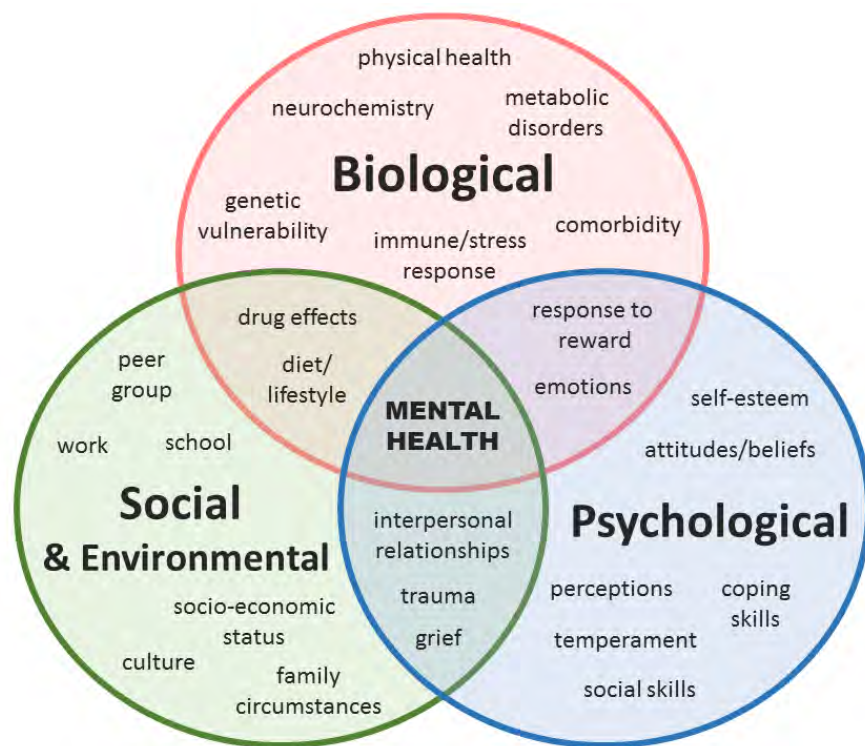
⁵³ Regional Perspectives. (2022-2022). Chapter 5. British Columbia. Section 5.2. Indigenous Peoples in B.C. are experiencing and adapting to climate change. Retrieved May 20-21, 2022 from <https://changingclimate.ca/regional-perspectives/chapter/5-0/>

As an example of some of the hazards faced by Indigenous communities, Section 5.2.3.3. of the Regional Perspectives report states that people living on First Nations reserves in Canada are 33 times more likely to experience evacuations due to wildfire. Wildfires have numerous associated hazards including direct hazards (burns) and air quality. In the Clayoquot Sound area there has been an increase in storm severity and a decrease in storm frequency with accompanying flooding, storm surges, electrical hazards, etc. These hazards directly impact workers in those communities. See the BC First Nations Climate Strategy and Action Plan.

Assessments of health and safety hazards related to climate change and the impact on Indigenous peoples should be included in hazard and risk assessments. See Section VI of this Guide. As per Health of Canadians in a Changing Climate (2022):

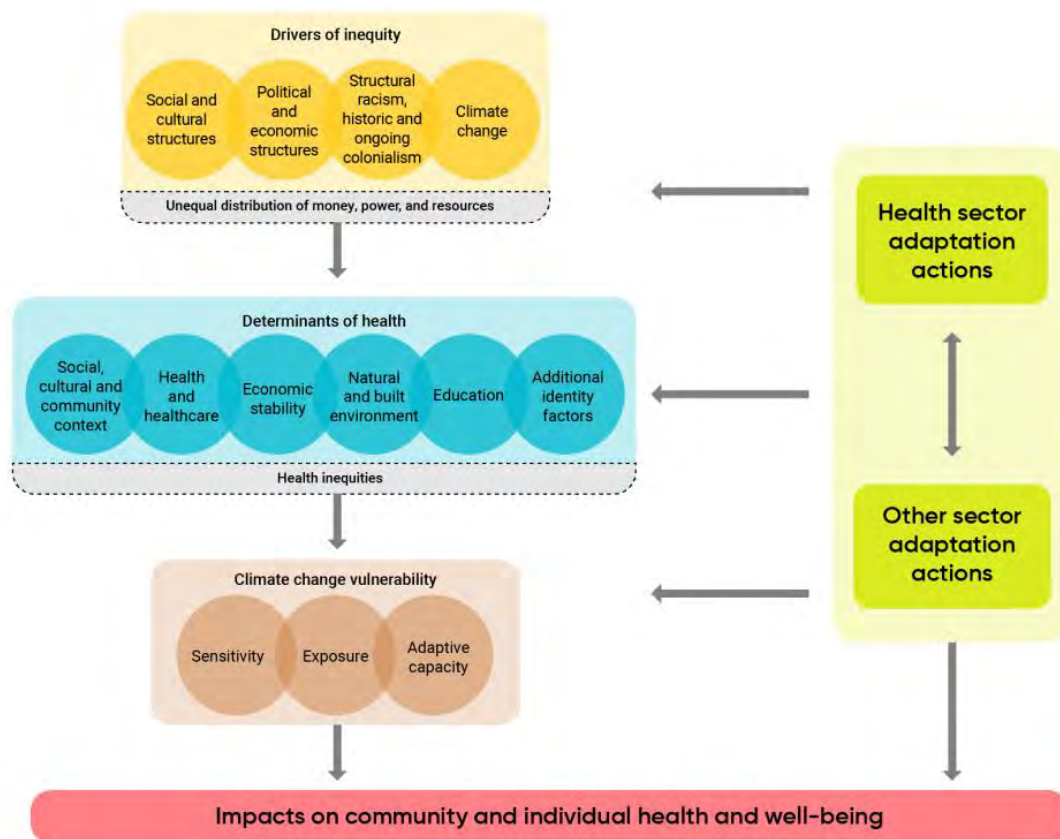
“Indigenous knowledge systems are increasingly recognized, both nationally and internationally, as important in adapting to climate change, monitoring impacts at the local and regional level, and informing climate change policy and research.”

It is imperative to apply the biopsychosocial approach / model e.g.:



“Indigenous leadership is “essential for effective adaptation” in B.C. he said, noting that a First Nations climate strategy and action plan in B.C. was released last month...”

(Crawford, 2022)⁵⁴



Health of Canadians in a Changing Climate. (2022). See <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

⁵⁴ Crawford, T. (May 20, 2022). B.C. must move faster on climate change: report. Further adaptation planning should involve more Indigenous-led solutions. *The Vancouver Sun*. Retrieved May 20, 2022. BC First Nations Climate Strategy and Action Plan. Spring 2022. Retrieved May 20, 2022 from <https://www.bcafn.ca/sites/default/files/2022-04/BCFNCSAP%20Final%20Draft%20%2822April2022%29.pdf>

“Indigenous knowledges have been critical to the survival and resilience of Indigenous peoples since time immemorial.

Although these knowledges are increasingly recognized as equal to scientific information in understanding and adapting to climate change, the meaningful engagement of Indigenous peoples and their knowledge systems in climate change research and policy remains a challenge. Indigenous-focused content has, for example, been under-represented in the Intergovernmental Panel on Climate Change (“IPCC”) assessment reports, as well as in policy discussions surrounding the UNFCCC.”

“Indigenous knowledges can inform climate change and health-related decision-making at a variety of levels to benefit diverse stakeholders, including researchers, decision makers and community. They have been used to establish multiple ecosystem indicators and baselines, which are useful for identifying priority areas for environmental monitoring, protection, and potential remediation. Indigenous knowledges have been used to develop predictive models for identifying climate change vulnerabilities and adaptation options, such as potential impacts on traditional livelihoods and subsequent health implications. Indigenous knowledges can and have been used with scientific knowledge to improve risk assessments, enabling individuals to make informed decisions about weather-related risks and hazards...”⁵⁵

⁵⁵ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



CLIMATE CHANGE AND SOCIAL VULNERABILITY IN THE UNITED STATES

A Focus on Six Impacts

SEPTEMBER 2021

EPA. Climate Change and Social Vulnerability. A Focus on Six Impacts. September 2021. See https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf

I.IV.II. Racialized Minorities:⁵⁶

More than 40% of outdoor workers in the US identify as African American, Black, Hispanic or Latino.⁵⁷ Extreme heat and other hazards caused by climate change are affecting the health and safety of racialized minorities. While the statistics are from the US, similar hazards exist for workers in Canada. An EPA Vulnerability Report⁵⁸ stated that:

- Black and African American individuals are 40% more likely than non-Black and non-African American individuals to currently live in areas with the highest projected increases in mortality rates due to climate driven changes in extreme temperatures.
- Black and African American individuals are 34% more likely to live in areas with the highest projected increases in childhood asthma diagnoses due to climate driven changes in particulate air pollution.
- Hispanic and Latino individuals are 43% more likely than non-Hispanic and non-Latino individuals to currently live in areas with the highest projected labour hour losses in weather-exposed industries due to climate driven increases in high temperature days.
- Hispanic and Latino individuals are also 50% more likely to live in coastal areas with the highest projected increases in traffic delays from climate driven changes in high-tide flooding.
- American Indian and Alaska Native individuals are 48% more likely than non-American Indian and non-Alaska Native individuals to currently live in areas where the highest percentage of land is projected to be inundated due to sea level rise.

⁵⁶ Terminology used is based on the CUPE BC and CUPE committees as well as the terms used in the reference data e.g. EPA reports

⁵⁷ McDaniel, E. Outdoor Workers Could Face Far More Dangerous Heat By 2065 Because Of Climate Change. NPR. (August 17, 2021). Retrieved June 06, 2022 from <https://www.npr.org/2021/08/17/1028552251/outdoor-workers-could-face-far-more-dangerous-heat-by-2065-because-of-climate-ch>

⁵⁸ EPA. Climate Change and Social Vulnerability. A Focus on Six Impacts. (September 2021). Retrieved June 04, 2022 from https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf

The EPA⁵⁹ also stated that:

“WASHINGTON (Sept. 2, 2021) — A new EPA analysis released today shows that the most severe harms from climate change fall disproportionately upon underserved communities who are least able to prepare for, and recover from, heat waves, poor air quality, flooding, and other impacts.

EPA’s analysis indicates that racial and ethnic minority communities are particularly vulnerable to the greatest impacts of climate change. *Climate Change and Social Vulnerability in the United States: A Focus on Six Impact Sectors* is one of the most advanced environmental justice studies to date that looks at how projected climate change impacts may be distributed across the American public.

‘The impacts of climate change that we are feeling today, from extreme heat to flooding to severe storms, are expected to get worse, and people least able to prepare and cope are disproportionately exposed,’ said EPA Administrator Michael S. Regan ‘This report punctuates the urgency of equitable action on climate change. With this level of science and data, we can more effectively center EPA’s mission on achieving environmental justice for all.’”

As per the EPA report, Hispanics and Latinos (terms used in the report) have high participation in weather-exposed industries, such as construction and agriculture, which are especially vulnerable to the effects of extreme temperatures. With 2°C (3.6°F) of global warming, Hispanic and Latino individuals are 43% more likely to currently live in areas with the highest projected reductions in labour hours due to extreme temperatures. See page 41, figure 5.2 from the EPA report (next page).⁶⁰ A 2019 study found that Black construction workers were on average 51% more likely to die from heat and Mexican-born workers were 91% more likely to die of heat.⁶¹

⁵⁹ EPA. (September 02, 2021). EPA Report Shows Disproportionate Impacts of Climate Change on Socially Vulnerable Populations in the United States. Retrieved June 04, 2022 from <https://www.epa.gov/newsreleases/epa-report-shows-disproportionate-impacts-climate-change-socially-vulnerable>

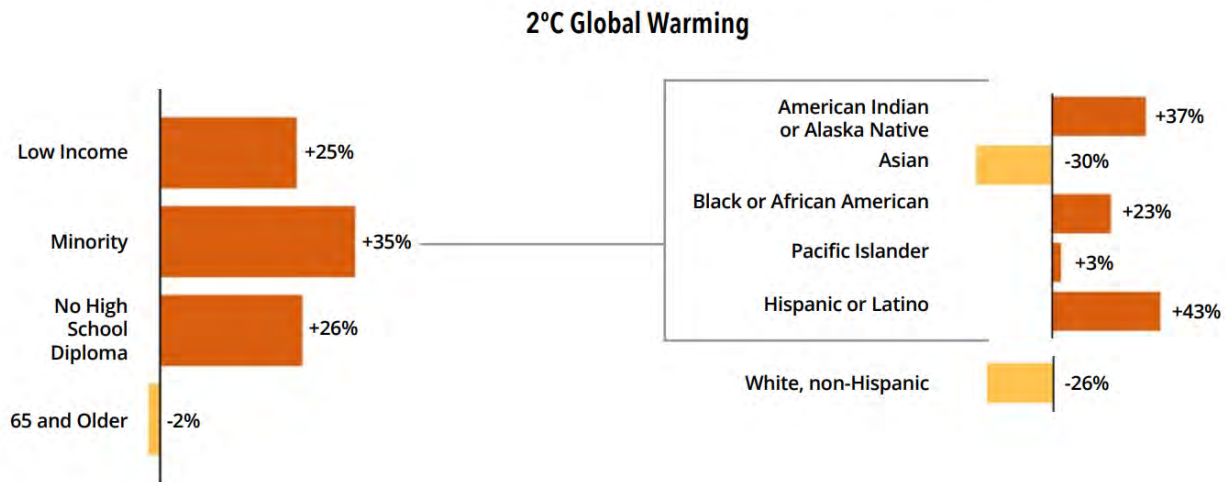
⁶⁰ EPA. Climate Change and Social Vulnerability. A Focus on Six Impacts. (September 2021). Retrieved June 04, 2022 from https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf

⁶¹ Sue Dong, X., West, G.H., Holloway-Beth, A., Wang, X., & Sokas, R.K. (2019). Heat-related deaths among construction workers in the United States. National Library of Medicine. Retrieved June 06, 2022 from <https://pubmed.ncbi.nlm.nih.gov/31328819/>

Key Findings on Social Vulnerability in the Labor Sector (continued)

Figure 5.2 – Likelihood that Those in Socially Vulnerable Groups Currently Live in Areas with the Highest Projected Labor Hour Losses Due to Climate-Driven Increases in High-Temperature Days

The bar charts present the relative likelihood that weather-exposed workers in each socially vulnerable group (e.g., low income) currently live in areas with the highest projected labor hour losses relative to their reference populations (e.g., non-low income). Positive percentages indicate higher comparative risk, and negative percentages indicate lower comparative risk. Levels of global warming are relative to the 1986-2005 average.



Age, including older workers, also has significant overlapping considerations. As per the report, it was observed that Black people 65 and older (all persons, not just workers) are 41% percent to 60% more likely to die as a result of fine-particle pollution, or soot, depending on how high temperatures rise. **Workers may be from multiple equity seeking groups.**

In the US, the average construction worker earns 25% less than the median worker and labourers in the farming, fishing and forestry sectors earn an average of 48% less. Any decrease in pay associated with reduced labour hours resulting from high temperature days may cause some workers to choose to work during high temperature days thereby putting their health at risk.⁶²

⁶² EPA. Climate Change and Social Vulnerability. A Focus on Six Impacts. (September 2021). Retrieved June 04, 2022 from https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf

In 49 cities analyzed for the study, from Seattle to Miami, Black people are 41% to 59% more likely to die as a result of poor air quality.⁶³ While the data refers to the US, many Canadian cities are experiencing similar climate change related impacts.

The White House (Biden Administration) has created a Fact Sheet on mobilizing to protect workers and communities from extreme heat.⁶⁴ Initiatives include:

- The Department of Labor is launching a multi-prong initiative on occupational heat exposure to protect outdoor workers, including agricultural, construction and delivery workers, as well as indoor workers, including those in warehouses, factories and kitchens.
- The Department of Labor's Occupational Safety and Health Administration ("OSHA") is responsible for setting and enforcing standards to ensure safe, healthy working conditions. It is developing workplace heat standards and increasing enforcement. Workers in agriculture and construction are often at highest risk, but the problem affects all workers exposed to heat, including indoor workers without climate-controlled environments. Too often, heat-induced injuries and illnesses are misclassified or not reported, especially in sectors that employ vulnerable and undocumented workers.
- OSHA is launching a rulemaking process to develop a workplace heat standard: The issuance of an Advance Notice of Proposed Rulemaking ("ANPRM") on heat illness prevention in outdoor and indoor work settings. This is a significant step toward a federal heat standard to ensure protections in workplaces across the country. The ANPRM will initiate a comment period allowing for OSHA to gather diverse perspectives and technical expertise on topics including heat stress thresholds, heat acclimatization planning and exposure monitoring.

⁶³ Fears, D. & Grandoni, D. (September 02, 2021). EPA just detailed all the ways climate change will hit U.S. racial minorities the hardest. It's a long list. The Washington Post. Retrieved June 06, 2022 from <https://www.washingtonpost.com/climate-environment/2021/09/02/ida-climate-change/>

⁶⁴ FACT SHEET: Biden Administration Mobilizes to Protect Workers and Communities from Extreme Heat. (September 20, 2021). Retrieved June 04, 2022 from <https://www.whitehouse.gov/briefing-room/statements-releases/2021/09/20/fact-sheet-biden-administration-mobilizes-to-protect-workers-and-communities-from-extreme-heat/>

- OSHA is implementing an enforcement initiative on heat related hazards: OSHA will prioritize heat related interventions and workplace inspections on days when the heat index exceeds 80°F. On these days, OSHA Area Directors will dedicate additional resources in responding to heat related complaints and expand the scope of programmed and unprogrammed inspections to address heat related hazards. In addition to shaping the focus of OSHA field staff, this initiative also will expand on OSHA’s campaign to educate and assist employers on heat illness prevention.
- OSHA is developing a National Emphasis Program on heat inspections: OSHA is also working to formalize a National Emphasis Program (“NEP”) on heat hazard cases, which will target high-risk industries and focus OSHA resources and staff time on heat inspections. Establishing a new NEP requires extensive data review, which OSHA is working to complete in order for the NEP to take effect before the summer 2022 heat season. In doing so, OSHA will build on the existing Regional Emphasis Program for Heat Illnesses in Region VI, which covers Arkansas, Louisiana, New Mexico, Oklahoma and Texas.
- OSHA is forming a heat work group to engage stakeholders and inform ongoing efforts: Within OSHA’s National Advisory Committee on Occupational Safety and Health (“NACOSH”), OSHA is forming a Heat Illness Prevention Work Group to provide better understanding of challenges and best practices in protecting workers from heat hazards. This group will include three members of the full NACOSH—a public representative, labor representative and management representative—as well as new members from a range of sectors and industries. OSHA will convene periodic meetings of the work group regarding identification, monitoring and response to workplace heat hazards; heat emergency response plans and worker training and engagement.

Canadian jurisdictions should consider the initiatives undertaken in the US and create similar processes and protections for workers.

Climate Change and the Health of People with Disabilities

Understanding the threats that climate change poses to human health can help us work together to lower risks and be prepared.

Climate change threatens human health, including mental health, and access to clean air, safe drinking water, nutritious food, and shelter. Everyone is affected by climate change at some point in their lives. Some

What is climate change and why does it matter for health?

I.IV.III. Persons with Disabilities:

The United Nations Human Rights Council has adopted a resolution on climate change and the rights of persons with disabilities. The UN Climate Resolution Emphasises Protection of Disability Rights People with Disabilities Should Be Included in Climate Action states that:⁶⁵

“The impacts of climate change disproportionately affect [people with] disabilities. They are frequently in situations of social, economic, and political disadvantage and may not have access to adequate resources, information, and services necessary to adapt to the effects of climate change.”

⁶⁵ Schulte, C. (July 15, 2019). The UN Climate Resolution Emphasises Protection of Disability Rights People with Disabilities Should Be Included in Climate Action. Dispatches. Retrieved June 06, 2022 from <https://www.hrw.org/news/2019/07/15/un-climate-resolution-emphasizes-protection-disability-rights>

Types of disabilities can vary considerably. They can include episodic disabilities; short term and long term disabilities; physical, intellectual, sensory and psychological domains, etc. Issues facing persons with disabilities related to climate change include (not an exhaustive list):

- Limited access to knowledge, resources and services to effectively respond to climate change
- Vulnerability to extreme climate events e.g. hurricanes
- Vulnerability to loss of services and supports e.g. transportation
- Increased susceptibility to diseases caused by or worsened by climate change
- Difficulties during evacuations e.g. flooding

Extreme heat is one recent example that significantly affected persons with disabilities in BC.⁶⁶ BC did not have a heat plan when temperatures reached record temperatures of 49.6 Celsius in June 2021. The report stated that:

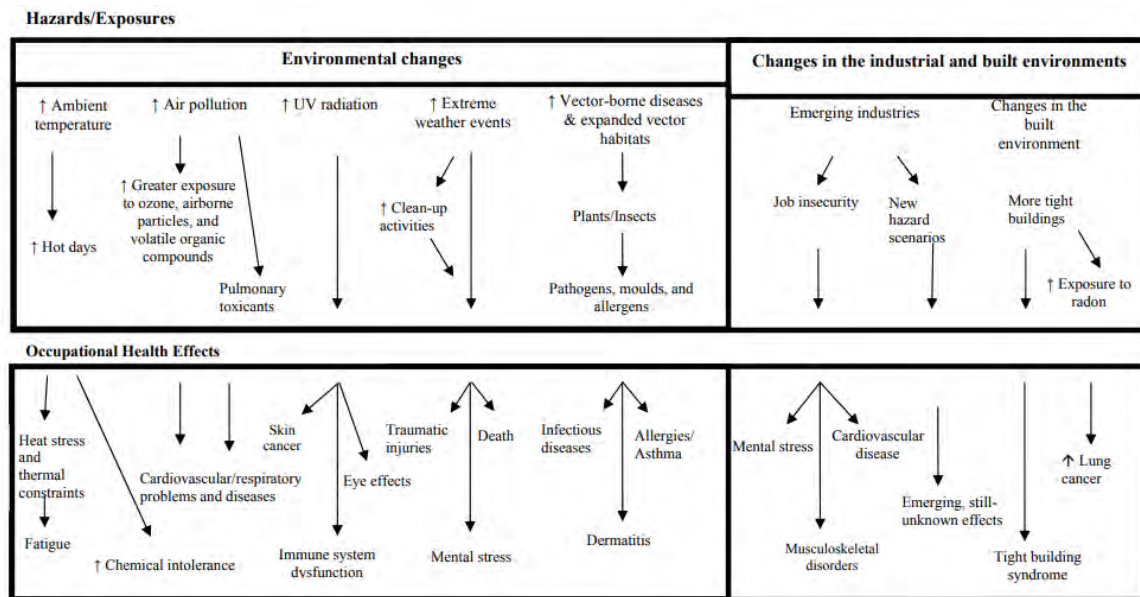
“People with disabilities and older people are at high risk of heat stress, but they were left to cope with dangerous heat on their own,’ said Emina Ćerimović, senior disability rights researcher at Human Rights Watch.”

