HEALTH EFFECTS OF AIR POLLUTION

We come into contact with many kinds of air pollutants every day. They are being released in our neighbourhoods, our backyards, inside our homes, and are finding their way into our lungs. Outdoor pollutants seep into houses, even through closed doors and windows. Air pollution can also cover large areas, as with smoke from a forest fire, or ground-level ozone in mountain valleys. Air pollution can be dangerous even when you can't see or smell it, such as carbon monoxide.

Outdoor air pollution now takes a greater toll on human life in BC than HIV/AIDS, and is the world's leading cause of preventable deaths. Health effects from air pollution can last for a short while (e.g., coughing) or become chronic (e.g., heart and lung disease). Health problems increase when we are exposed to air pollution for a long time (exposure), and when we breathe in a lot of it (concentration). In 2013, the World Health Organization declared that outdoor air pollution is carcinogenic to humans based on a thorough review of studies conducted over decades.

Health Canada, in collaboration with colleagues at Environment and Climate Change Canada, updated estimates of health impacts of air pollution. Using the Air Quality Benefits Assessment Tool, they estimate that 1,600 premature deaths in B.C. in 2015 can be linked to above-background air pollution (fine particulate matter, nitrogen dioxide and ozone) from all sources, with an economic valuation of $11.5B per year.

The health burden of air pollution was estimated:

In British Columbia:

1600 premature deaths

Nationally:

14, 600 premature deaths

2.7 million astha Symptoms

35 million acute respiratory symptom days

Environment Canada estimated that in 2006, a 10% reduction in $PM_{2.5}$ and Ozone emissions would quantifiable economic benefits to the Central Okanagan economy of $16.6 million and $1.8 million respectively. These benefits were calculated based on decreased rates of mortality and morbidity (respiratory hospital emissions, emergency room visits, child bronchitis, etc.)

Even areas that meet the national standard of "good" air quality may not be good enough. Scientists have found that low levels of particulate matter in the air can heighten the risk of lung and heart disease. As our population grows, more people will mean more motor vehicles and emissions, and increased pollution from other human activities.

SOURCES

http://www.bcairquality.ca/health/index.html

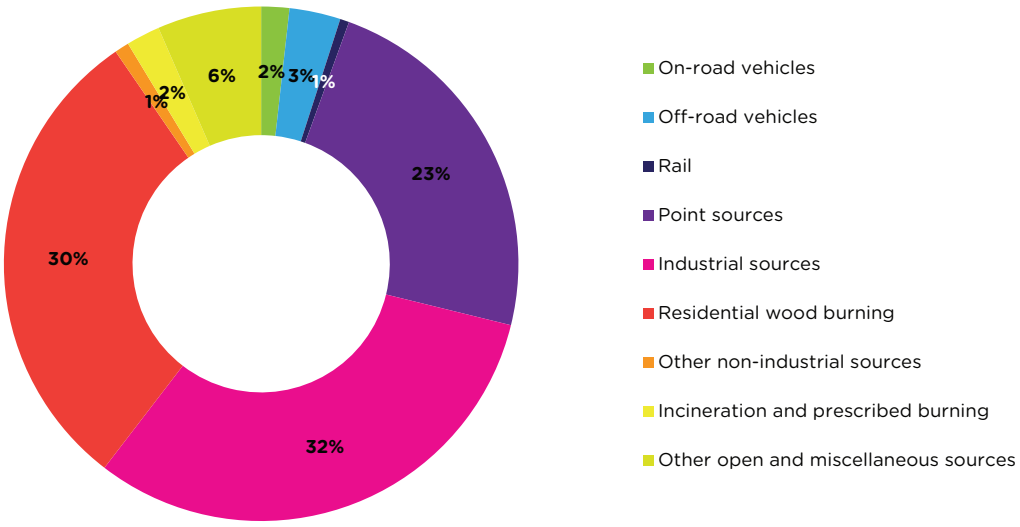
B.C. State of the Air Report-2020

The Regional District of the Central Okanagan, the District of Peachland, the City of Kelwona, the District of Lake Country, West Bank First Nation, and the City of West Kelowna worked in partnership to develop **a Central Okanagan Clean Air Strategy with the vision of clean and healthy air for current and future generations.** This work builds on the existing regional air quality program and will help to protect and improve our region's air through government policy and actions, community education and awareness initiatives, and pollution prevention programs.

WHAT IS PARTICULATE MATTER?