As an example, the current BC Climate Preparedness and Adaptation Strategy⁶⁷ does not mention heat related impacts on people with disabilities. Climate change policies must be more effective, accessible, inclusive and equitable. Persons with disabilities may also be members of other equity seeking groups; this compounds the hazards presented by climate change.

⁶⁶ Canada. Disastrous Impact of Extreme Heat. Failure to Protect Older People, People with Disabilities in British Columbia. (October 05, 2021). Retrieved June 05, 2022 from <https://www.hrw.org/about/get-local/canada/canada-disastrous-impact-extreme-heat-failure-protect-older-people-people>

⁶⁷ Climate Preparedness and Adaptation Strategy. Retrieved June 06, 2022 from <https://www2.gov.bc.ca/gov/content/environment/climate-change/adaptation>

Adam-Poupart et al. (2013)⁶⁸ have identified a complex overlapping series of occupational health effects related to climate change as per page three, figures 1 and 2 of the report:



Gutnik & Roth (2018),⁶⁹ recommended a twin tack approach for inclusion. This means:

“building capacities of local, national and international DRR⁷⁰ stakeholders to integrate the most at risk groups including persons with disabilities in their prevention, mitigation, preparedness and relief programming”.⁷¹

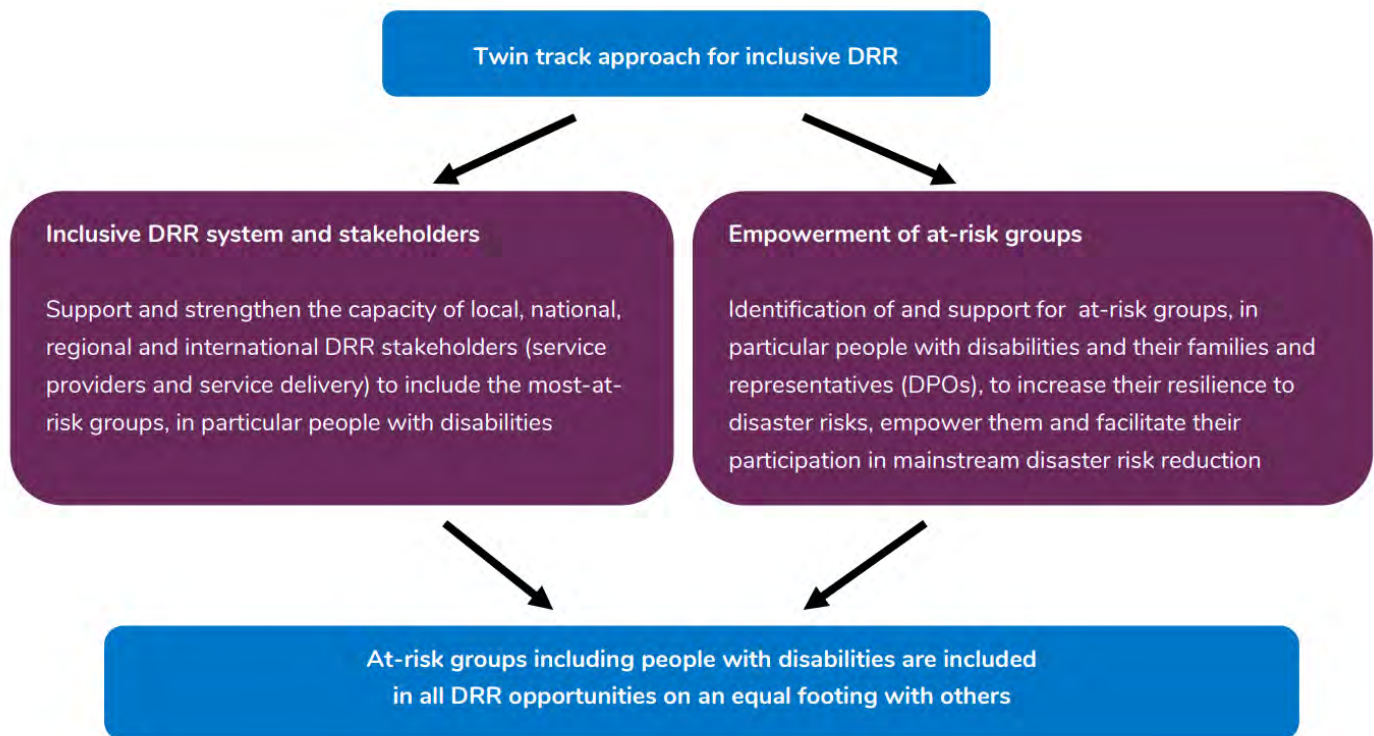
⁶⁸ Adam-Poupart, A., Labrèche, F., Smargiassi, A., Duguay, P., Busque, M.A., Gagné, C., & Zayed, J. (2013). Studies and Research Projects. Impacts of Climate Change on Occupational Health and Safety. Retrieved June 05, 2022 from <https://www.irsst.qc.ca/media/documents/pubirsst/r-775.pdf>

⁶⁹ Gutnik, A., & Roth, M. (2018). Disability and Climate Change: How climate-related hazards increase vulnerabilities among the most at risk populations and the necessary convergence of inclusive disaster risk reduction and climate change adaptation. Retrieved June 04, 2022 from https://www.ohchr.org/sites/default/files/Documents/Issues/ClimateChange/Submissions/Disabilities/Humanity_and_Inclusion.pdf

⁷⁰ Disaster Risk Reduction

⁷¹ Gutnik, A., & Roth, M. (2018). Disability and Climate Change: How climate-related hazards increase vulnerabilities among the most at risk populations and the necessary convergence of inclusive disaster risk reduction and climate change adaptation. Retrieved June 04, 2022 from https://www.ohchr.org/sites/default/files/Documents/Issues/ClimateChange/Submissions/Disabilities/Humanity_and_Inclusion.pdf

The twin track approach has been successfully implemented by a number of organizations including CBM,⁷² the Disability inclusive DRR Network (“DiDRR Network”), Malteser International and a number of local level organizations of persons with disabilities. Gutnik & Roth (2018),⁷³ provide a flow chart on how the twin track approach works (page 44):



Actions needed include: Effective workplace interventions, enhanced surveillance, improved regulations, enforcement, increase community level resilience, increase inclusion and increase empowerment of people with disabilities relating to the impacts of climate change.⁷⁴

⁷² CBM. See <https://www.cbm.org/>

⁷³ Gutnik, A., & Roth, M. (2018). Disability and Climate Change: How climate-related hazards increase vulnerabilities among the most at risk populations and the necessary convergence of inclusive disaster risk reduction and climate change adaptation. Retrieved June 04, 2022 from

https://www.ohchr.org/sites/default/files/Documents/Issues/ClimateChange/Submissions/Disabilities/Humanity_and_Inclusion.pdf

⁷⁴ Infectious Disease and Climate Change in Canada: Key informant interviews. (September 2019). Canadian Public Health Association. Retrieved June 07, 2022 from

https://www.cpha.ca/sites/default/files/uploads/resources/idcc/CPHA_IDCC_Key_informant_interviews.pdf



Red tide algal blooms, which include potentially toxic concentrations of microorganisms, such as protozoans and unicellular algae.

II. Extent of the Problem:

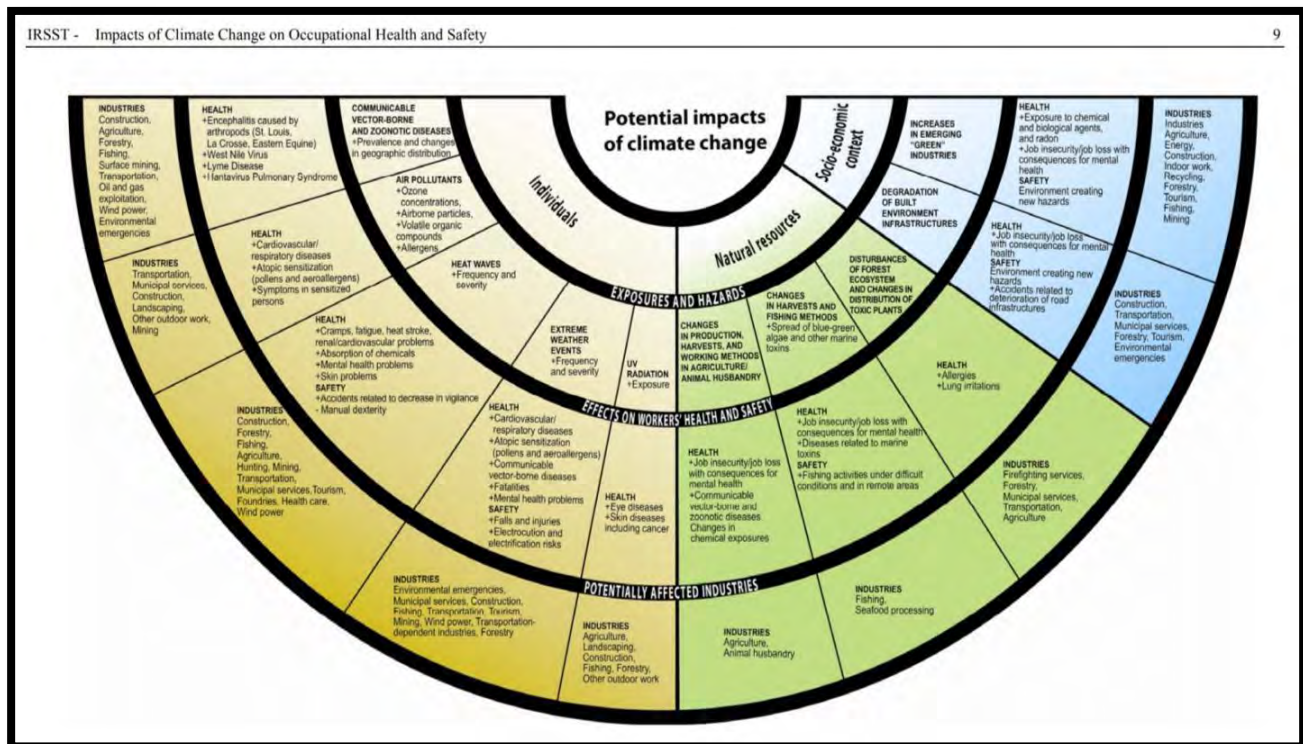
II.I. Introduction:

Climate change is affecting all of Canada. Some regions and cities are being affected more than others, at different times and different rates. Many cities have been experiencing extremes in temperature, air quality and extreme weather events. As per the report by the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (“IRSST”):⁷⁵

“Climate projections suggest that the extreme heat episodes and heat waves being experienced by many North American cities will increase in frequency and severity in the coming years [2, 6].”

⁷⁵ The Institut de recherche Robert-Sauvé en santé et en sécurité du travail (“IRSST”). See <https://www.irsst.qc.ca/media/documents/PubIRSST/R-775.pdf>

Intercity comparisons are useful for BC in order to establish context and comparators. The IRSST report shows the wide ranging impact of climate change, especially on individuals.



When applying the figure above, indirect effects are just as important as direct effects. As per the IRSST:⁷⁶

“The accident incidence rate is minimal when the work activity is performed at temperatures of approximately 17 °C to 23 °C WBGT3, but increases with lower or higher temperatures [21]. Work performed at a high ambient temperature can change worker skills and capacities when physical tasks are involved; this in turn can have consequences on work capacity, productivity, and safety.”

⁷⁶ The Institut de recherche Robert-Sauvé en santé et en sécurité du travail (“IRSST”). See <https://www.irsst.qc.ca/media/documents/PubIRSST/R-775.pdf>

Both short term and long term threat multipliers and additive effects must be considered; indirect effects of climate change to have very large impacts on workers over time.⁷⁷



II.II. Air Temperature (Outside) including Humidity:

BC is expected to experience increases in average temperatures faster than the global average. The last three full decades (1980–2010) have been the warmest on record extending back to 1850. Since 2009, BC has encountered extreme heat events associated with increased mortality and heat related hospitalizations. In June 2021 there was a heat dome that killed over 500 people. Temperatures soared to record levels (nearly 50° Celsius). In response, the Government of BC created a heat alert system that was implemented in 2022.

⁷⁷ Climate change recognized as a 'threat multiplier', UN Security Council debates its impact on peace. United Nations. Retrieved June 02, 2022 from <https://www.un.org/peacebuilding/news/climate-change-recognized-%E2%80%99threat-multiplier%E2%80%99-un-security-council-debates-its-impact-peace>

Higher relative humidity affects the body's ability to cool by evaporation and may exacerbate the effects of heat alone (see the OHCOW materials at the end of the Guide). Risk increases for people residing in proximity to urban heat islands ("UHI"), which occur where large buildings and large concrete surfaces absorb and then emit solar radiation, creating locally elevated temperatures.

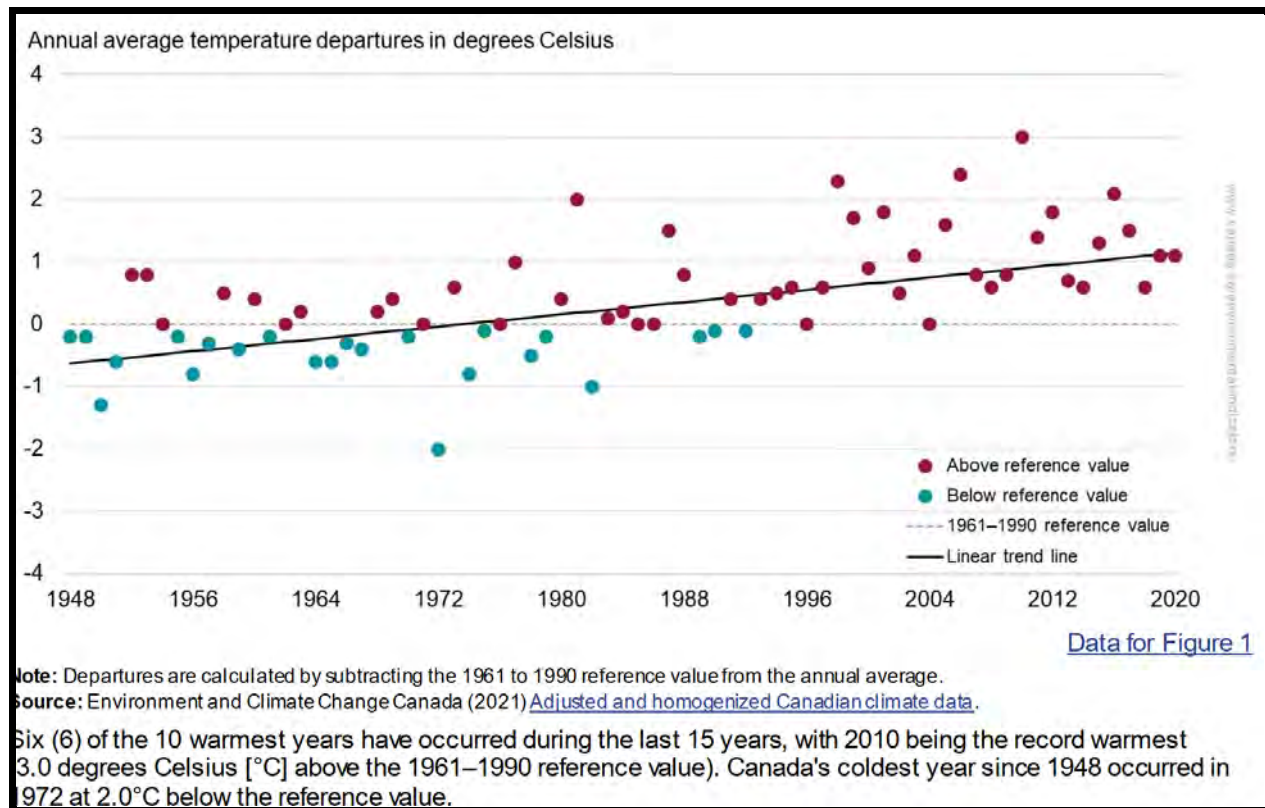
Workers with pre-existing conditions, and other equity seeking groups, may be at particular risk. Older workers often have diminished cardiac output which limits the efficiency of heat dissipation. There is no agreement on gender differences in regard to vulnerability to extreme temperatures. There are significant links between the risk of injury and high daily temperatures – especially for male workers under the age of 25 who are engaged in heavy physical work. Women under the age of 25 and over the age of 55 who had light to limited physical demands are also negatively affected by higher temperatures. There is a higher risk of injury following high temperatures in the previous 24 hours, especially the evening prior to work, for all age groups and genders. Workers who work in 34 degrees Celsius or higher are at high risk. As per the Institute for Work & Health ("IWH"),⁷⁸ the odds of injury increase for each one degree Celsius increase in daily maximum temperature.⁷⁹ At 35 degrees Celsius worker movement may be reduced by 50% depending on the activity and its duration. Temperatures above 38 degrees cause heat exhaustion as well as physical and cognitive impairment. Temperatures exceeding 39 degrees cause heat stroke, the risk of organ damage, unconsciousness and possible death as per the International Labour Organization ("ILO"). The risk of these types of heat injury are real and are not mitigated by acclimatization, which is not effective over the long term. As per the ILO:

"By 2030 the equivalent of more than 2 per cent of total working hours worldwide is projected to be lost every year, either because it is too hot to work or because workers have to work at a slower pace."

⁷⁸ Institute for Work & Health. Association between high ambient temperature and acute work-related injury: a case-crossover analysis using workers' compensation claims data. Retrieved February 14, 2020 from <https://www.iwh.on.ca/>

⁷⁹ McInnes, J.A., Akram, M., Macfarlane, E.M., Keegel, T., Sim, M.R., & Smith, P. (2017). Association between high ambient temperature and acute work-related injury: a case-crossover analysis using workers' compensation claims data. *Scandinavian Journal of Work Environment and Health*, 43(1), M. Harma. 86-94. Finland: Nordic Association of Occupational Safety and Health ("NOROSH"). Retrieved February 14, 2020 from <https://www.iwh.on.ca/>

As per the Government of Canada the number of hot days is increasing:^{80,81}



Based on current data, the annual highest daily temperature that occurs once every ten years (on average) will become a once in two-year event by 2050 — a 500% increase in frequency.

The annual highest daily temperature that occurs once every fifty years is projected to become a once in five-year event by 2050 — a 1,000% increase. In southern Canada, the number of hot days above 30°C is expected to increase by up to 50 days annually by the end of 2100.⁸²

⁸⁰ Government of Canada. Canada's Changing Climate Report. (CCCR 2019). Retrieved June 02, 2022 from https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR_FULLREPORT-EN-FINAL.pdf

⁸¹ Government of Canada. Temperature Change in Canada. Canadian Environmental Sustainability Indicators. Retrieved June 03, 2022 from <https://www.canada.ca/content/dam/eccc/documents/pdf/cesindicators/temperature-change/2021/temperature-change-en.pdf>

⁸² Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

It is predicted that there will be a significant impact on employment due to heat stress as per the ILO in the following figure:

Table 4.1 Working hours lost to heat stress, by sector and country, North America, 1995 and 2030 (projections)

Country	1995						2030					
	Agriculture (in shade) (%)	Industry (%)	Construction (in shade) (%)	Services (%)	Total (%)	Total (thousand full-time jobs)	Agriculture (in shade) (%)	Industry (%)	Construction (in shade) (%)	Services (%)	Total (%)	Total (thousand full-time jobs)
Canada	0	0	0	0	0	0.0	0.03	0.01	0.03	0	0	0.8
United States	0.58	0.22	0.58	0.03	0.11	150.3	1.18	0.54	1.18	0.09	0.21	389.3
North America	0.50	0.21	0.50	0.02	0.10	150.3	1.01	0.48	1.01	0.08	0.19	390.1

Note: The table shows the percentage of working hours lost to heat stress (and the associated health, well-being and productivity effects) in each sector and in the economy as a whole. It also shows the equivalent loss in terms of full-time jobs for the economy as a whole. Work in agriculture and construction is assumed to be carried out in the shade. The heat stress index for work in the afternoon sun adds around 2–3°C to the in-shade WBGT (see Appendix II for further details). The data are based on historical observations and on estimates obtained using the RCP2.6 climate change pathway, which envisages a global average temperature rise of 1.5°C by the end of the century.

Source: ILO estimates based on data from the ILOSTAT database and the HadGEM2 and GFDL-ESM2M climate models.

International Labour Organization. Working hours lost to heat, by sector and country.

As per the ILO study, by 2050, Canadian cities will be experiencing summer days that are up to 4 degrees Celsius hotter than present. The ILO also stated that cooling requirements for buildings will increase by 400% by 2050 affecting workers who work in offices, healthcare facilities, community centres and numerous other types of buildings.

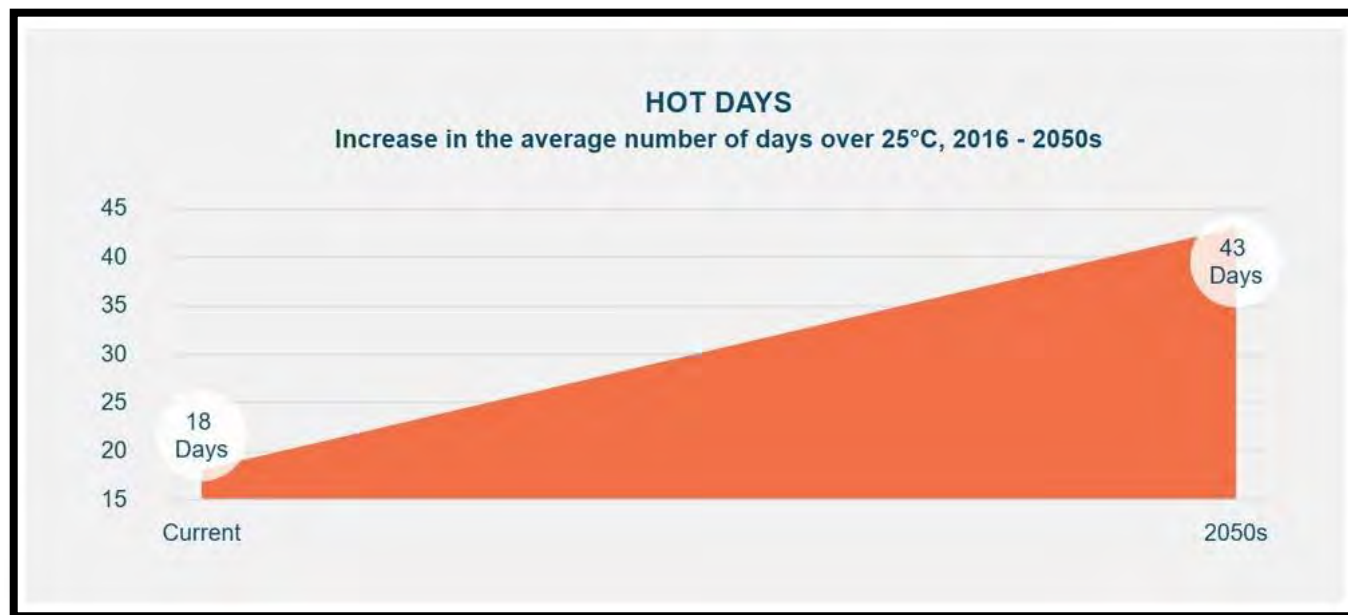
There will be more than a 23% increase in consecutive dry days per year by 2050. As per the City of Vancouver Climate Change Adaptation Strategy:⁸³

“Regional climate predictions expect twice as many summer days above 25°C in the 2050s than today.

⁸³ City of Vancouver. Climate Change Adaptation Strategy. Retrieved June 03, 2022 from <https://vancouver.ca/green-vancouver/climate-change-adaptation-strategy.aspx>

Our annual average temperature is warming. In the 2050s, our region will have twice as many summer days above 25°C compared to today. With hotter, drier summers, and decreasing snowpack on local mountains, water conservation will become increasingly important.”

The following figure from the same report shows an average increase in days with temperatures above 25 degrees Celsius from 18 days to 43 days.



Increase in the average number of days over 25°C, 2016 - 2050s

The City of Vancouver Climate Adaptation Strategy and the OHCOW websites (see below) show the potential changes to Vancouver and Canada as well as provide tools for workers.

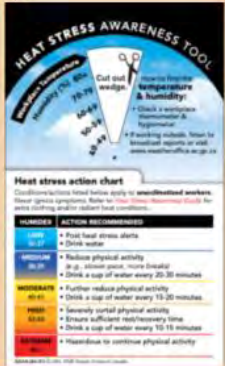

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Heat stress can lead to heat-related illness, disability and even death. Explore this toolkit to learn more about how you can prevent heat stress.







Many cities across B.C. recorded the hottest days of their histories during the 'heat dome' heatwave that blanketed much of the Pacific Northwest at the end June, 2021. (Black Press Media file photo)

B.C. launches heat alert system following 2021's deadly heat dome

System to have 2 levels: warning and extreme heat emergencies

JANE SKRYPNEK / Jun. 6, 2022 1:53 p.m. / NEWS

Public Safety and Solicitor General
Government launches preparedness plan for heat events, heat alert

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News Release

Victoria
Monday, June 6, 2022 1:28 PM

The Province is launching the BC Heat Alert and Response System (BC HARS) to help ensure people, First Nations communities and local governments have the tools they need to stay safe during heat events.

BC HARS includes two categories of heat events: heat warnings and extreme heat emergencies. In the event of a heat warning or extreme heat emergency, the provincial government and local authorities will take appropriate actions based on their individual heat plans and processes.

Government of BC. See <https://news.gov.bc.ca/releases/2022PSSG0035-000904>



Sample municipal health response plan.

As per reports and recommendations to municipalities:⁸⁴

“Environment Canada projects that by the latter part of this century, Toronto will average 65 days per year where the temperature exceeds 30°C, more than four times the historic average between 1961 and 1990. This represents a critical concern that will disproportionately impact the health and wellbeing of the city’s more vulnerable populations.”

The increase in temperature is one of the more obvious hazards to workers (including indoor workers without access to air conditioning). There are a number of additional factors that can magnify the effects of heat exposure on workers. These include:

- Age – The ability to tolerate heat diminishes in workers over 45 years of age. The metabolism in older workers takes longer to return to normal
- Pre-existing conditions - Workers with health problems such as heart disease and hypertension, workers who are overweight and workers who take certain medications such as heart failure and hypertension medications
- Clothing and personal protective equipment that magnify the effects of thermal injury

As stated previously, the Southern Canadian prairies and the interior of BC will be at a higher risk for drought in the future.⁸⁵ There have been declines in summer (June–August) streamflow in four BC rivers due to smaller late-spring snowpacks. This is expected to worsen.⁸⁶ Summer water flow in the Fraser River is expected to decline as well.

⁸⁴ Government of Canada. Adapting to Climate Change. Retrieved June 03, 2022 from <https://www.nrcan.gc.ca/climate-change/impacts-adaptations/adapting-climate-change-introduction-canadian-municipalities/10079> and <https://www.canada.ca/en/environment-climate-change/services/climate-change/adapting/plans.html>

⁸⁵ Government of Canada. Canada’s Changing Climate Report. (CCCR 2019). Retrieved June 03, 2022 from https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR_FULLREPORT-EN-FINAL.pdf and <https://www.canada.ca/en/environment-climate-change/services/science-technology/canadas-changing-climate-report.html>

⁸⁶ Government of Canada. Canada’s Changing Climate Report. (CCCR 2019). Retrieved June 03, 2022 from https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR_FULLREPORT-EN-FINAL.pdf and <https://www.canada.ca/en/environment-climate-change/services/science-technology/canadas-changing-climate-report.html>

The Columbia and Peace rivers are expected to have increased run-off (which further supports that climate change will have extreme regional variations). As per the Government of Canada, the greatest snow loss across Canada during the 2020–2050 period is projected to occur in the shoulder seasons (October–November and May–June).

“Seasonal snow accumulation decreased by a rate of 5% to 10% per decade across most of Canada (1981–2015), with the exception of southern Saskatchewan, Alberta, and British Columbia (increases of 2% to 5% per decade).” (With the exception of the Metro Vancouver area which is expected to see a significant decrease.)

And,

“A reduction of 5% to 10% per decade in seasonal snow accumulation (through 2050) is projected across much of southern Canada.”⁸⁷

The UN’s Intergovernmental Panel on Climate Change has warned for a decade that wildfires, drought, severe weather, such as BC’s deadly heat dome⁸⁸ in June 2021 and flooding would become more frequent and more intense because of the climate crisis. In August 2021, it issued a “code red” for humanity.⁸⁹

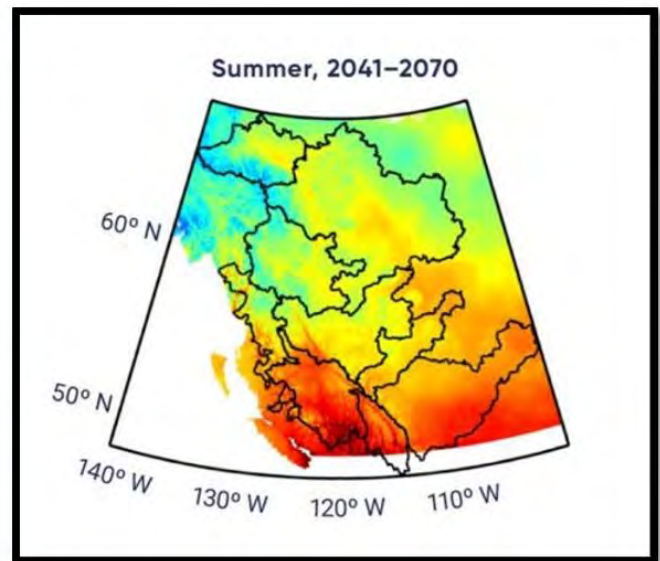


⁸⁷ Government of Canada. Canada’s Changing Climate Report. (CCCR 2019). Retrieved February 10, 2020 from https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR_FULLREPORT-EN-FINAL.pdf

⁸⁸ CTV News Vancouver. Emergency Alert System in B.C. to be in place for extreme heat. Retrieved June 03, 2022 from <https://bc.ctvnews.ca/emergency-alert-system-in-b-c-to-be-in-place-for-extreme-heat-in-june-minister-1.5903158>

⁸⁹ Crawford, T. Vancouver Sun. (May 28, 2022). Retrieved June 03, 2022 from <https://vancouversun.com/news/local-news/climate-news-to-may-29>

As per the Government of Canada projections for annual precipitation changes over the longer term in BC (with red indicting much drier conditions)⁴¹



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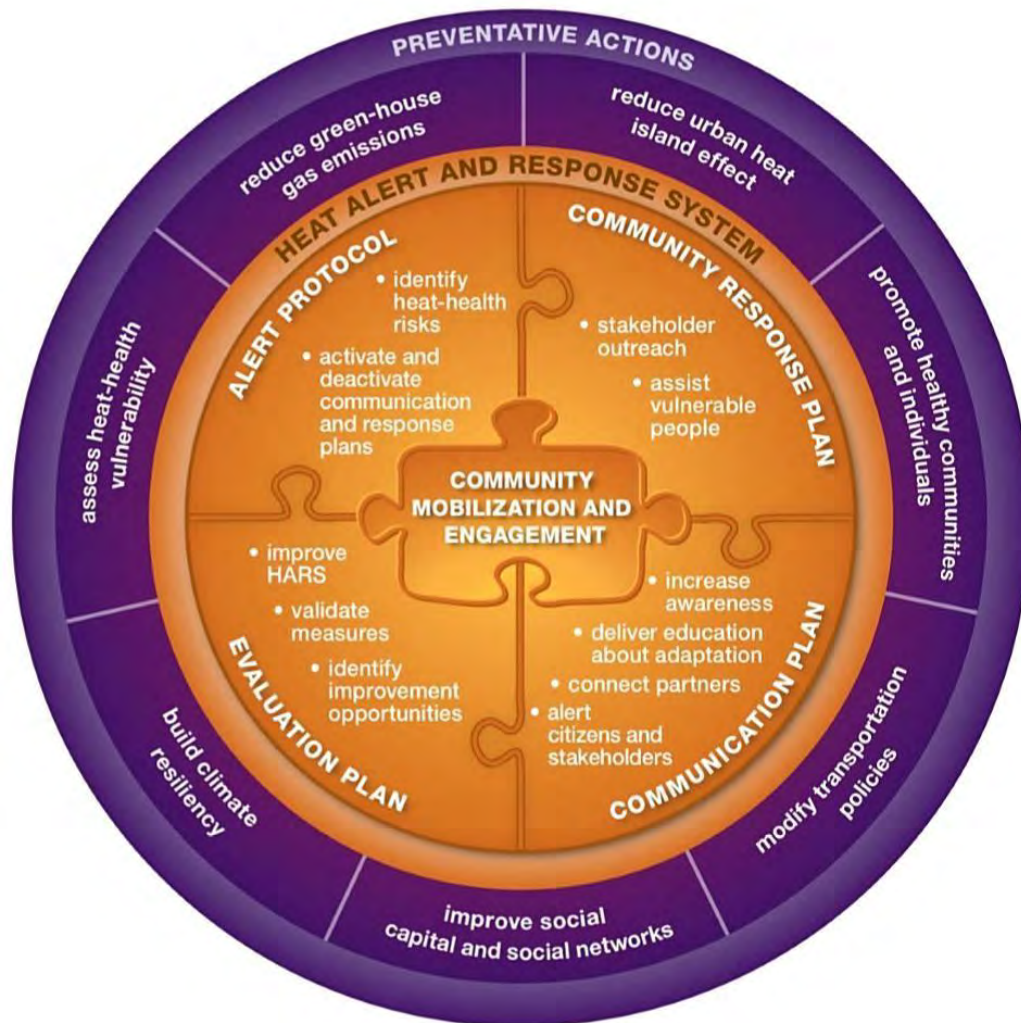
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Journal articles

Association between high ambient temperature and acute work-related injury: a case-crossover analysis using workers' compensation claims data

Institute for Work & Health. Journal Articles. See <https://www.iwh.on.ca/journal-articles/association-between-high-ambient-temperature-and-acute-work-related-injury-case-crossover-analysis-using-workers-compensation-claims-data>

The Municipal Heat Response Planning in British Columbia⁹⁰, Canada, advocated for the new heat alert and response systems (“HARS”). Health Canada outlined the recommended elements of a HARS program as per the following figure (which focuses on the public as opposed to workers but can be adapted):



⁹⁰ McKee, J., Chen, T., & Kosatsky, T. (2017). Municipal Heat Response Planning in British Columbia, Canada. BC Centre for Disease Control. Retrieved February 19, 2020 from <http://www.bccdc.ca/resource-gallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/Health-Environment/BC%20Municipal%20Heat%20Response%20Planning.pdf>

As of the study date, only six municipalities have formalized heat response plans, although they contained a number of deficiencies that need to be addressed.

There are a number of components to heat response planning. As per the Municipal Heat Response Planning in British Columbia, Canada:⁹¹

“Surrey began the planning process for its Climate Adaptation Strategy in 2011, using a five-milestone approach facilitated by the International Council for Local Environmental Initiatives (ICLEI): initiate, research, plan, implement and monitor. The strategy was developed through consultation with an “adaptation team” comprised of representatives from City Departments. Following research into potential climate impacts and risk stratification, municipal actions were categorized based on type of impact (Ex. infrastructure, ecosystems, human health and safety etc.).”

And,

“The City of Vancouver developed a comprehensive strategy to prepare for and respond to extreme weather events in response to a publicized hot weather death in 2009. This strategy was guided by an Extreme Hot Weather Committee, comprised of representatives from City departments, as well as Vancouver Coastal Health, BC Housing, the Greater Vancouver Shelter Strategy and the Coroner’s Office. The development process produced a set of Initial Response Guidelines (IRG), most recently updated in March 2016. These IRGs include both preparedness activities prior to the heat season, as well as an emergency protocol to be triggered in response to extreme heat.” (This was in addition to the City of Vancouver Climate Change Adaptation Strategy.)

⁹¹ McKee, J., Chen, T., & Kosatsky, T. (2017). Municipal Heat Response Planning in British Columbia, Canada. BC Centre for Disease Control. Retrieved February 19, 2020 from <http://www.bccdc.ca/resource-gallery/Documents/Guidelines%20and%20Forms/Guidelines%20and%20Manuals/Health-Environment/BC%20Municipal%20Heat%20Response%20Planning.pdf>

And,

“North Shore Emergency Management (NSEM) is an inter-municipal agency shared between the City of North Vancouver, District of North Vancouver and District of West Vancouver that provides emergency management services. The 2016 North Shore Extreme Heat Initial Response Guideline (IRG) developed by the agency did not describe the planning process. The North Shore Extreme Heat IRG is primarily focused on informing emergency response activities within the first 4-6 hours following alert of an extreme heat event.

The protocol will be triggered on request of a medical health officer, likely following a Heat Health Warning from the health authority occurring “when the average of the day’s 2pm temperature and the next day’s high is greater than or equal to 34C at Abbotsford or 29C at YVR”.”

The US will experience much more severe climate change impacts. By the end of this century Chicago may have over 60 days of temperatures over 100 degrees Fahrenheit. The Southern half of the US may see more than a 30% reduction in work hours due to extreme heat.⁹²

Responses to thermal injury must consider a variety of demographic groups: older workers, workers with pre-existing health conditions such as cardiovascular and respiratory conditions and members of the public (as workers may have to assist in the event of heat related health issues). For a detailed list of heat related health impacts see Appendix F.

⁹² (No author). 4th National Climate Assessment. Retrieved February 26, 2020 from <https://nca2018.globalchange.gov/>

The Health of Canadians in a Changing Climate (2022) report (figure 3.4.2. at page 132), provides a number of impacts on health from heat.⁹³

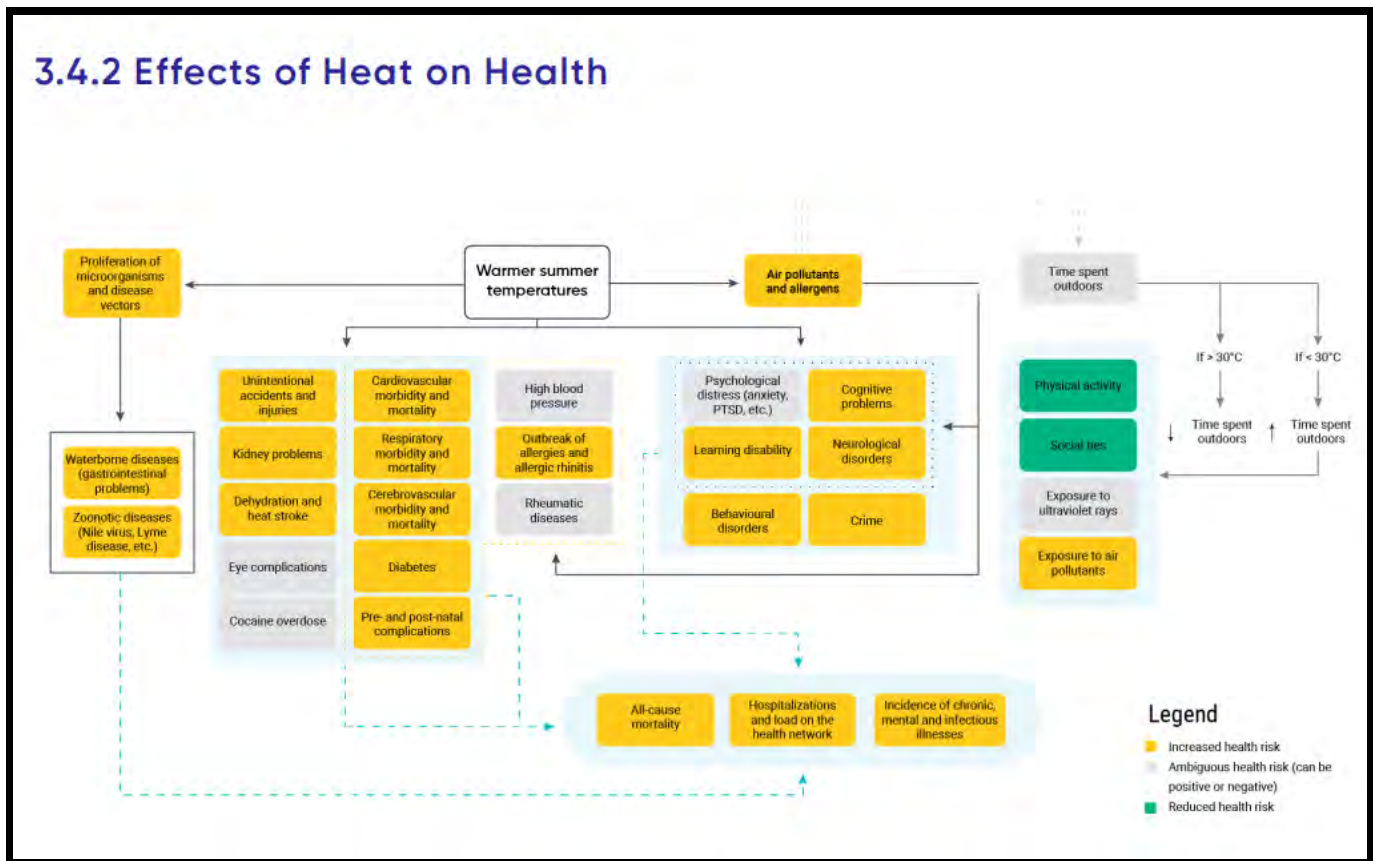


Figure 3.4.2 Effects of Heat on Health from The Health of Canadians in a Changing Climate.

According to meta-analyses, every one-degree increase in temperature increases mortality rates by 2% to 5%, cardiovascular illness rates by 3.4% and respiratory illness rates by 3.6% among older persons.⁹⁴

⁹³ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

⁹⁴ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

People who are at increased risk to heat are also among those most at risk of hospitalization and death due to COVID-19: older persons and people with one or more chronic health condition, such as cardiovascular, pulmonary or kidney disease, high blood pressure or obesity.⁹⁵ Reporting of health problems was 5.6 times higher for people aged 65 and over.⁹⁶

Jobs requiring work outdoors, or in environments conducive to heat accumulation, place workers at higher risk of heat related injuries.⁹⁷ The risk of injuries is not influenced by the type of task e.g. manual vs. non-manual tasks.

Heat related injuries are more frequent for men and younger workers.

Men appear to be more at risk from the impacts of heat. Quebec men aged 45 to 64 had a higher risk of hospitalization due to ischemic heart disease during extreme heat events.⁹⁸

In the provinces of Quebec, Ontario, Manitoba, Saskatchewan and Alberta (from 2001 to 2016) each 1°Celsius increase in the maximum daily summer temperature increased the number of daily heat related illness claims (e.g. from syncope, heat exhaustion, heatstroke) from occupational health and safety compensation agencies by 28% to 51%, depending on the province and the meteorological heat indicator.⁹⁹

Heat stroke symptoms can be confused with COVID-19 symptoms, such as muscle pain, headache, unusual fatigue or exhaustion, generalized discomfort, difficulty breathing, vomiting or nausea and fever or an increase in body temperature.