Particulate matter (PM) consists of airborne particles in solid or liquid form. PM may be classified as primary or secondary, depending on the compounds and processes involved during its formation. Primary PM is emitted at the emissions source in particle form, for example, smoke from a chimney burning wood, or a recently tilled field subject to wind erosion. Secondary PM formation results from a series of chemical and physical reactions involving different precursor gases, such as sulphur oxides and nitrogen oxides, and ammonia reacting to form sulphate, nitrate and ammonium particulate matter.

SOURCES OF FINE PARTICULATE MATTER ($PM_{2.5}$) IN THE CENTRAL OKANAGAN AIRSHED



The size of PM particles largely determines the extent of environmental and health damage caused. For this reason, Environment Canada identifies different sizes of PM:

Total Particulate Matter (TPM) - airborne particulate matter with an upper size limit of approximately 100 micro metre (µm) in aerodynamic equivalent diameter

Inhalable Particulate Matter <10 microns (PM10) - airborne particulate matter with a mass median diameter less than 10 µm

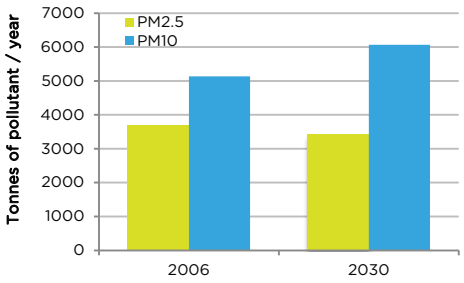
Fine Particulate Matter <2.5 microns (PM2.5) – airborne particulate matter with a mass median diameter less than 2.5 µm

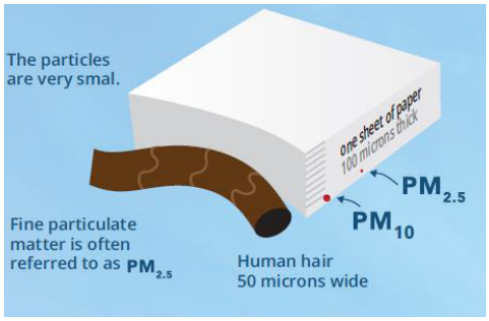
Numerous studies have linked PM to aggravated cardiac and respiratory diseases such as asthma, bronchitis and emphysema and to various forms of heart disease. PM can also have adverse effects on vegetation and structures, and contributes to visibility deterioration and regional haze.

Efforts to address particulate matter (PM) levels in the air are important in both the United States and Canada. Canada and the United States have completed a joint transboundary particulate matter science assessment report in support of the Canada-U.S. Air Quality Agreement.

In a recent PM2.5 study (2015-2016) "hotspots" were found across the Central Okanagan. For more information visit; rdco.com/airquality

PARTICULATE MATTER FORECAST FOR THE CENTRAL OKANAGAN





SOURCES

https://www.ec.gc.ca/air/default.asp?lang=En&n=2C68B45C-1

WHAT IS GROUND LEVEL OZONE?

Ozone is a colourless, odourless gas made of three oxygen atoms. Ozone can form in two places:

1) high up in the atmosphere, and **2)** right down at the ground. When it's up high in the ozone layer it's "good" ozone. The ozone layer acts like sunscreen lotion for the Earth – blocking out most of the Sun's harmful ultraviolet rays. When it's near the ground it's "bad" ozone. "Ground-level ozone" is formed when nitrogen oxides (NOx) and volatile organic compounds (VOCs) react in the air during hot and sunny days. See the EPA video of how Ozone is formed here: (http://www.epa.gov/airnow/ozone/o3.html)

NO_x and VOCs come from natural sources as well as human activities. About 95 per cent of NO_x from human activity come from the burning of coal, gasoline and oil in motor vehicles, homes, industries and power plants. VOCs from human activity come mainly from gasoline combustion, upstream oil and gas production, residential wood combustion, and from the evaporation of liquid fuels and solvents. Significant quantities of VOCs also originate from natural (biogenic) sources such as coniferous forests.

GROUND LEVEL OZONE AND...

YOUR HEALTH

Ozone can be harmful to everyone, especially children, seniors, and people with lung and heart conditions.