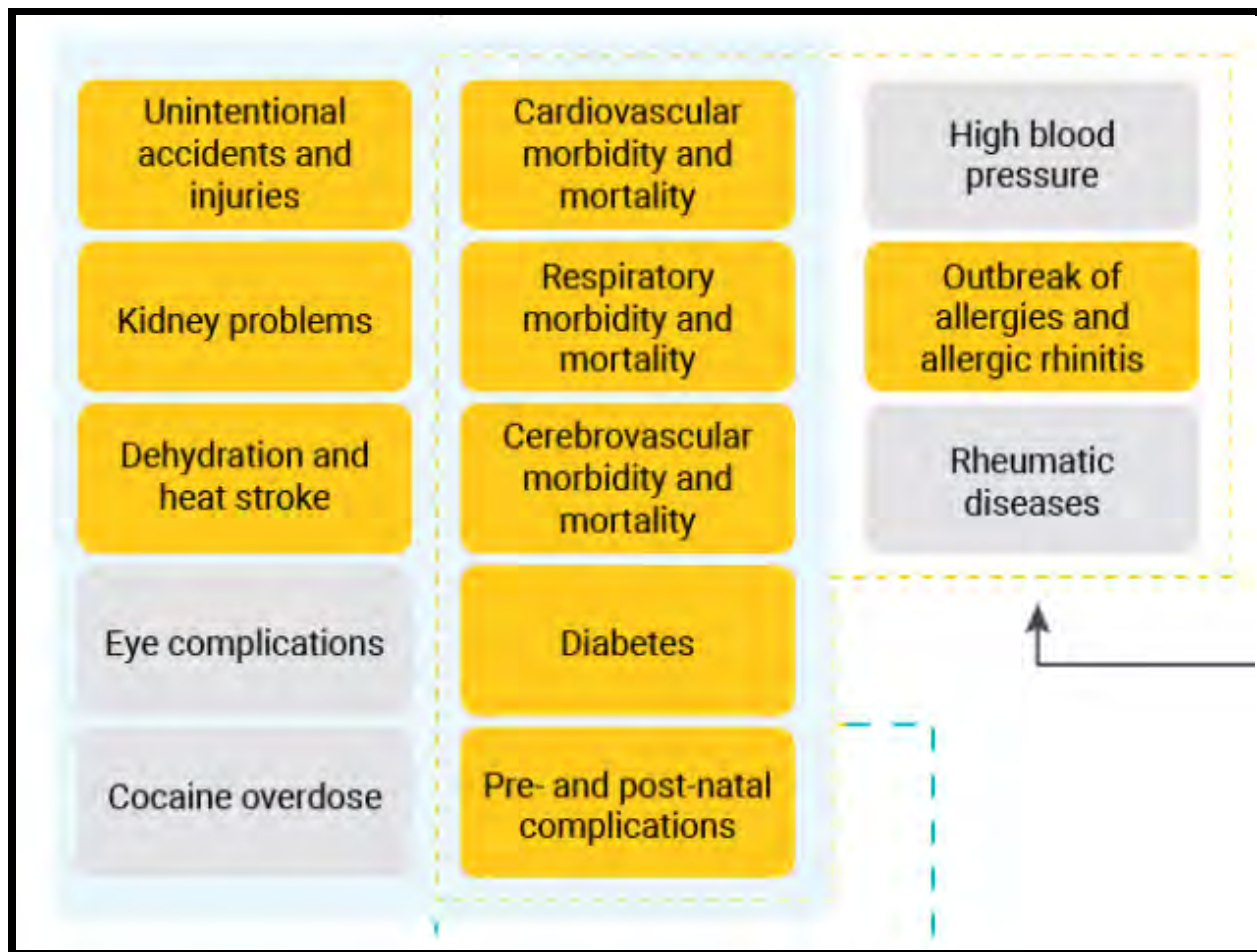
⁹⁵ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

⁹⁶ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

⁹⁷ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

⁹⁸ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

⁹⁹ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



Section of figure 3.4.2. from Health of Canadians in a Changing Climate.

Droughts caused by higher temperatures can cause and exacerbate allergic and respiratory symptoms and promote the spread of infectious diseases. Related respiratory diseases include bronchitis, sinusitis, pneumonia and asthma.¹⁰⁰

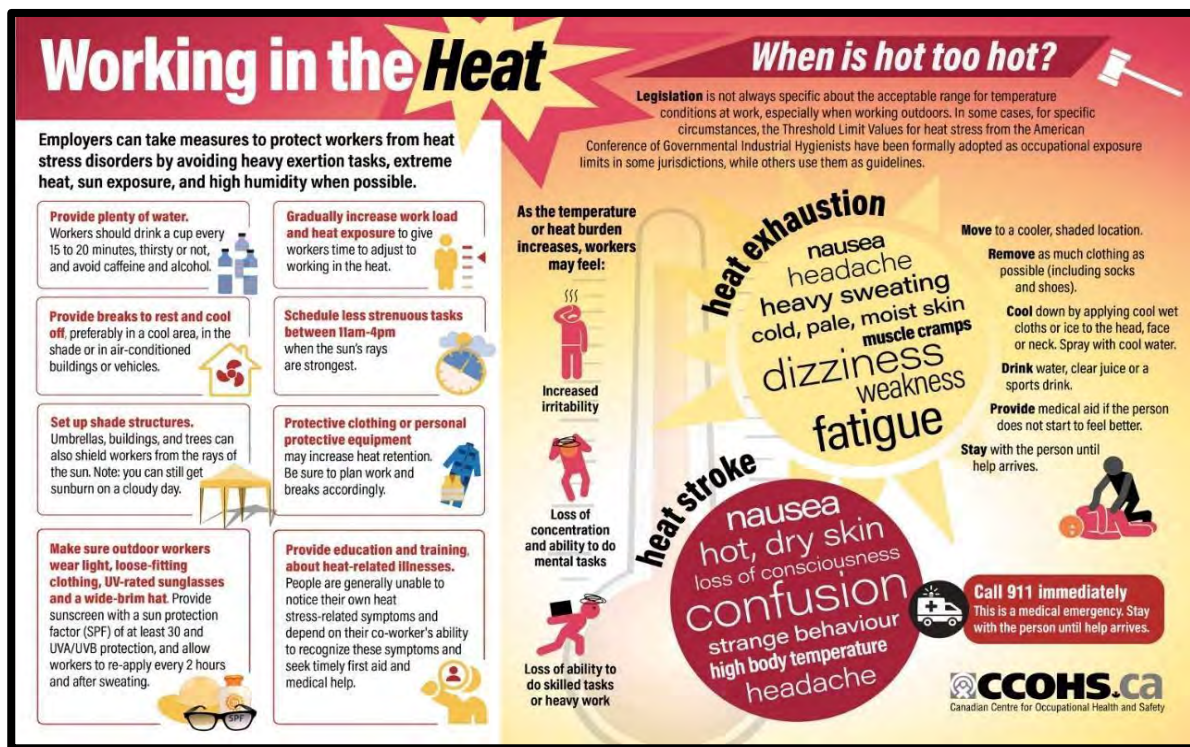
Droughts can increase pathogen concentrations in water and facilitate the transport of organic matter to water bodies during subsequent rainfall.¹⁰¹

¹⁰⁰ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

¹⁰¹ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

Health and safety measures to address heat include longer rest periods, more worker turnover and better monitoring of worker hydration or level of physical effort are effective in decreasing the effects of heat on workers (Xiang et al., 2014; Varghese et al., 2018).¹⁰²

A growing threat to health in Northern communities is permafrost melting due to increased temperatures. Permafrost currently covers 40% of Canada's landmass, but this area is expected to decrease by between 16% to 20% by 2090. This Guide does not address the impacts on workers for this Region.¹⁰³ Melting permafrost may release infectious diseases from frozen wildlife carcasses and heavy metals such as mercury that can threaten the health of workers.¹⁰⁴



CCOHS Working in the Heat Poster.

¹⁰² Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

¹⁰³ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

¹⁰⁴ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



II.III. Ultraviolet / Solar Radiation (including UV A, B and C):

Solar radiation is the most important cause of skin cancer and the most common cancer worldwide. There are associations between solar radiation and melanoma of the eye and non-Hodgkin lymphoma.¹⁰⁵ With ozone depletion, the hazards and risks from ultraviolet radiation / solar radiation (“UV”) are increasing across Canada. Outdoor workers are at particular risk from the combination of high levels of UV radiation combined with an increasing number of hot days.¹⁰⁶ UV A, B and C are classified as carcinogenic to humans (Group 1) by the International Agency for Research on Cancer. Short term exposure may lead to sun burns. Longer term exposure may lead to cancers such as basal and squamous cell carcinomas.¹⁰⁷ Long term exposure risks to UV radiation include melanoma, a dangerous and often lethal form of cancer; eye diseases including pterygium, cataracts and macular degeneration. Exposure to solar radiation can occur via skin or eyes.

¹⁰⁵ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

¹⁰⁶ CAREX Canada. Retrieved June 03, 2022 from <https://www.carexcanada.ca/>

¹⁰⁷ CAREX Canada. Solar UV Radiation Occupational Exposures. Retrieved February 18, 2020 from https://www.carexcanada.ca/profile/uv_radiation_solar-occupational-exposures/

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.¹⁰⁸ Approximately 416,000 workers are exposed to solar radiation in the construction sector.¹⁰⁹ The occupations with the largest number of exposed workers in this sector include construction. As per Peters et al. (2019),¹¹⁰ only 14% of outdoor workers experienced acceptable levels of UV radiation. Up to 10% of outdoor workers were exposed to more than 10 times the acceptable limit of UV radiation. They stated that the mean personal UV dose was 4.5 SED (cumulative standard erythral dose unit of measurement) which was much higher than the recommended SED of 1.33.^{111,112}

The Global Solar UV Index (“UVI”) is a tool created by the World Health Organization, the World Meteorological Organization, the United Nations Environment Programme and the International Commission on Non Ionizing Radiation Protection and is used to describe the level of solar UV radiation at the Earth’s surface. It is classified in 5 categories from 0 to > 11 where: ≤ 2 are considered low, 3-5 moderate, 6-7 high, 8-10 very high and ≥ 11 extreme. Utility workers had double the exposure of municipal workers – 10.4 SED versus 5.5 SED. These levels of exposure are expected to increase over time due to climate change.

In Vancouver, 49% of outdoor workers aged 16 to 24 reported spending at least four hours per day in the sun. Up to 37% of workers over the age of 45 spent at least four hours a day in the sun.¹¹³ Thermal injury caused by climate change is impacting CUPE members.

¹⁰⁸ CAREX Canada. Retrieved June 03, 2022 from <https://www.carexcanada.ca/>

¹⁰⁹ CAREX Canada. Retrieved June 03, 2022 from <https://www.carexcanada.ca/>

¹¹⁰ Peters, C.E., Pasko, E., Strahlendorf, P., Linn Holness, D., & Tenkate, T. (2019). Solar Ultraviolet Radiation Exposure among Outdoor Workers in Three Canadian Provinces. *Annals of Work Exposures and Health*, Volume 63, Issue 6, July 2019, Pages 679–688. Retrieved February 19, 2020 from <https://doi.org/10.1093/annweh/wxz044>

¹¹¹ Sun Safety at Work. Retrieved February 18, 2020 from <https://sunsafetyatwork.ca/>

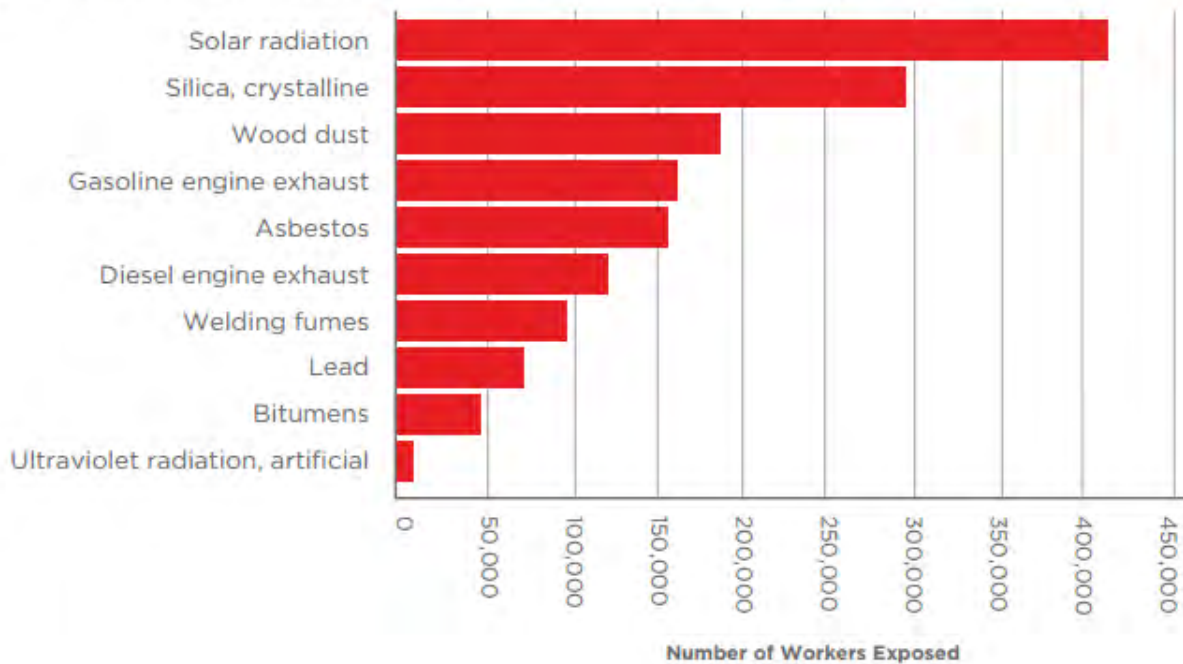
¹¹² While there are no explicit occupational exposure limits for solar UVR exposure in Canada, international regulations and guidelines exist and are based on the limit of 30 Joules / square meter, divided by the effective irradiance. For acute skin damage, the ICNIRP guideline for the maximum efficient radiant exposure equates to approximately 1 to 1.3 SED (ICNIRP, 2010)

¹¹³ Peters, C.E., Demers, P.A., Kalia, S., Nicol, A.M., & Kohoorn, M. (2016). Levels of Occupational Exposure to Solar Ultraviolet Radiation in Vancouver, Canada. *The Annals of Occupational Hygiene*, Volume 60, Issue 7, August 2016, Pages 825–835. Retrieved February 19, 2020 from <https://academic.oup.com/annweh/article/60/7/825/2196245>

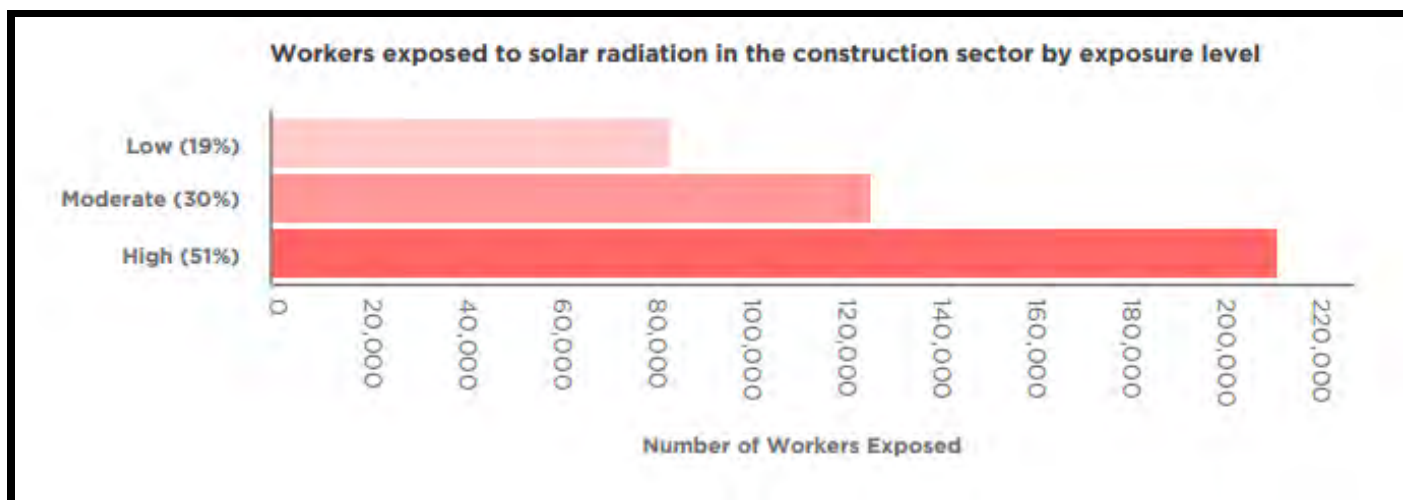
Estimates of prevalent exposures

CAREX Canada estimates of the number of workers exposed to carcinogens in the construction sector are summarized in Figure 1. They include solar radiation, crystalline silica, wood dust, asbestos, and diesel engine exhaust. Exposure level estimates, where available, are summarized in the Carcinogen Profiles below.

Figure 1. Top 10 prevalent carcinogen exposures for the construction sector, CAREX Canada Database, 2016



CAREX Table on Estimates of prevalent exposures 2016.



CAREX Canada. Estimates of prevalent exposures. Construction sector.



CCOHS Sun Safety Infographic.

As per CAREX Canada:¹¹⁴

“Exposure to solar radiation (UV) is defined broadly as physical exposure at work to the sun that is likely to exceed typical non-occupational exposure (not including heavy recreational sunbathers).”

“Category 1: Low Exposure

A group of workers (people in the same job category) is put in this exposure category if job description websites and literature review shows that outdoor work is uncommon for the job title.

Category 2: Moderate Exposure

A group of workers is put in this exposure category if:

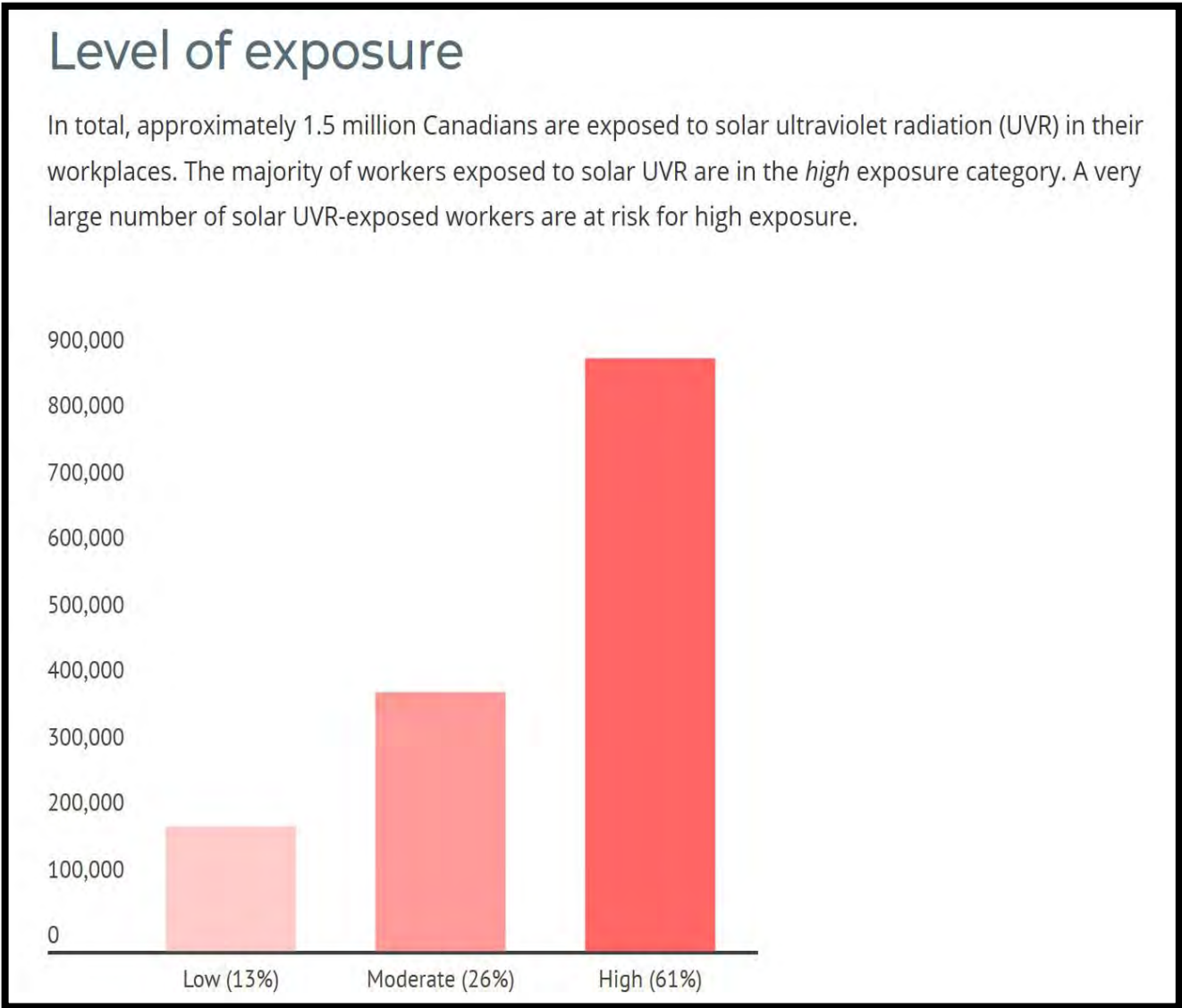
1. A job entails both indoor and outdoor work, and all workers in that job are required to work outdoors at least some of the time, OR
2. A job has some people who work outdoors and some who work indoors.

Category 3: High Exposure

A group of workers is put in this exposure category if they are expected to be outside ≥75% of their workday. These workers were identified using occupational skin cancer prevention tools used to target workers at high risk of exposure to the sun’s rays.”

¹¹⁴ CAREX Canada. Solar UV Radiation Occupational Exposures. Retrieved February 18, 2020 from https://www.carexcanada.ca/profile/uv_radiation_solar-occupational-exposures/

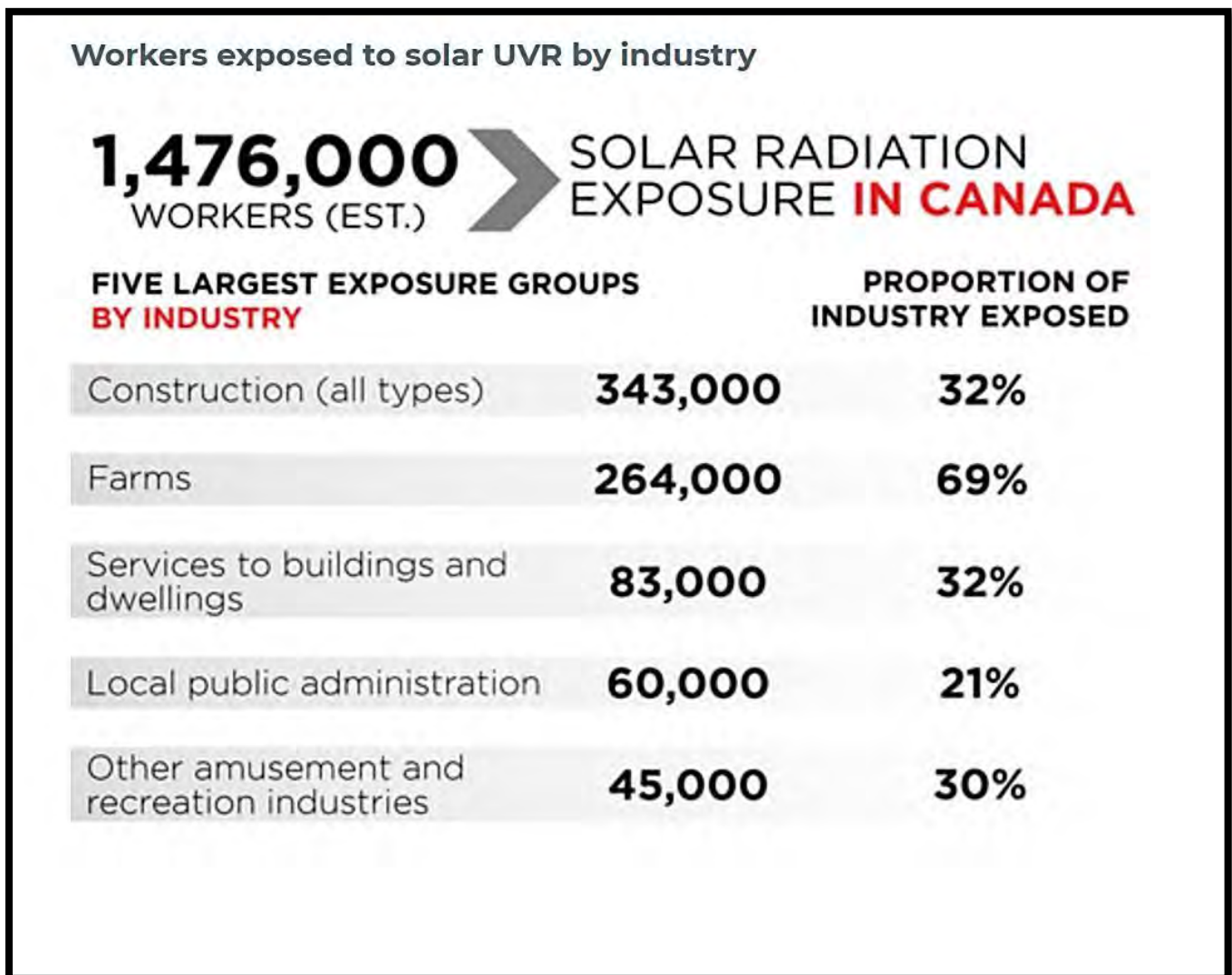
As per CAREX Canada:¹¹⁵



CAREX Graph on Level of Exposure (to ultraviolet radiation).

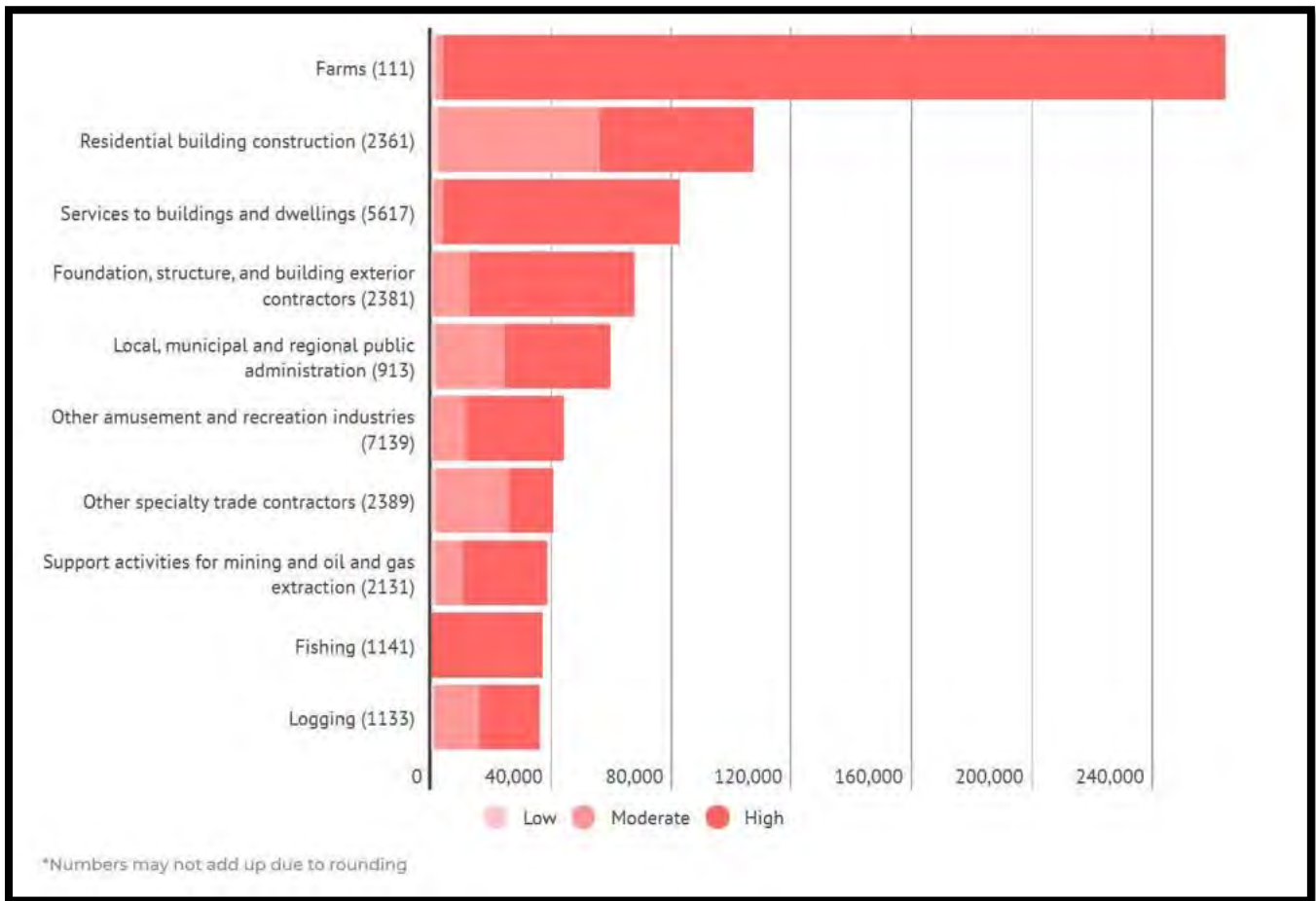
¹¹⁵ CAREX Canada. Solar UV Radiation Occupational Exposures. Retrieved February 18, 2020 from https://www.carexcanada.ca/profile/uv_radiation_solar-occupational-exposures/

CAREX has identified UV exposure by sector and type of occupation.¹¹⁶



CAREX Figure on Workers exposed to solar UVR by industry.

¹¹⁶ CAREX Canada. Solar UV Radiation Occupational Exposures. Retrieved February 18, 2020 from https://www.carexcanada.ca/profile/uv_radiation_solar-occupational-exposures/



CAREX figure on solar radiation exposure in Canada by industry.

UV exposure depends on many factors. These include, non-exhaustively:

- Season
- Time of day
- Including latitude
- Weather and cloud cover
- Altitude
- Surface reflection
- Time spent outdoors
- Work duties

- Shade
- Personal protective equipment
- Other sun protection e.g. sunscreen
- Age

With climate change, each variable may be affected differently. Site and occupation specific hazard and risk assessments will need to occur.



CDC. Centers for Disease Control and Prevention. The National Institute for Occupational Safety and Health (“NIOSH”).

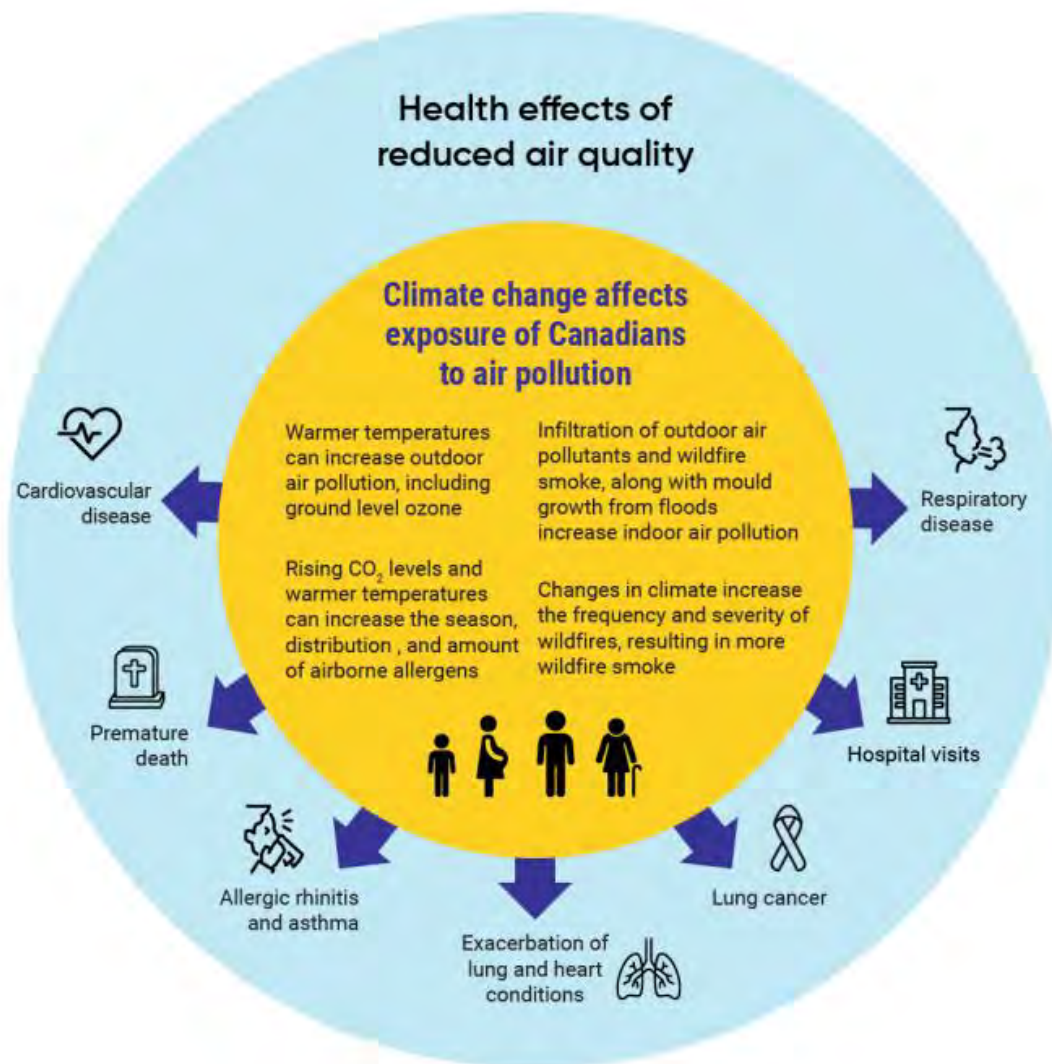


II.IV. Air Quality including Diminished Visibility:

The effects of increased exposure to air pollutants (including vehicle emissions such as diesel exhaust, industrial emissions, smoke from forest fires, etc.) are an increased incidence and aggravation of respiratory and cardiovascular diseases. Air quality, other than mould and pollen, can include the following harmful substances:

- “Smog” (fog or haze combined with smoke and other atmospheric pollutants)
- Ground-level ozone
- Volatile Organic Compounds (gases from certain organic solids or liquids, some of which may have short and long term adverse health effects)
- Airborne particulate matter including smoke and particulates from wildfires

There are many inter-related health effects from reduced air quality as per the report Health of Canadians in a Changing Climate (2022) figure below:¹¹⁷



¹¹⁷ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

Table of health effects as per the report Health of Canadians in a Changing Climate (2022):¹¹⁸

Overview of Climate-Related Health Impacts Associated with Air Quality		
HEALTH IMPACT OR HAZARD CATEGORY	CLIMATE-RELATED CAUSES	POSSIBLE HEALTH EFFECTS
Air quality	- Higher levels of airborne particulate matter related to smoke from wildfires - Increased ground-level ozone (and potentially particulate matter) due to warming - Higher levels of airborne particulate matter related to droughts - Increased mould and chemical contaminants in indoor environments due to flooding, effects on ambient air quality and increased releases from indoor sources of air pollution - Extended season and geographical distribution of pollen, and increased production of pollen by plants and trees - Warming and changes to precipitation affecting growth and ranges of air/aerosol or droplet-borne pathogens	- Air quality-related respiratory and cardiovascular disease and premature deaths - Exacerbation of chronic respiratory diseases, such as asthma and chronic obstructive pulmonary disease - Lung cancer - Development and exacerbation of allergies - Eye, nose, and throat irritation, and shortness of breath - Exacerbation of mental health impacts - Impacts on health infrastructures and services - Impacts on health and social services - Risks from infectious diseases acquired by inhalation from environmental sources (e.g., cryptococcosis)

¹¹⁸ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

The US Centers for Disease Control and Prevention states ground level ozone is an issue:¹¹⁹

“Ground-level ozone (a key component of smog) is associated with many health problems, such as diminished lung function, increased hospital admissions and emergency room visits for asthma, and increases in premature deaths.”

For a comprehensive Guide on air quality, see the CUPE BC Region Indoor, Outdoor and Forest Fire Guide 2020 at <https://www.cupe.bc.ca/committee/occupational-health-and-safety-committee/>. The Government of Canada Natural Air Pollution Surveillance (“NAPS”) Network states that ground-level ozone has multiple respiratory effects.

Significant associations exist between short term exposure to ozone and respiratory emergency room and hospital visits. The health effects associated with air pollutant exposure vary according to a number of factors, including environmental concentrations, exposure duration and respiratory rate.

Outdoor work performed over long periods of time and that requires heavy physical effort has a greater exposure to air pollutants e.g. public services, landscaping, horticulture, arboriculture and construction.

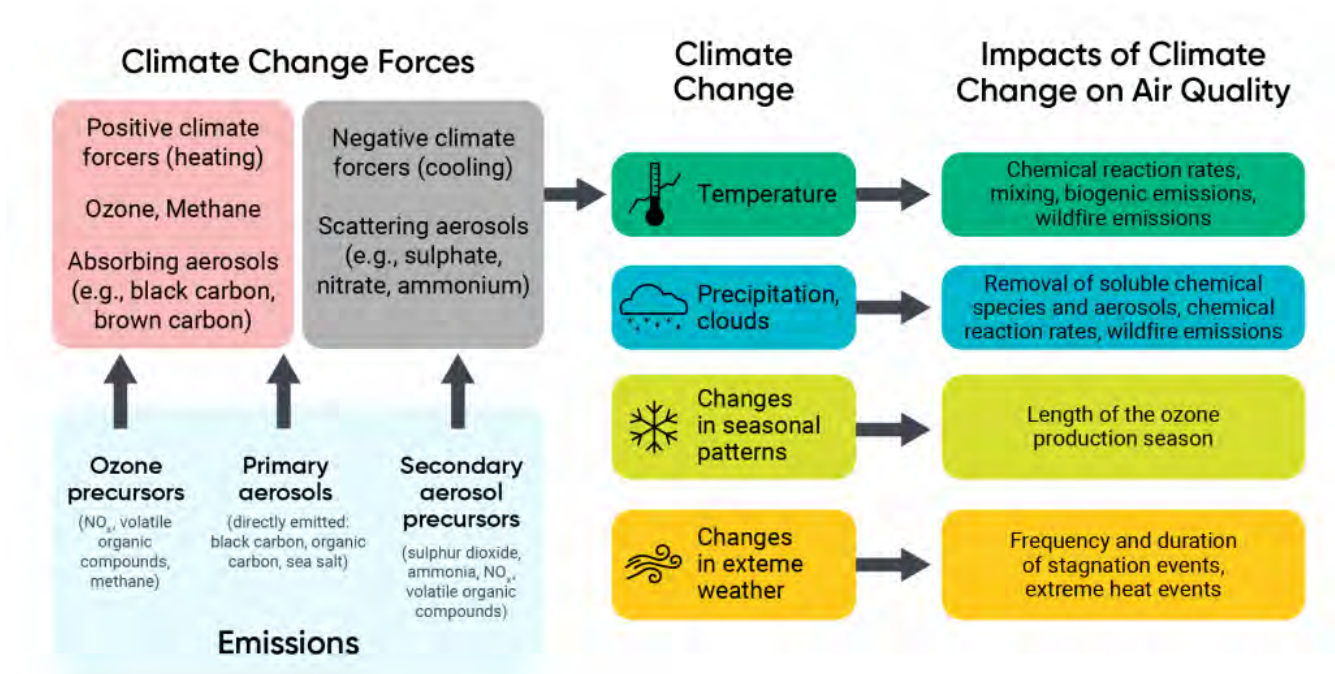
There is a direct relationship between higher temperatures and ozone. Increases in ozone concentrations occur with temperature for every degree above 22°C.¹²⁰

Wildfire emissions contain many different air pollutants, including PM, CO, NOX, methane, polycyclic aromatic hydrocarbons and VOCs, and contribute to the formation of ozone and secondary PM.

¹¹⁹ US Centers for Disease Control and Prevention. Air Pollution. Retrieved February 18, 2020 from https://www.cdc.gov/climateandhealth/effects/air_pollution.htm

¹²⁰ Protecting your Community from Climate Change. A Training Program for Ontario Municipalities. Retrieved February 17, 2020 from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://climateontario.ca/doc/ORAC_Products/CleanAirPartnership/CAP_Municipal_Adaptation_Training_Program.pdf

The Health of Canadians in a Changing Climate (2022) report provides a flow chart of the impact of climate change on air quality.¹²¹



NIOSH and the CDC have a number of resources available to workers (see next page).

¹²¹ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



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Building Ventilation

Construction and Renovation

Promoting productive workplaces through safety and health research



INDOOR ENVIRONMENTAL QUALITY



Overview

Indoor environmental quality (IEQ) refers to the quality of a building's environment

CDC. Centers for Disease Control and Prevention. The National Institute for Occupational Safety and Health (“NIOSH”).



II.V. Pollen and Other Allergens:

The increase in air temperatures and higher CO₂ concentrations are expected to promote expanded range of plants, earlier flowering periods, lengthen pollen seasons, increase the quantities of allergens produced, intensify allergenicity and a change in distribution areas. A Health Canada 2019 study confirmed the link between climate change and allergies. The pollen production season in the Northern hemisphere has increased by around fifteen days over the past three decades.¹²² As per the Government of Canada:¹²³

“The growing season, which starts when there are six consecutive days with daily mean temperature above 5°C in spring or summer and ends when this condition fails to be met late in the year, started earlier and ended later, resulting in an increase in growing season length of about 15 days between 1948 and 2016.”