Specifically it can:

- Cause eye, throat and nose irritation and coughing
- Worsen existing lung and heart diseases
- Reduce life expectancy

THE ENVIRONMENT

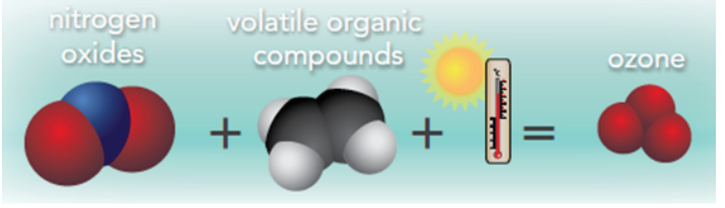
Ozone can affect our environment and our economy by:

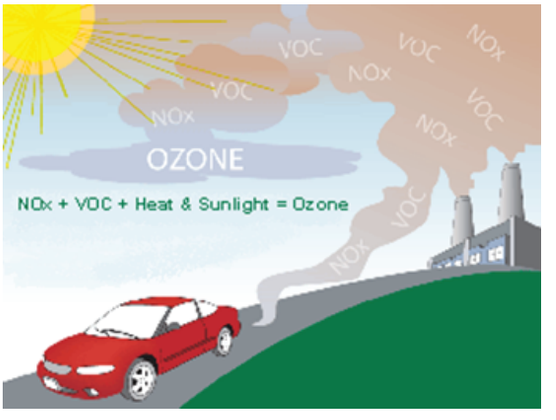
- Damaging ecosystems and vegetation
- Stunting tree growth
- Reducing crop yields
- Damaging buildings and materials
- Accelerating global climate change

OUR GLOBAL CLIMATE

Ground-level ozone is a major component of smog. It can also trap heat in the atmosphere and reduce the ability of plants to absorb carbon dioxide.

http://www.epa.gov/airnow/ozone/o3.html





SOURCES

https://www.ec.gc.ca/air/default.asp?lang=En&n=590611CA-1
http://www.metrovancouver.org/services/air/Documents/GLOFactsheet.pdf

PHOTO

http://www.gettingoutside.com/EPA-vs-Big-Polluters

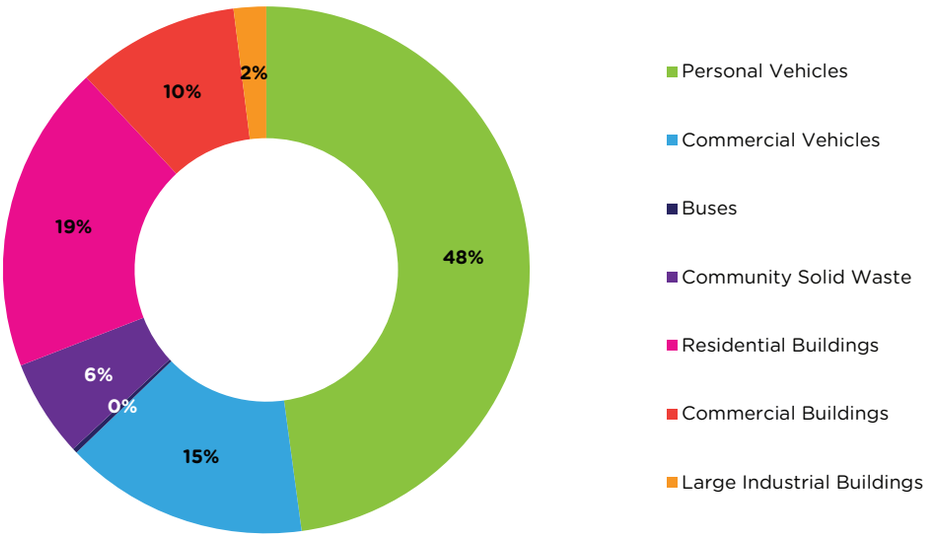
GREENHOUSE GAS EMISSION (GHGs)

Burning fossil fuels (gasoline, diesel, natural gas) is the major source of both smog-forming local air pollution, and of the region's greenhouse gas (GHG) emissions. Because of this strong link, reducing pollution from fossil fuel sources results in healthier air in the Central Okanagan, as well as reduced impact on global climate change.

The region is committed to reducing its GHG emissions. Local governments in the Central Okanagan have set targets to reduce GHG emissions by 33% by 2020. Currently communities are leveling off emissions, but not yet achieving a significant downward trend.