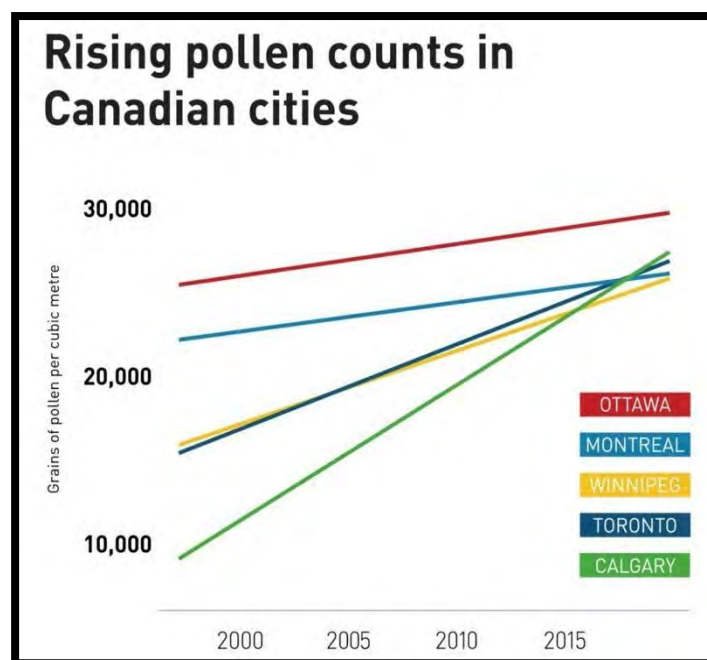
¹²² The Institut de recherche Robert-Sauvé en santé et en sécurité du travail (“IRSSST”). Retrieved February 09, 2020 from <https://www.irsst.qc.ca/media/documents/PubIRSSST/R-775.pdf>

¹²³ Government of Canada. Canada’s Changing Climate Report. (CCCR 2019). Retrieved February 09, 2020 from https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR_FULLREPORT-EN-FINAL.pdf

In Montréal the duration of the pollen season lengthened from 40 to 70 days a year.¹²⁴

A 2019 study published in the Lancet Planetary Health journal looked at 17 locations around the world and found more than 70% of the cities studied showed increases in annual pollen rates over several decades.¹²⁵

Data from Aerobiology Research which measures pollen for the Weather Network and others, found that birch pollen season increased by 60 days in Toronto between 2006 and 2017,¹²⁶ as an example.¹²⁷



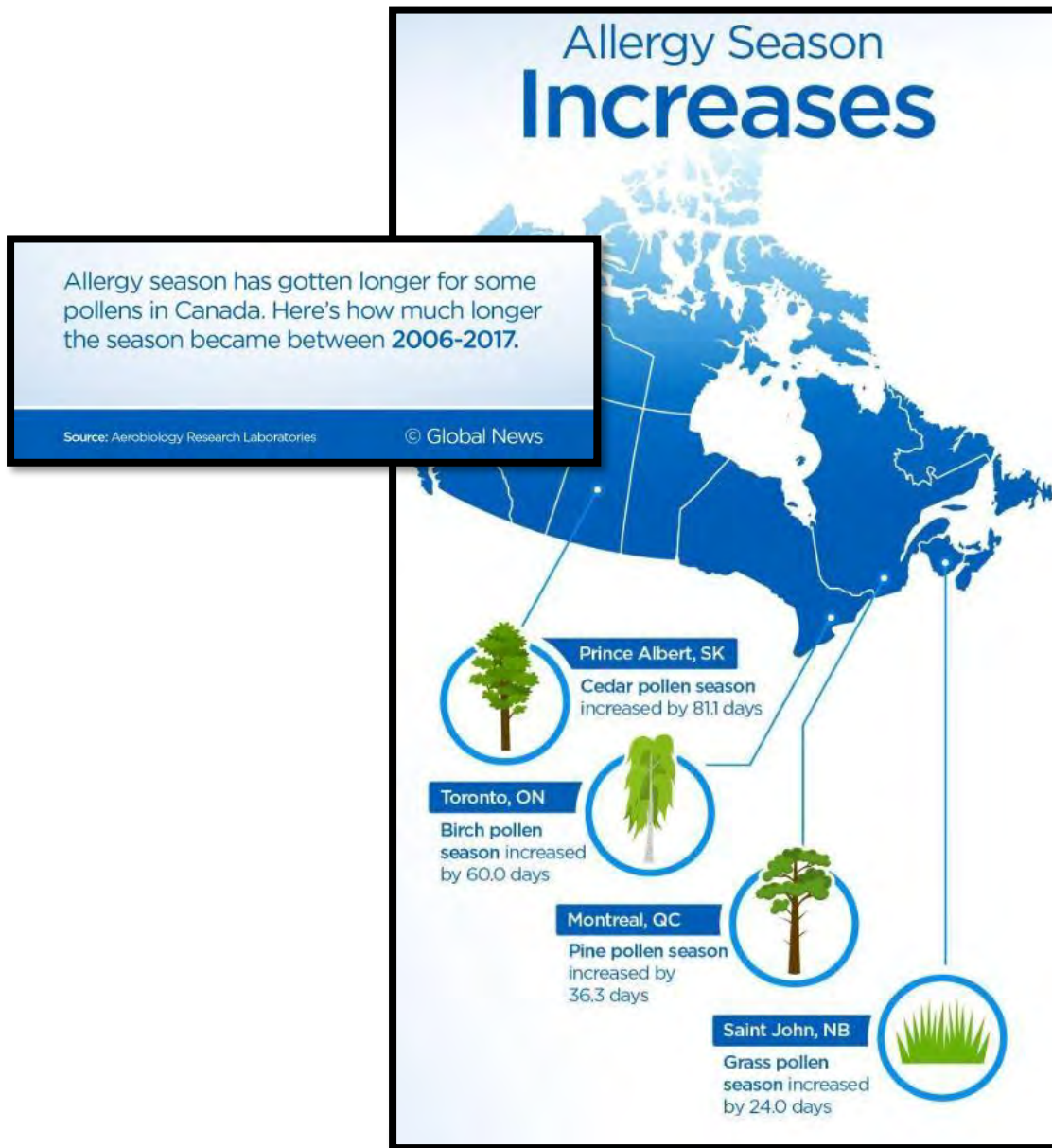
¹²⁴ Pelley, L. (August 29, 2019). "I actually had to call in sick": Why seasonal allergies are getting worse for city dwellers. *CBC News*. Retrieved February 12, 2020 from <https://www.cbc.ca/news/canada/toronto/cities-seasonal-allergies-symptoms-worsening-climate-change-1.5256496>

¹²⁵ Pelley, L. (August 29, 2019). "I actually had to call in sick": Why seasonal allergies are getting worse for city dwellers. *CBC News*. Retrieved February 12, 2020 from <https://www.cbc.ca/news/canada/toronto/cities-seasonal-allergies-symptoms-worsening-climate-change-1.5256496>

¹²⁶ Young, L. (December 07, 2018). Climate change means more disease, deaths for Canadians, Lancet report finds. (November 28, 2018). *Global News*. Retrieved February 18, 2020 from <https://globalnews.ca/news/4708944/climate-change-health-impacts-canada/>

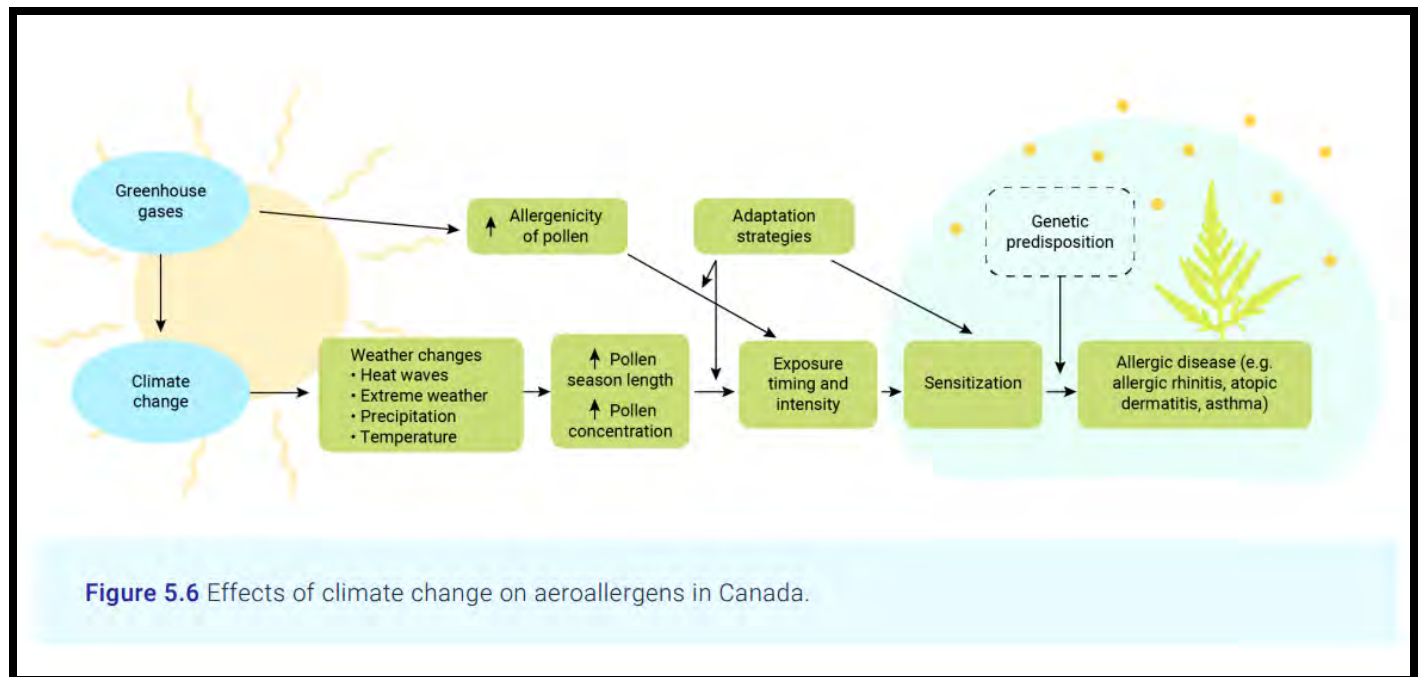
¹²⁷ Aerobiology Research Laboratories. See <https://www.aerobiology.ca/>

The following figure illustrates the extent of the problem in Central and Eastern Canada:¹²⁸

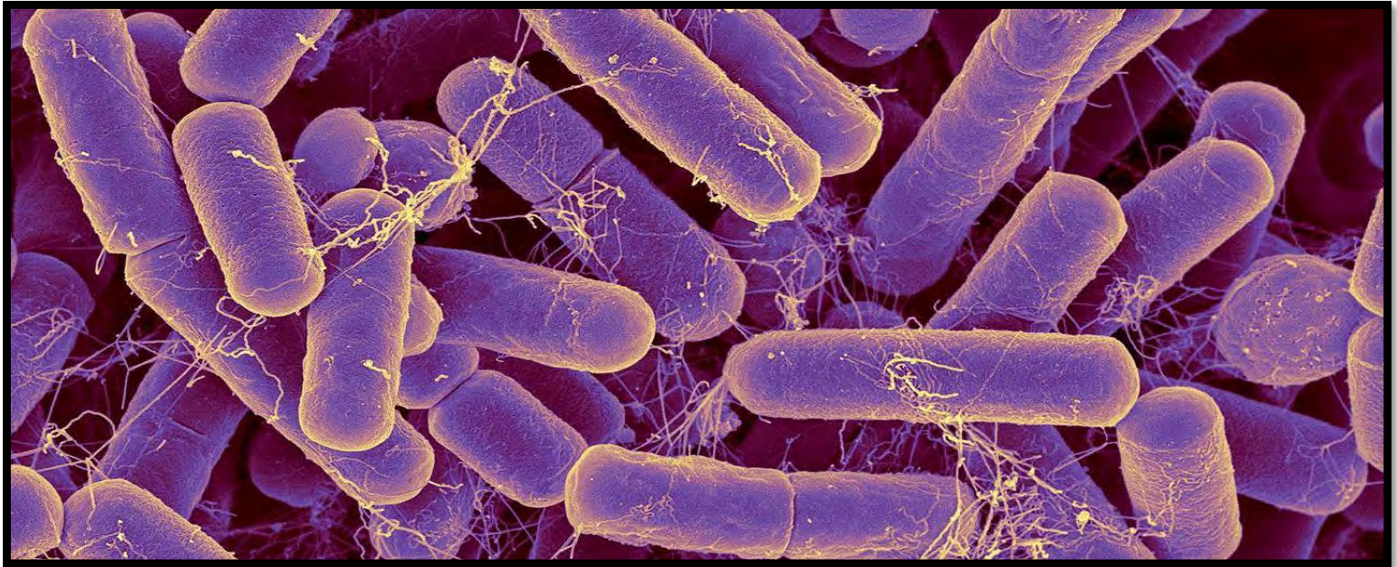


¹²⁸ Young, L. (December 07, 2018). Climate change means more disease, deaths for Canadians, Lancet report finds. (November 28, 2018). *Global News*. Retrieved February 18, 2020 from <https://globalnews.ca/news/4708944/climate-change-health-impacts-canada/>

There is a direct effect between climate change and pollen counts as per the report Health of Canadians in a Changing Climate (2022) figure below:¹²⁹



¹²⁹ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



II.VI. Pathogens (including Fungi, Viruses, Bacteria, Protozoa including Amoeba, Parasites):

II.VI.I. Overview:

Risk from infectious diseases is affected by three factors: presence of the disease, protective behaviours by individuals and people's sensitivity to the pathogen (which may be affected by their overall health and underlying health issues). Climate change is expected to affect all three of these factors directly or indirectly.¹³⁰ There are hundreds of different types of fungi, bacteria, viruses, protozoa, amoeba and parasites that may be impacted by climate change.¹³¹ The spread of diseases and the vectors for those diseases (mosquitos, ticks, fleas, etc.) across Canada is occurring.¹³²

¹³⁰ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

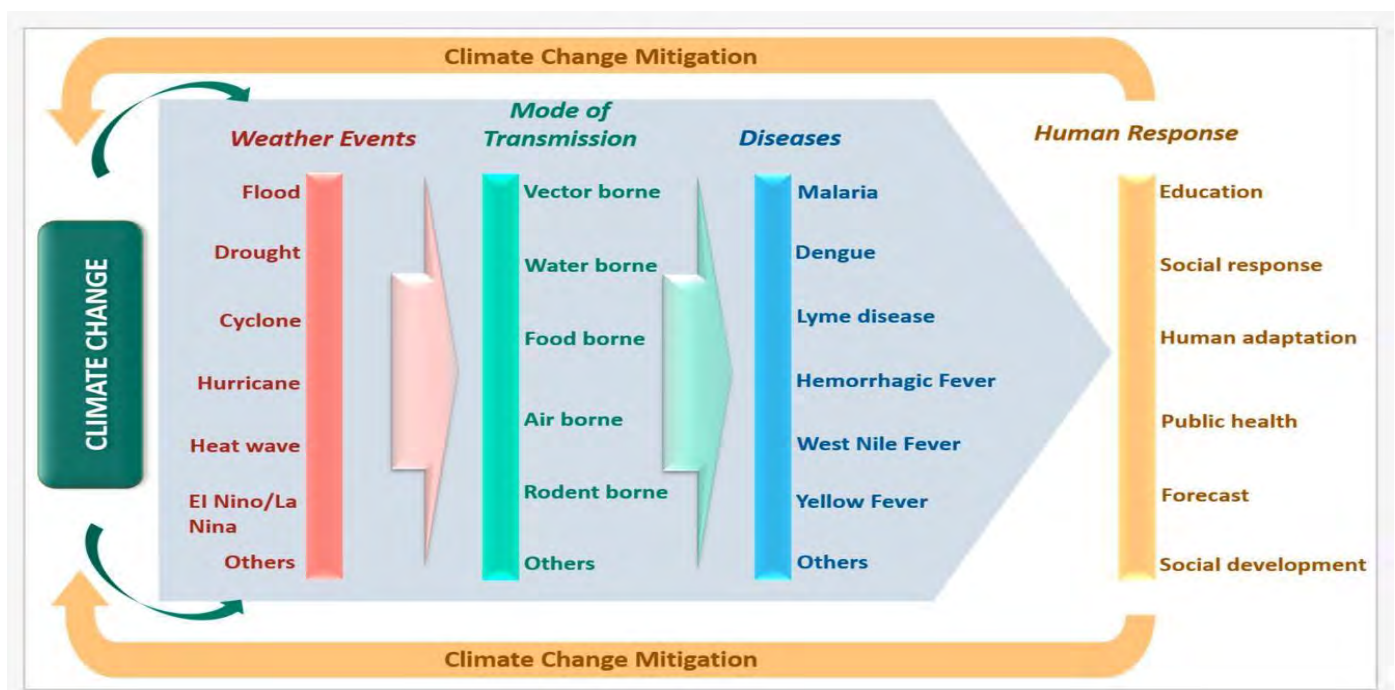
¹³¹ Infectious Disease and Climate Change in Canada: Key Informant Interviews. (September 2021). Canadian Public Health Association. Retrieved June 07, 2022 from https://www.cpha.ca/sites/default/files/uploads/resources/idcc/CPHA_IDCC_Key_informant_interviews.pdf

¹³² How Does a Changing Climate Impact the Health of Workers? Part 5: Vectorborne Disease. PubMed. Retrieved February 16, 2020 from <https://www.ncbi.nlm.nih.gov/pubmed/30540652>

There are distinct regional differences - the proportion of the human population in Eastern Canada inhabiting areas with established tick populations will increase from 18% in 2010 to over 80% in 2020.¹³³

There are very few studies on the increase in protozoa (e.g. amoeba) and parasites caused by climate change (an exception is red tides (algal blooms)). These are included for reference purposes only. Differences in exposure durations, sector, occupation, demographics, the presence of pre-existing conditions or co-morbid conditions and the precarity of work will also affect the impact of pathogens and vectors.

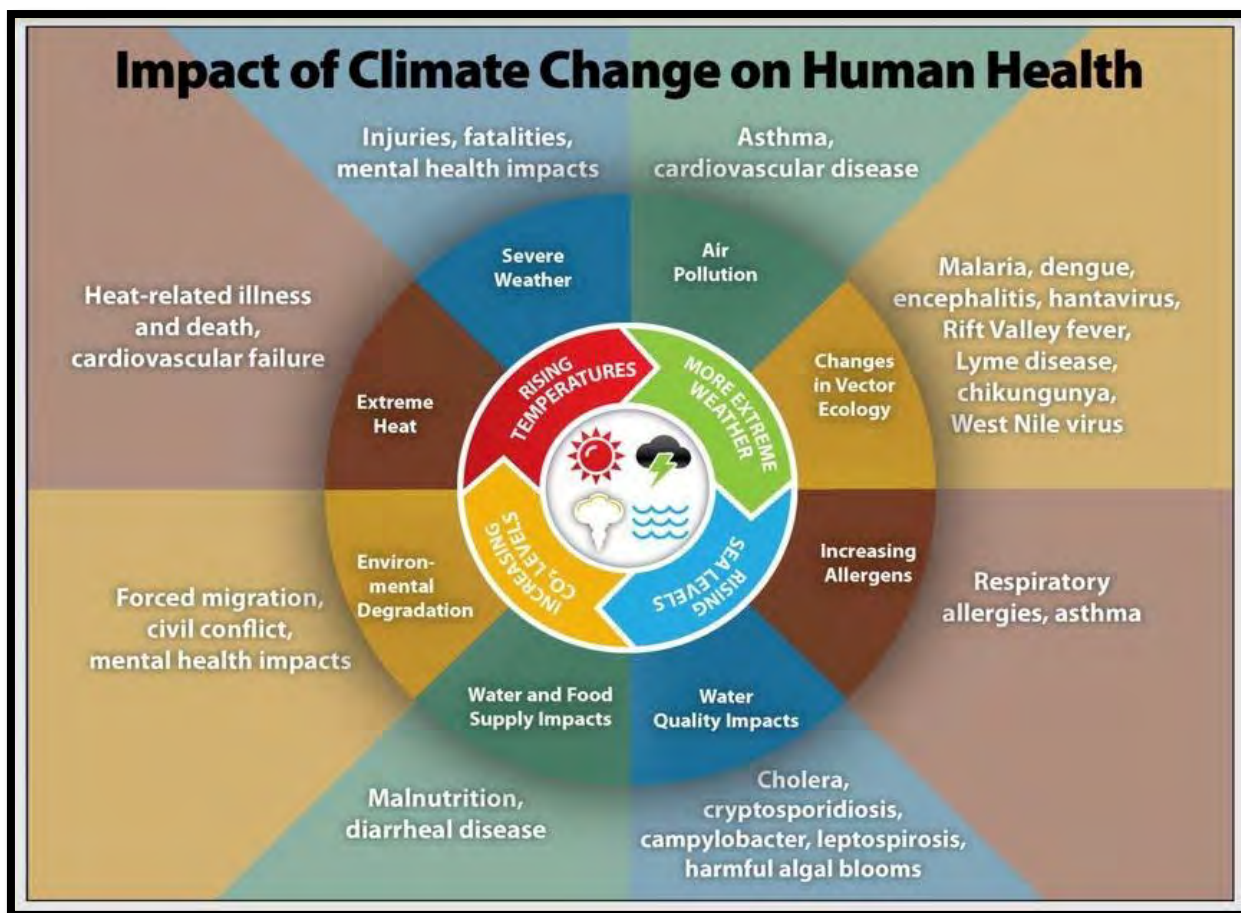
Diseases can be spread via vectors e.g. mosquitoes, air, water or food. There is also secondary transmission whereby an infected plant or animal infects a worker. All of these may affect workers directly or indirectly. As per the flow chart Khan et al. (2019):¹³⁴



¹³³ How Does a Changing Climate Impact the Health of Workers? Part 5: Vectorborne Disease. PubMed. Retrieved February 16, 2020 from <https://www.ncbi.nlm.nih.gov/pubmed/30540652> and Official Journal of the Association of Medical Microbiology and Infectious Disease Canada. Retrieved February 18, 2020 from <https://jammi.utpjournals.press/doi/full/10.3138/jammi.2018-12-10>

¹³⁴ Khan, D.M., Vu, H.H.T., Lai, Q.T., & Ahn, J.W. (2019). Aggravation of Human Diseases and Climate Change Nexus. *International Journal of Environmental Research and Public Health*. 16(15). Retrieved February 17, 2020 from <https://www.mdpi.com/1660-4601/16/15/2799/htm>

Parts of Canada, and Ontario in particular, will support the invasion of exotic mosquito species that can transmit diseases such as vivax malaria, yellow fever, Chikungunya, Zika and Dengue fever.¹³⁵ As per the figure from the US Centers for Disease Control and Prevention a variety of types of climate change have inter-related effects on pathogens:¹³⁶



¹³⁵ Infectious Disease and Climate Change in Canada: Key informant interviews. (September 2019). Canadian Public Health Association. Retrieved June 07, 2022 from https://www.cpha.ca/sites/default/files/uploads/resources/idcc/CPHA_IDCC_Key_informant_interviews.pdf

¹³⁶ Centers for Disease Control and Prevention. Climate Effects on Health. Retrieved February 18, 2020 from <https://www.cdc.gov/climateandhealth/effects/default.htm>

Climate change increases exposure to hazards and risks related to infectious diseases via:

- Heat-waves – Increase in pathogens that cause infectious respiratory diseases
- Droughts – Which are associated with an increase in diarrheal diseases
- High precipitation and floods – Increase in water borne diseases, diarrheal diseases and rodent related diseases¹³⁷

As per Health of Canadians in a Changing Climate (2022), climate change is introducing diseases in all parts of Canada. For example, rabies in Arctic foxes, Hantavirus pulmonary syndrome carried by mice, roundworms and other parasites carried by domestic dogs, coyotes, foxes or raccoons.¹³⁸ *Cryptococcus gatti*, blastomycosis and coccidioidomycosis are fungal infections which are likely to change with expected changes in temperature and rainfall.¹³⁹

As per the following excerpt from the table¹⁴⁰ from the Canada Communicable Disease Report (see next two pages), there are numerous foodborne pathogens related to climate change:

¹³⁷ Wu, X., Lu, Y., Zhou, S., Chen, L., & Xu, B. (2016). Impact of climate change on human infectious diseases: Empirical evidence and human adaptation. *Environment International*. Volume 86. Retrieved February 17, 2020 from <https://www.sciencedirect.com/science/article/pii/S0160412015300489>

¹³⁸ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

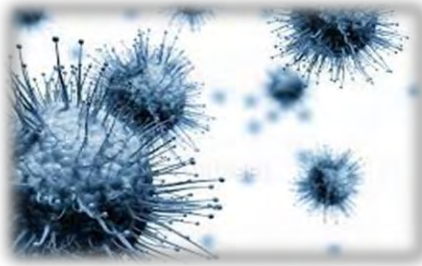
¹³⁹ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

¹⁴⁰ Smith, B.A. & Fazil, A. (2019). How will climate change impact microbial foodborne disease in Canada? *Canada Communicable Disease Report*. 45(4). Retrieved February 18, 2020 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6587690/>

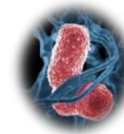
Key foodborne pathogens currently ranked in Canada to consider in the context climate change (6)

Pathogen	Symptoms (42)	Current cases per 100,000 people (6)	Influence of climate on occurrence (20,43)
Norovirus	Symptoms include nausea, vomiting, diarrhea, stomach cramps, low-grade fever, chills, headache, muscle aches and fatigue	3,223.79	Extreme weather events (such as heavy precipitation and flooding) and decreased air temperature
<i>Clostridium perfringens</i>	Symptoms include diarrhea, pain and cramps, stomach bloating, increased gas, nausea, weight loss, loss of appetite, muscle aches and fatigue. In rare cases, severe dehydration, hospitalization, death	544.50	Uncertain
<i>Campylobacter</i> spp.	Symptoms include fever, nausea, vomiting, stomach pain, and diarrhea. In rare cases, hospitalization and long-lasting health effects, death	447.23	Changes in the timing or length of seasons, increased air temperatures, precipitation and flooding
<i>Salmonella</i> spp., nontyphoidal	Symptoms include chills, fever, nausea, diarrhea, vomiting, stomach cramps, and headache. In rare cases, hospitalization and long-lasting health effects, death	269.26	Changes in the timing or length of seasons, extreme weather events, increased air temperatures

<i>Bacillus cereus</i>	Symptoms include diarrhea or vomiting. In rare cases, hospitalization and long-lasting health effects, death	111.60	Changes in the timing or length of seasons, drought
Verotoxigenic <i>Escherichia coli</i> non-O157	Symptoms include diarrhea. In rare cases, hospitalization and long-lasting health effects, death	63.15	Changes in the timing or length of seasons, extreme weather events, increased air temperatures
Verotoxigenic <i>Escherichia coli</i> O157	Symptoms include diarrhea. In rare cases, hospitalization and long-lasting health effects, death	39.47	Changes in the timing or length of seasons, extreme weather events, increased air temperatures
<i>Toxoplasma gondii</i>	Symptoms include minimal to mild illness with fever. In rare cases, inflammation of the brain and infection of other organs, birth defects	28.10	Extreme weather events, increased air temperatures, precipitation (44)
<i>Vibrio parahaemolyticus</i>	Symptoms include diarrhea, stomach cramps, nausea, vomiting, fever and headache. In rare cases, liver disease	5.53	Extreme weather events, increased air temperatures, increased sea surface temperature
<i>Listeria monocytogenes</i>	Symptoms include fever, nausea, cramps, diarrhea, vomiting, headache, constipation, muscle aches. In severe cases, stiff neck, confusion, headache, loss of balance, miscarriage, stillbirth, premature delivery, meningitis, death	0.55	Extreme weather events, increased air temperatures, precipitation
<i>Vibrio vulnificus</i>	Symptoms include diarrhea, stomach cramps, nausea, vomiting, fever, headache. In rare cases, liver disease	<0.01	Extreme weather events, increased air temperatures, increased sea surface temperature



II.VI.II. Infectious Diseases (Non-Waterborne Diseases):



(Also see the Section on Influenza below)

The spread of air-borne infectious disease such as influenza tend to increase in humid conditions. Humidity change also affects the viruses of waterborne diseases and the survival rate for certain parasites. Salmonellas increase with longer periods of higher temperatures.¹⁴¹ Increased durations of sun and temperature increase the incidence of Cholera.¹⁴² Extended periods of higher temperatures increase algae blooms. Temperature increases affect the range of vectors such as ticks. Low humidity with higher temperatures reduces tick and flea populations.¹⁴³ Droughts increase the prevalence of disease by increasing the concentration of fecal borne diseases.¹⁴⁴ Higher velocity winds contribute to the expanded range of mosquitoes. Dengue fever, yellow fever, Rift Valley fever are not found in Canada nor in mosquitoes in Canada. While Zika has been found in Canada, it has not been commonly locally acquired.¹⁴⁵ West Nile virus is now endemic to Ontario as per “Protecting your Community from Climate Change. A Training Program for Ontario municipalities”.¹⁴⁶ Chikungunya has not been locally acquired in Canada¹⁴⁷ although it is found through the Southeastern US and the range of mosquitos that carry it is moving northward.¹⁴⁸

¹⁴¹ Wu, X., Lu, Y., Zhou, S., Chen, L., & Xu, B. (2016). Impact of climate change on human infectious diseases: Empirical evidence and human adaptation. *Environment International*. Volume 86. Retrieved February 17, 2020 from <https://www.sciencedirect.com/science/article/pii/S0160412015300489>

¹⁴² Wu, X., Lu, Y., Zhou, S., Chen, L., & Xu, B. (2016). Impact of climate change on human infectious diseases: Empirical evidence and human adaptation. *Environment International*. Volume 86. Retrieved February 17, 2020 from <https://www.sciencedirect.com/science/article/pii/S0160412015300489>

¹⁴³ Wu, X., Lu, Y., Zhou, S., Chen, L., & Xu, B. (2016). Impact of climate change on human infectious diseases: Empirical evidence and human adaptation. *Environment International*. Volume 86. Retrieved February 17, 2020 from <https://www.sciencedirect.com/science/article/pii/S0160412015300489>

¹⁴⁴ Wu, X., Lu, Y., Zhou, S., Chen, L., & Xu, B. (2016). Impact of climate change on human infectious diseases: Empirical evidence and human adaptation. *Environment International*. Volume 86. Retrieved February 17, 2020 from <https://www.sciencedirect.com/science/article/pii/S0160412015300489>

¹⁴⁵ HealthLinkBC. See <https://www.healthlinkbc.ca>

¹⁴⁶ Protecting your Community from Climate Change. A Training Program for Ontario Municipalities. Retrieved February 17, 2020 from http://www.climateontario.ca/doc/ORAC_Products/CleanAirPartnership/CAP_Municipal_Adaptation_Training_Program.pdf

¹⁴⁷ HealthLinkBC. See <https://www.healthlinkbc.ca/health-topics/abq4390>

¹⁴⁸ Government of Canada. Chikungunya. See <https://www.canada.ca/en/public-health/services/diseases/chikungunya.html>



II.VI.III. Waterborne Diseases:

Waterborne diseases are a sub-set of infectious diseases that require a separate review. Many infectious diseases are transmitted by food and water. There is now substantial evidence that weather can affect the risk of diseases such as gastrointestinal disease. As per the Canada Communicable Disease Report (2019):¹⁴⁹

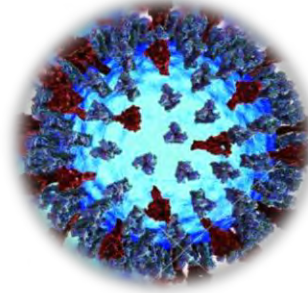
“Infectious diseases emerge due to changes in their geographic ranges and by “adaptive emergence,” a genetic change in the microorganisms infecting animals (usually wildlife) that results in these microorganisms becoming capable of infecting humans, and perhaps being transmitted from human to human – in other words a genetic adaptation that leads to a new zoonotic disease.”

“Climate change has been shown to result in warming temperatures and increasing precipitation, both of which influence the survival and spread of the zoonotic pathogens and/or the reproductive rate and geographic distribution of their vectors.”

¹⁴⁹ Canada Communicable Disease Report. (2019). Retrieved February 17, 2020 from <https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2019-45/issue-4-april-4-2019/article-1-climate-change-infectious-diseases.html>

Common diseases that may arise from contaminated water include:¹⁵⁰

- *Campylobacteriosis*
- *Cryptosporidiosis*
- *Giardiasis*
- *Salmonellosis*
- Verotoxigenic *E. Coli*



Precipitation increases causes the risk of epidemic waterborne disease to increase by 200%.¹⁵¹
As per Charron et al. (no date):

“Curriero et al. (2001) found that more than half the waterborne disease outbreaks in the United States during the last half-century followed a period of extreme rainfall, with 68% of outbreaks following storms of a severity that ranked in the top 20% for that region.”

¹⁵⁰ Charron, D.F., Edge, T., Fleury, M.D., Galatianos, W., Gillis, D., Kent, R., Maroouf, A.R., Neudoerffer, C., Schuster, C.J., Thomas, M.K., Valcour, J., & Waltner-Toews, D. Link Between Climate, Water And Waterborne Illness, And Projected Impacts of Climate Change. Retrieved February 16, 2020 from <https://collections.unu.edu/eserv/UNU:2653/pdf252333.pdf>

¹⁵¹ Charron, D.F., Edge, T., Fleury, M.D., Galatianos, W., Gillis, D., Kent, R., Maroouf, A.R., Neudoerffer, C., Schuster, C.J., Thomas, M.K., Valcour, J., & Waltner-Toews, D. Link Between Climate, Water And Waterborne Illness, And Projected Impacts of Climate Change. Retrieved February 16, 2020 from <https://collections.unu.edu/eserv/UNU:2653/pdf252333.pdf>

They also state that:¹⁵²

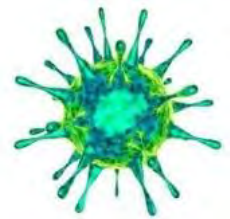
“...excess precipitation could increase our risk of waterborne illness through flooding (increased run-off, decreased effectiveness of treatment), high temperatures (pathogen replication) and drought (through concentration of pathogens in smaller volumes of water, decreased hygiene measures due to water shortages). Heavy rainfall or snowmelt may flush manure, human sewage, wildlife and pet droppings into surface drinking water reservoirs or ground water, and can lead to widespread contamination of drinking water sources.”

In Alberta (with similar results in BC):

“Findings indicate that climate variables significantly affect the risk of hospitalization for gastrointestinal illness. Specifically, the quantities of rain and extreme precipitation events 42-days prior to a case or control affect the outcome.”

Outbreaks of *Vibrio parahaemolyticus* in BC have been associated with above-average ocean temperatures, which promote growth and proliferation of this pathogen.¹⁵³

While these results are for the general public, there may be an increased risk for workers. The risk is greater for older workers and workers with pre-existing chronic diseases. As per the CCOHS:¹⁵⁴



¹⁵² Charron, D.F., Edge, T., Fleury, M.D., Galatianos, W., Gillis, D., Kent, R., Maroouf, A.R., Neudoerffer, C., Schuster, C.J., Thomas, M.K., Valcour, J., & Waltner-Toews, D. Link Between Climate, Water And Waterborne Illness, And Projected Impacts of Climate Change. Retrieved February 16, 2020 from <https://collections.unu.edu/eserv/UNU:2653/pdf252333.pdf>

¹⁵³ BC Medical Journal. Climate Change and Infectious Disease in Canada and BC. (November 2018). Retrieved February 18, 2020 from <https://www.bcmj.org/cohp/climate-change-and-infectious-disease-canada-and-bc>

¹⁵⁴ Canadian Centre for Occupational Health and Safety. Older Workers. Retrieved February 20, 2020 from https://www.ccohs.ca/oshanswers/psychosocial/aging_workers.html

Changes in weather patterns, such as warmer temperatures, increased precipitation and more frequent drought and wildfires are expected to affect the incidence and distribution of waterborne, foodborne, vectorborne and zoonotic diseases which will affect Indigenous persons. Indigenous Peoples globally and across Canada have significantly higher rates of infectious diseases than non-Indigenous populations (placing them at greater risk for climate related infectious diseases).¹⁵⁵ Recent studies indicate an increased prevalence of parasites in wildlife, causing trichinellosis in walrus and polar bear, brucellosis in caribou, lungworm infection in muskox, giardiasis in beaver, as well as tularemia, rabies and cryptosporidiosis. These diseases have the potential to be transmitted from animals to humans, either directly, from the consumption of traditional foods, or indirectly, through exposure to domestic animals carrying these.¹⁵⁶

Another type of waterborne disease is algae, such as “red tides” (e.g. *Noctiluca scintillans* algal blooms).¹⁵⁷ Climate change is increasing the prevalence of red tides. As per the CBC News¹⁵⁸:

“The colourful algae, on the other hand, isn't harmful to humans, says Elysha Gordon, Canadian shellfish sanitation program coordinator with the DFO.” (Unless ingested after shellfish have been contaminated.)

“Gordon says algal blooms occur for a number of reasons, including warmer temperatures, salinity, upwelling and wind.

She says they usually occur from May to September, but climate change and higher extreme temperatures have made them more prevalent, popping up even during the winter months.”

¹⁵⁵ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

¹⁵⁶ Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

¹⁵⁷ Stanton, K. (November 06, 2018). Dangerously high levels of Red Tide found in bivalve shellfish on B.C. coast. *Global News* Retrieved February 20, 2020 from <https://globalnews.ca/news/4621644/red-tide-danger-bivalve-shellfish-bc-coast/>

¹⁵⁸ Correia, C. (July 18, 2018). ‘Red tide’ algal blooms appearing around B.C. coastal waters. (2018). *CBC News*. Retrieved February 16, 2020 from <https://www.cbc.ca/news/canada/british-columbia/red-tide-algal-blooms-algae-bc-coastal-waters-1.4749546>

There are many types of algae that can cause a red tide. These can occur in saltwater or fresh water. Fresh water types include a bacterium called cyanobacteria. Some species are more toxic than others such as *Karenia Brevis* which causes respiratory irritation and cyanobacteria which can poison drinking water.¹⁵⁹ The Washington Post¹⁶⁰ stated that:

“Humans are also playing a role by driving up global temperatures via greenhouse gas emissions. In a letter published by the journal Environmental Science & Technology, researchers at the University of Florida and the University of North Carolina said that “climate change will severely affect our ability to control blooms, and in some cases could make it near impossible.”

“As air and ocean temperatures increase, the environment becomes more hospitable to toxic algal blooms in several ways, according to scientists and the Environmental Protection Agency.”

Increased temperatures and CO₂ associated with climate change are the primary causes of increases in red tides.^{161,162} Red tides may be aerosolized by wind. There are very few confirmed accounts of this in BC, so this is not discussed in this section. It is merely a speculative possibility. As a blog cast (2014):¹⁶³

“Wakins *et al*, 2008 reports that the highly lipophilic nature of brevetoxin can be easily absorbed via the respiratory tract as they are able to pass through the cell membrane of cells.

¹⁵⁹ Government of Canada. Fisheries and Oceans Canada. Bivalve shellfish contamination closures. Retrieved February 20, 2020 from <https://www.pac.dfo-mpo.gc.ca/fm-gp/contamination/index-eng.html>

¹⁶⁰ The Washington Post. How climate change is making ‘red tide’ algal blooms even worse. (2018). Retrieved February 21, 2020 from <https://www.washingtonpost.com/news/capital-weather-gang/wp/2018/08/14/how-climate-change-is-making-red-tide-algal-blooms-even-worse/>

¹⁶¹ Bradenton Herald. Red tide is always bad. Global warning is making it worse, researcher says. (2019). Retrieved February 20, 2020 from <https://www.bradenton.com/news/local/article225072815.html>

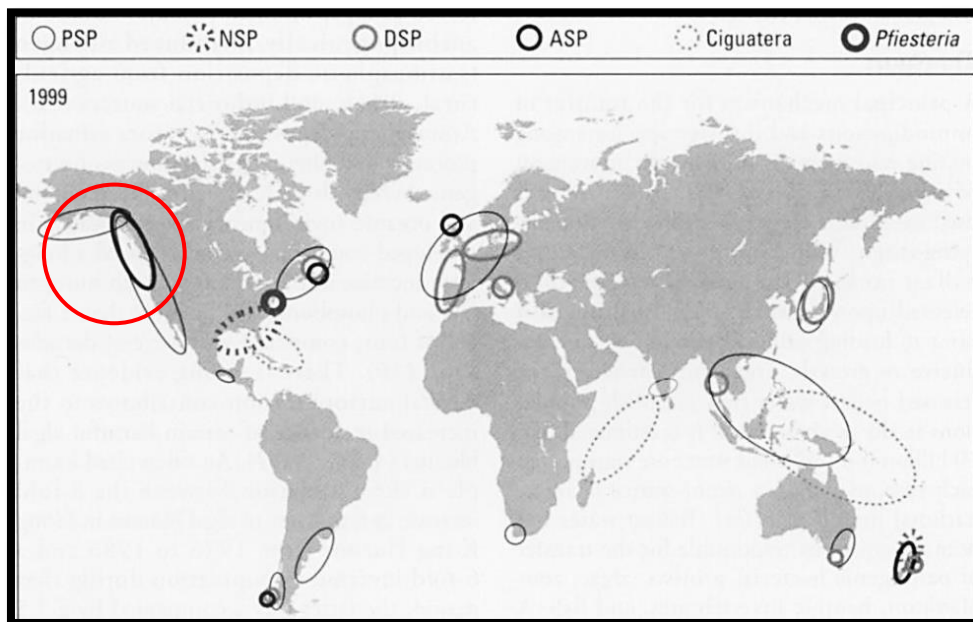
¹⁶² Zohdi, E. & Abbaspour, M. (2019). Harmful algal blooms (red tide): a review of causes, impacts and approaches to monitoring and prediction. *International Journal of Environmental Science and Technology*. Retrieved February 21, 2020 from <https://link.springer.com/article/10.1007/s13762-018-2108-x>

¹⁶³ No author found. (2014). Algal Red Tides Algal blooms increasing in response to climate change. Climate Change Podcast. Retrieved February 21, 2020 from <https://algalredtides.wordpress.com/>

Even then many reports of individuals living near red tide endemic areas have experienced irritation of the eyes, nose, and throat, as well as coughing, wheezing, and shortness of breath. People with asthma also experience more severe symptoms.”

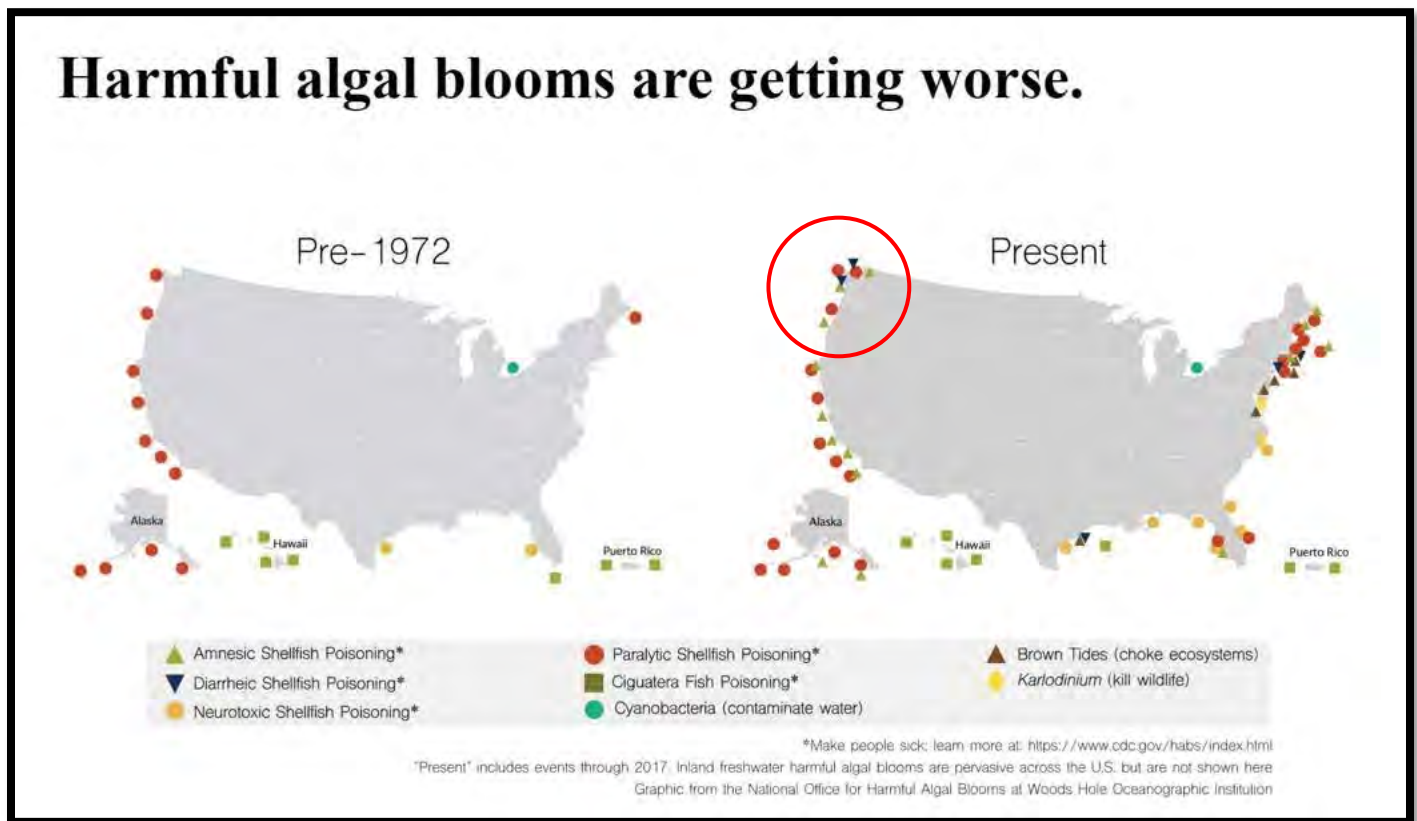


Areas of increased red tides include the following as per the map from Brevis (2014):¹⁶⁴