SOURCES OF EMISSIONS IN THE CENTRAL OKANAGAN (2010)

The following pie chart illustrates the major sources of community GHG emissions in the Central Okanagan:



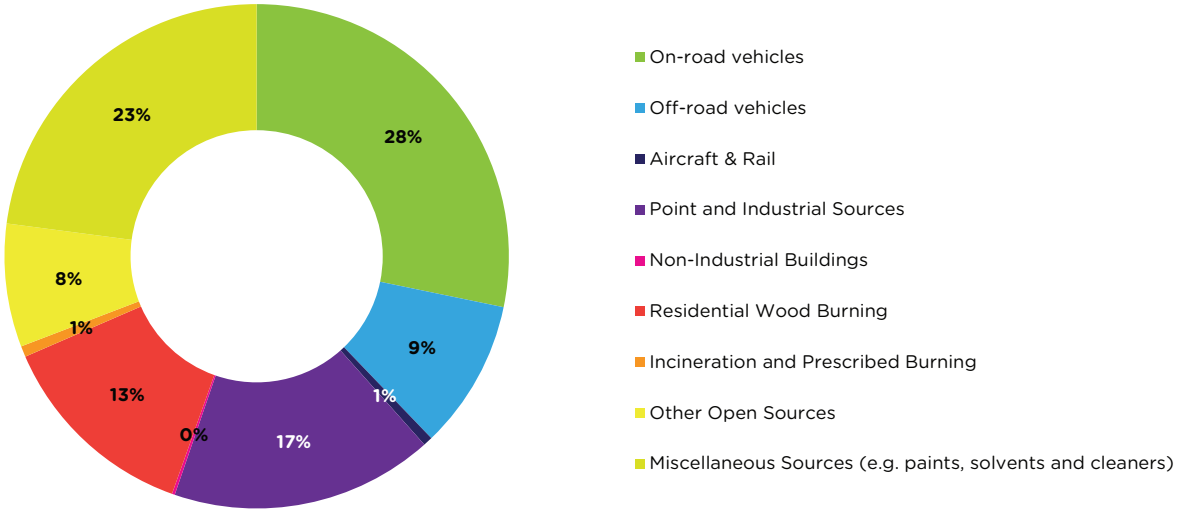
Regional District of Central Okanagan · City of Kelowna · City of West Kelowna · Westbank First Nation · Lake Country (Life. The Okanagan Way.) · Peachland (On the Lake)

WHAT ARE VOLATILE ORGANIC COMPOUNDS (VOCs)?

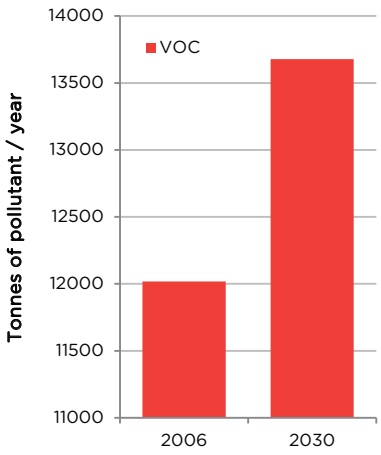
Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products numbering in the thousands. Examples include: paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings, office equipment such as copiers and printers, correction fluids and carbonless copy paper, graphics and craft materials including glues and adhesives, permanent markers, and photographic solutions.

Organic chemicals are also widely used as ingredients in household products. Paints, varnishes, and wax all contain organic solvents, as do many cleaning, disinfecting, cosmetic, degreasing, and hobby products. Fuels are made up of organic chemicals. All of these products can release organic compounds while you are using them, and, to some degree, when they are stored.

SOURCES OF VOCs IN THE CENTRAL OKANAGAN AIRSHED



VOC FORECAST FOR THE CENTRAL OKANAGAN



HEALTH EFFECTS OF VOCs

Health effects can include eye, nose, and throat irritation; headaches, loss of coordination, nausea; damage to liver, kidney, and central nervous system. The ability of organic chemicals to cause health effects varies greatly from those that are highly toxic, to those with no known health effect. As with other pollutants, the extent and nature of the health effect will depend on many factors including level of exposure and length of time exposed. Eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment are among the immediate symptoms that some people have experienced soon after exposure to some organics. At present, not much is known about what health effects occur from the levels of organics usually found in homes. Many organic compounds are known to cause cancer in animals; some are suspected of causing, or are known to cause, cancer in humans.

SOURCES

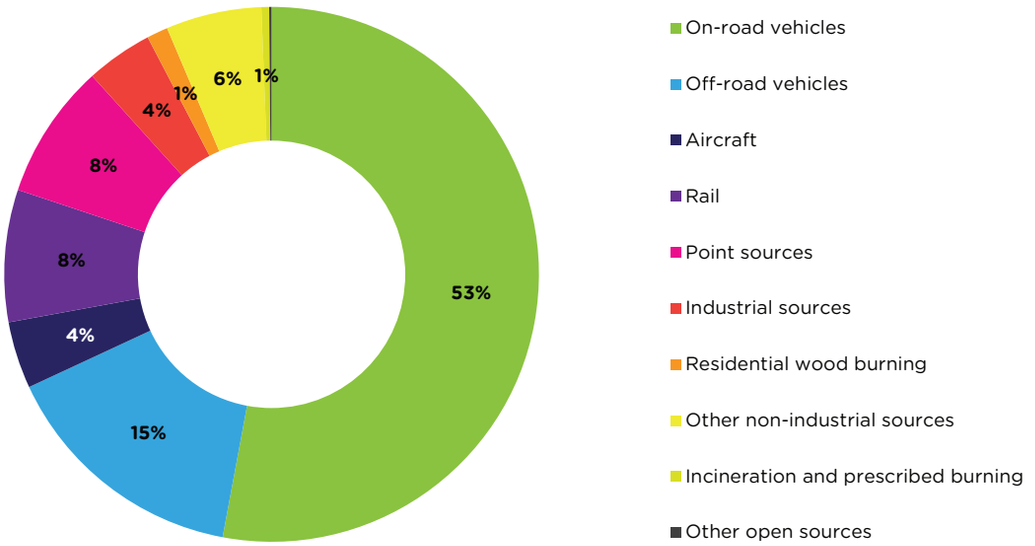
http://www.epa.gov/iaq/voc.html

Regional District of Central Okanagan · City of Kelowna · City of West Kelowna · Westbank First Nation · Lake Country Life. The Okanagan Way. · Peachland On the Lake

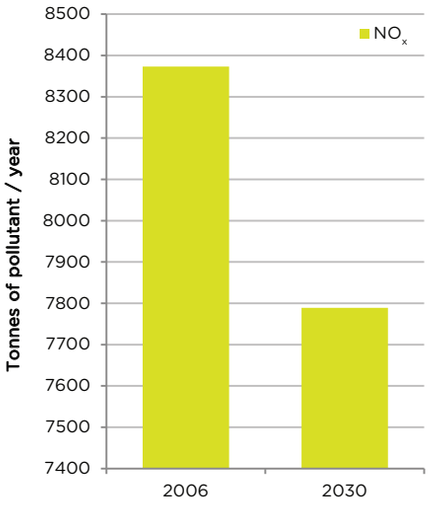
WHAT IS NITROGEN DIOXIDE?

Nitrogen dioxide (NO_2) belongs to a group of nitrogen-containing substances called nitrogen oxides (NO_x). NO_x are released into the atmosphere from high-temperature combustion processes such as car engines, power plants and industrial processes. Although primarily emitted as nitric oxide (NO), NO_2 is rapidly formed when NO reacts with ozone (O_3) and volatile organic compounds (VOCs). The major sources of NO_2 in Canada are on-road and off-road vehicles, the oil and gas industry, and the use of fuel for electricity generation and heating. It is a precursor to fine particulate matter ($PM_{2.5}$), and contributes to acid rain.

SOURCES OF NO_X IN THE CENTRAL OKANAGAN AIRSHED



NITROGEN OXIDE FORECAST FOR THE CENTRAL OKANAGAN



SOURCES

http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=C8BFC3F2-1

http://www.epa.gov/airtrends/aqtrnd95/no2.html

HEALTH AND ENVIRONMENTAL EFFECTS

Nitrogen dioxide can irritate the lungs and lower resistance to respiratory infections such as influenza, and increase susceptibility to allergens for people with asthma. The effects of short-term exposure are still unclear, but continued or frequent exposure to concentrations that are typically much higher than those normally found in the ambient air may cause increased incidence of acute respiratory illness in children. EPA's health-based national air quality standard for NO_2 is 0.053 ppm (measured as an annual arithmetic mean concentration). Nitrogen oxides contribute to ozone formation and can have adverse effects on both terrestrial and aquatic ecosystems. Nitrogen oxides in the air can significantly contribute to a number of environmental effects such as acid rain and eutrophication in coastal waters like the Chesapeake Bay. Eutrophication occurs when a body of water suffers an increase in nutrients that leads to a reduction in the amount of oxygen in the water, producing an environment that is destructive to fish and other animal life.