¹⁶⁴ Brevis, K. (2014). Algal Red Tides Algal blooms increasing in response to climate change. Climate Change Podcast. Retrieved February 21, 2020 from <https://algalredtides.wordpress.com/>

As per the map from the National Office for Harmful Algal Blooms at Woods Hole Oceanographic Institution,¹⁶⁵ algal blooms are increasing. While this figure is from the US, there are a number of studies indicating that the Washington State and the Southcoast of BC are also experiencing increased algal blooms:

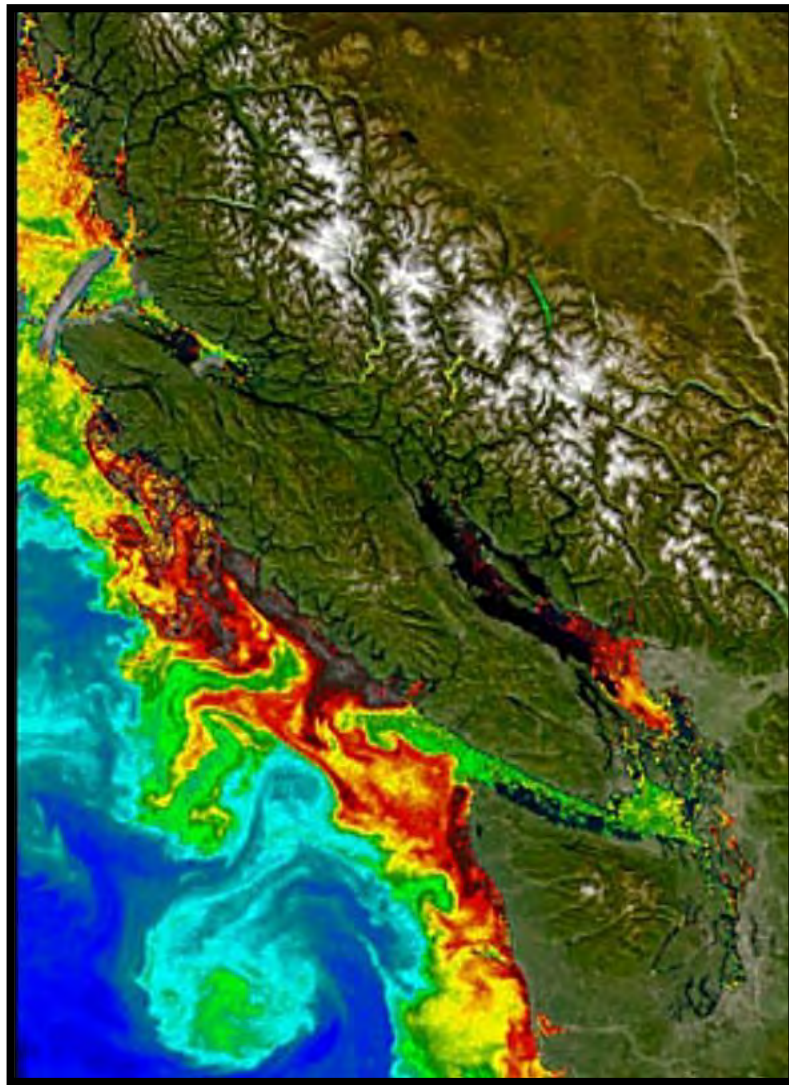


Climate change has also caused an increase in *Vibrio* bacteria which are harmful to humans when ingested (via food or water), ear infections, eye infections and infections via an open wound while swimming.¹⁶⁶

¹⁶⁵ National Office for Harmful Algal Blooms at Woods Hole Oceanographic Institution. Retrieved February 21, 2020 from <https://www.whoi.edu/redtide/> and <https://www.whoi.edu/know-your-ocean/ocean-topics/hazards/harmful-algae-red-tides/>

¹⁶⁶ National Oceanic & Atmospheric Administration. What is a harmful algal bloom? Retrieved February 21, 2020 from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3413071 and <https://oceanservice.noaa.gov/hazards/hab/> and <https://oceanservice.noaa.gov/hazards/hab/west-coast.html>

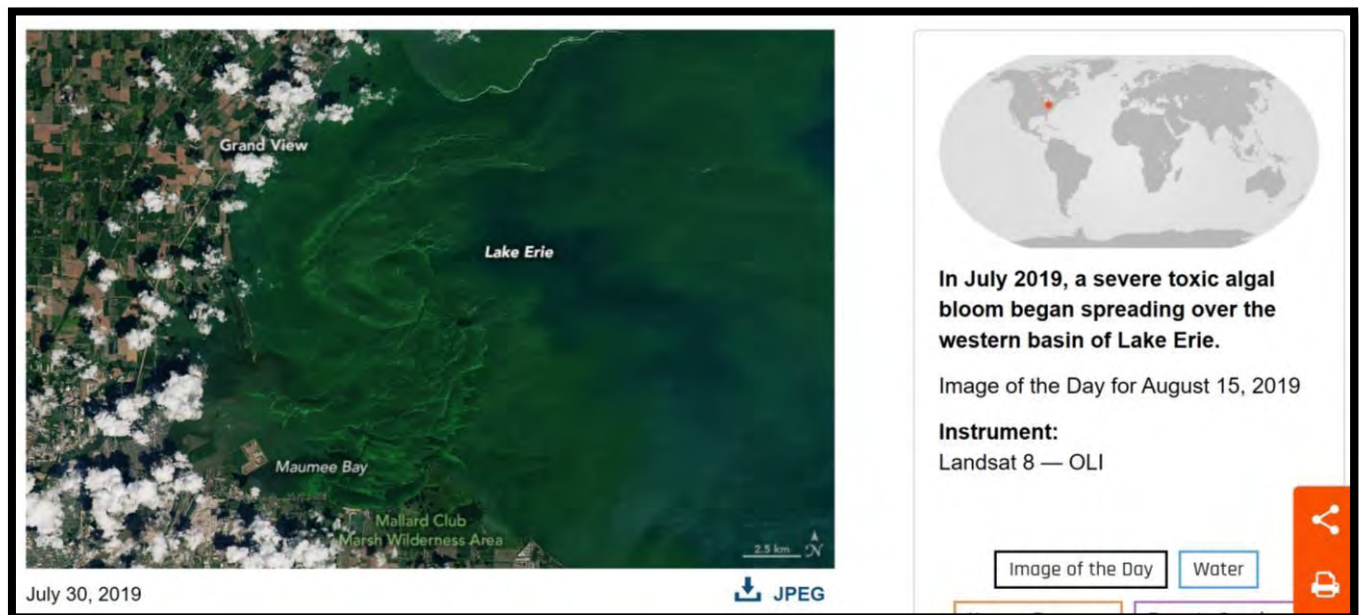
As per the US Centers for Disease Control and Prevention there have been outbreaks of this type of bacteria in areas where there has been an increase in warmer waters.¹⁶⁷ Sample photo of algal blooms and increased chlorophyll as per the image from NASA's Earth Observatory:¹⁶⁸



¹⁶⁷ US Centers for Disease Control and Prevention. *Vibrio* Species Causing Vibriosis. Retrieved February 20, 2020 from <https://www.cdc.gov/vibrio/index.html>

¹⁶⁸ NASA Earth Observatory. Retrieved February 21, 2020 from <https://earthobservatory.nasa.gov/>

While this Guide focuses on BC, there are numerous algal blooms occurring across Canada. For example, in Lake Erie, there was a severe toxic algal bloom in July 2019 as per the image from NASA Earth Observatory:¹⁶⁹



There are four species that cause most human infections. Most are foodborne with 95% of fatalities being linked to ingestion.¹⁷⁰ These four species include:¹⁷¹

- *Vibrio vulnificus*
- *Vibrio alginolyticus*
- *Vibrio parahaemolyticus*
- *Vibrio cholerae*

¹⁶⁹ NASA Earth Observatory. Retrieved February 21, 2020 from <https://earthobservatory.nasa.gov/>

¹⁷⁰ Craig, R.K. (2019). Warning Oceans, Coastal Diseases, and Climate Change Public Health Adaptation. *Sea Grant Law & Policy Journal*. Retrieved February 21, 2020 from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3413071

¹⁷¹ Craig, R.K. (2019). Warning Oceans, Coastal Diseases, and Climate Change Public Health Adaptation. *Sea Grant Law & Policy Journal*. Retrieved February 21, 2020 from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3413071

As per Craig (2019):¹⁷²

“Indeed, there is considerable evidence that a warming ocean is increasing coastal populations’ disease risk from all *Vibrio* species.”

And,

“the Centers for Disease Control and Prevention (CDC) estimates that the average annual incidence of all *Vibrio* infection will continue to increase because of a longer transmission season and a continuing increasing geographical range as the ocean continues to warm.”

Employers and Locals should monitor this issue and conduct hazard and risk assessments as necessary.



¹⁷² Craig, R.K. (2019). Warning Oceans, Coastal Diseases, and Climate Change Public Health Adaptation. *Sea Grant Law & Policy Journal*. Retrieved February 21, 2020 from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3413071



II.VI.IV. Influenza (this Guide does not include COVID-19 / SARS-CoV-2):

There is evidence that climate change will increase the frequency of localized severe influenza. As per Towers et al. (2013):¹⁷³

“warm winters tend to be followed by severe epidemics with early onset, and that these patterns are seen for both influenza A and B.”

They stated that based on data from the US, there may be more early and severe influenza epidemics.

¹⁷³ Towers, S., Chowell, G., Hameed, R., Jastrebski, M., Khan, M., Meeks, J., Mubayi, A., & Harris, G. (2013). Climate change and influenza: the likelihood and severity of early influenza seasons following warmer and than average winters. Retrieved February 23, 2020 from <https://www.ncbi.nlm.nih.gov/pubmed/24045424>

Towers et al. (2013) also state that:

“mild influenza seasons during unusually warm winters are a harbinger of the likelihood of an unusually severe season to come.”

And,

“climate change can have a profound impact on influenza epidemics beyond just the time frame of the current season”.

LiveScience¹⁷⁴ reiterated these findings, as did Longman, (2017):¹⁷⁵

“According to research done at Arizona State University, scientists believe that climate change may be a factor in the flu season's increasingly early timing.

Using data going back to 1997, researchers found that warm winters are usually followed by severe and early flu outbreaks. The study found that mild winters preceded an atypically severe flu season 72% of the time, and that those flu seasons started an average of 11 days earlier. During warm winters, flu is less transmittable. That leaves a higher percentage of the population without immunity the next season – leading to a strong flu outbreak and an increase in more severe and fatal cases.”

Roussel et al. (2016)¹⁷⁶ state that:

“At the epidemic scale, no impact of climatic factors was highlighted. At the intra-annual scale, six climatic variables had a significant impact”.

¹⁷⁴ LiveScience. Retrieved February 23, 2020 from <https://www.livescience.com/49006-flu-season-worse-h3n2.html>

¹⁷⁵ Longman, M. (2017). The Impact of Climate Change on Flu. *Concentra*. Retrieved February 23, 2020 from <https://www.concentra.com/resource-center/articles/the-impact-of-climate-change-on-flu/>

¹⁷⁶ Roussel, M., Pontier, D., Cohen, J.M., Lina, B., & Fouchet, D. (2016). *BMC Public Health*. 2016;16. Retrieved February 23, 2020 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4881007/>

As per Khan et al. (2019):¹⁷⁷

“Epidemiological data further indicates the emergence and re-emergence of infectious diseases post every single extreme weather event.

Based on studies conducted mostly between 1990-2018, three aspects that resemble the impact of climate change impact on diseases are: (a) emergence and re-emergence of vector-borne diseases, (b) impact of extreme weather events...”

Liu et al. (2020)¹⁷⁸ state that:

“the widely spread 2017-2018 influenza epidemic can be attributed to the abnormally strong rapid weather variability. We demonstrate, from historical data, that the large rapid weather variability in autumn can precondition the deadly influenza epidemic in the subsequent months in highly populated northern mid-latitudes; and the influenza epidemic season of 2017-2018 was a typical case.

We further show that climate model projections reach a consensus that the rapid weather variability in autumn will continue to strengthen in some regions of northern mid-latitudes in a warming climate, implying that the risk of influenza epidemic may increase 20% to 50% in some highly populated regions in the later 21st century.”

There are few studies regarding pandemics and climate change.

Brenner and Marwan (2018)¹⁷⁹ state that:

¹⁷⁷ Khan, D.M., Vu, H.H.T., Lai, Q.T., & Ahn, J.W. (2019). Aggravation of Human Diseases and Climate Change Nexus. *International Journal of Environmental Research and Public Health*. 16(15). Retrieved February 17, 2020 from <https://www.mdpi.com/1660-4601/16/15/2799/htm>

¹⁷⁸ Liu, Q., Tan, Z.M., Sun, J., Hou, Y., Fu, C., & Wu, Z. Changing rapid weather variability increases influenza epidemic risk in a warming climate. Retrieved February 23, 2020 from <https://iopscience.iop.org/article/10.1088/1748-9326/ab70bc/meta>

¹⁷⁹ Brenner, F. & Marwan, N. (2018). Change of influenza pandemics because of climate change: Complex network simulations. *Revue d'Épidémiologie et de Santé Publique*. Volume 66, Supplement 5, July 2018, Page S424. Retrieved February 23, 2020 from <https://www.sciencedirect.com/science/article/pii/S0398762018312136>

“we point out the influence of climate change on pandemics from 1980 until 2040. A significant trend in the pandemic rate of spreading can be seen on a global scale.”

This was supported by Liang and Pong (2017) in a meta-study.¹⁸⁰ Overall, there is strong evidence of a nexus between climate change and epidemics. There is growing evidence of a nexus between climate change and pandemics.



Cover page from Health of Canadians in a Changing Climate (2022).

¹⁸⁰ Liang, L. & Pong, P. (2017). Climate change and human infectious diseases: A synthesis of research findings from global and spatio-temporal perspectives. *Environment International*. Volume 103, June 2017. Retrieved February 23, 2020 from <https://www.sciencedirect.com/science/article/pii/S0160412016309758>



II.VI.V. Mould and Fungi:

There is evidence that climate change increases mould and microorganisms. Indoor workers are exposed to microorganisms and mould in HVAC systems due to:

- Increases in humidity
- Increases in temperature
- Sealed buildings / sick building syndrome
- Moisture in buildings from rain or flooding
- Poorly designed ventilation and air conditioning systems
- Poor building maintenance
- Power outages due to extreme weather events may lead to the indoor use of portable gas - powered or electric generators causing carbon monoxide and other air pollutants

There are many different types of harmful moulds.¹⁸¹ These include:¹⁸²

- Allergenic moulds which cause allergic reactions
- Pathogenic moulds which cause diseases and infections
- Toxic moulds which produce toxic chemicals

Harmful mould types (all three categories) include:¹⁸³

- *Alternaria*
- *Chaetomium*
- *Fusarium*
- *Aspergillus*
- *Ulocladium*
- *Geotrichum*
- *Aureobasidium*
- *Memnoniella*
- *Basidiospores*
- *Bipolaris*
- *Cladosporium*



Cladosporium (black)

¹⁸¹ MicrobeNet. Retrieved February 19, 2020 from <https://www.cdc.gov/mold/faqs.htm>

¹⁸² Canadian Centre for Occupational Health and Safety. Indoor Air Quality – Moulds and Fungi. Retrieved February 19, 2020 from https://www.ccohs.ca/oshanswers/biol_hazards/iaq_mold.html

¹⁸³ US Centers for Disease Control and Prevention. Retrieved February 19, 2020 from <https://www.cdc.gov/niosh/topics/indoorenv/mold.html> and <https://www.cdc.gov/mold/faqs.htm>

As per the University of British Columbia:¹⁸⁴

“Increasing flooding and rainfall related to climate change is aiding fungi to grow more rapidly, causing degradation of the mechanical properties of buildings and infrastructure,’ she says. ‘Not only are the fungi breaking down the integrity of our buildings, but their proliferation is increasing health hazards for the people who live and work in these buildings.’”

Mycotoxins which are produced by fungi growing in crops such as corn and cereal grains, increase with increased air temperature, humidity and precipitation.¹⁸⁵ As per the Canada Communicable Disease Report:¹⁸⁶

“Studies from regions with similar climate and seasonality to Canada have linked foodborne contamination and disease incidence with seasonal trends. These studies reported a strong association between increasing air and water temperatures and an altered and extended summer season for non-cholera *Vibrio* species (spp.) infections.”

¹⁸⁴ University of British Columbia. UBC study finds health isn't the only issue with bacteria growth. (2019). Retrieved February 18, 2020 from <https://ok.ubc.ca/>

¹⁸⁵ Government of Canada. Increased risk of microbial foodborne diseases with climate change. Retrieved February 18, 2020 from <https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2019-45/issue-4-april-4-2019/article-5-microbial-foodborne-diseases-climate-change.html>

¹⁸⁶ Smith, B.A. & Fazil, A. (2019). How will climate change impact microbial foodborne disease in Canada? *Canada Communicable Disease Report*. 45(4). Retrieved February 18, 2020 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6587690/>



As per the Official Journal of the Association of Medical Microbiology and Infectious Disease Canada:¹⁸⁷

“Before emerging on Vancouver Island in 1999, *Cryptococcus gattii* was considered primarily a tropical and subtropical pathogen. Historically, infection with *C. gattii* has been associated with exposure to two species of Australian eucalyptus trees. On Vancouver Island, the fungus has been isolated on a variety of non-eucalypt trees such as the Douglas fir and Western red cedar. It has been suggested that warming conditions over the past decade have created an optimal environment for the establishment and spread of the fungal pathogen.”

There are many Guides, Fact Sheets and Bulletins on the CUPE BC OHS Committee website and the CUPE Health and Safety website. The CCOHS and OHCOW have also produced a number of materials for workers as per the next page (CCOHS Indoor Air Quality and Conducting an IAQ Investigation and OHCOW AirAssess App). See the Resources Section of this Guide for further information.

¹⁸⁷ Official Journal of the Association of Medical Microbiology and Infectious Disease Canada. Retrieved February 18, 2020 from <https://jammi.utpjournals.press/doi/full/10.3138/jammi.2018-12-10>

Conducting an IAQ investigation

- Treat IAQ concerns seriously and promptly.
- Collect health complaint data using a questionnaire specific for your workplace. You may need assistance from an expert.
- Look for patterns.
- Most affected people to clarify your findings.
- Check the heating, ventilating and air-conditioning (HVAC) system with the building operator/engineer.

Indoor Air Quality

Take a preventative approach to IAQ

- Provide an adequate volume of outdoor air
- Ensure that air is properly distributed
- Prevent outdoor pollutants from entering the building
- Provide separate ventilation for special-use areas
- Promote the use of unscented products
- Choose building materials, paints and furniture with low emissions
- Discourage mould growth
- Follow standards and best practices for your building's ventilation, thermal comfort, and pollutant control

Sources

- Building occupants
- Building materials
- Carpets, fabric, foam chair cushions
- Off-gas emissions: furniture, carpets, paints, workplace cleaners, solvents, pesticides, disinfectants and glues
- Damp areas, stagnant water and condensate pans
- Photocopiers, electric motors, electrostatic air cleaners

Indoor air contaminants

- Carbon dioxide, tobacco smoke, perfume, body odours
- Dust, fibreglass, asbestos, gases
- Dust mites
- Gases, vapours, odours, volatile organic compounds (VOCs)
- Microbial contaminants, fungi, moulds, bacteria
- Ozone

Symptoms

Headache
Fatigue
Shortness of breath
Irritability and dizziness
Sneezing
Coughing and sneezing
Rhinorrhoea
Nausea

People generally notice their symptoms after several hours at work and feel better after they have been away from the building.

IAQ issues

- Lack of outdoor air for HVAC system
- Poorly designed or maintained HVAC system
- Pollutants from the outdoor air
- Emissions from inside sources
- Poor temperature and humidity control

Common Causes

What the law says: All jurisdictions include the 'general duty clause' which requires employers to provide a healthy and safe workplace. This includes the provision of healthy indoor air. In addition, IAQ is implied in most building codes as design and operation criteria.

CCOHS.ca
Canadian Centre for Occupational Health and Safety

Occupational Health Clinics for Ontario Workers Inc.
OHCOV
Centres de santé des travailleurs (cst) de l'Ontario Inc. **on.ca**

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OCCUPATIONAL ILLNESS **INJURY PREVENTION** WORKPLACE MENTAL HEALTH WORKER PERSPECTIVE

NEWS & EVENTS APPS, TOOLS & CALCULATORS OTHER RESOURCES

AirAssess App

OHCOV's AirAssess app assesses the air quality in your workplace and provides you with ideas for taking action on any air quality issues

Indoor air quality (IAQ) issues at work can be caused or aggravated by a number of factors. The inter-relationships between these factors can be quite complex.

AirAssess looks for possible links between these factors and provides you with ideas to help you and your workplace take action



II.VII. Insects and Arachnids:

With the changing climate there have been changes in the range, concentration and number of many insects and arachnids. These include:

- Fleas
- Fire ants
- Bed bugs
- Mosquitoes
- Poisonous spiders
- Ticks
- Yellow jackets

Ticks and mosquitoes are also briefly addressed in Section II.VI. above.



Cockroaches are not included in this Guide as there is a lack of evidence regarding cockroaches in BC being vectors for disease nor is there significant evidence showing a climate change related increase in cockroach populations.

The most common insects and arachnids that may impact workers due to an increase in both their range and overall populations are:

- Mosquitoes
- Fire Ants
- Ticks
- Bed Bugs



Climate change affects insect and arachnid populations by:

- Increased overwintering ability
- Increased presence outside and inside human structures
- R-selection – Increasing short selection times and high reproduction rates
- Increased number and range of breeding sites
- Increased dispersal
- Increased availability of food
- Increased availability of habitat