Fraser Valley Regional District

Highlights of Air Quality and Emissions Trends

(1990-2013)

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Fraser Valley Regional District

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Purpose

This document provides highlights of ambient air quality measurements and air pollutant emissions trends in the Fraser Valley Regional District (FVRD), which have been monitored and compiled for more than twenty years. The results shown act as a resource and starting point for informing priorities in the upcoming new Air Quality Management Plan (AQMP) for the region, though do not provide detailed analysis and discussion.

Summary

The ambient air quality and emissions inventory data has shown that in the FVRD:

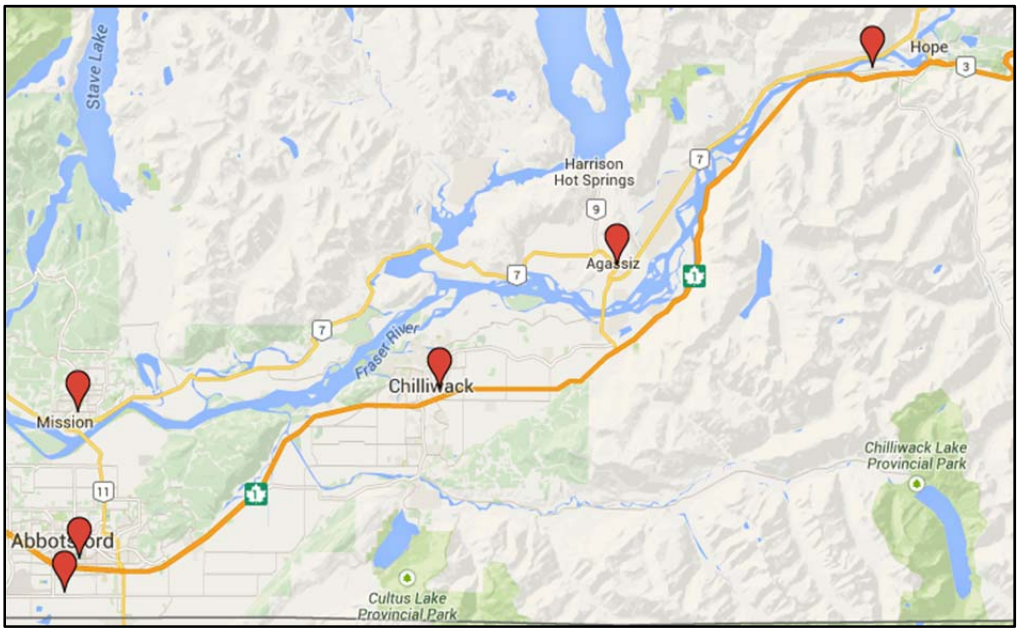
- Annual average ozone concentrations are increasing
- Ammonia concentrations are increasing, and emissions are forecast to rise
- Particulate matter emissions are forecast to rise
- Climate change-causing greenhouse gas emissions are forecast to rise
- Diesel emissions pose significant health risk

These highlights signify that additional actions need to be undertaken to reduce emissions of pollutants, and thereby their concentrations in ambient air, in order to realize human health, visibility, economic, and environmental benefits.

Background

The FVRD ambient air quality monitoring network measures criteria air contaminants, as well as meteorological parameters (wind speed, temperature, precipitation) on a continuous basis at six permanent locations. The air quality monitoring station locations are: Abbotsford-Central (Mill Lake Park), Abbotsford-Airport, Chilliwack (Airport), Hope (Airport), Kent (Municipal Hall), and Mission (Secondary School). The first four monitors have been in place since the 1990s or earlier, while Kent and Mission stations were added in 2013 and 2014, respectively. The trends shown in this document span 1994-2013, thus only the first four stations are displayed. The expanded network will be valuable in assessing future trends, as well as observing real-time air quality readings across the FVRD.

Figure 1. Permanent ambient air quality monitoring station locations in the FVRD



Criteria Air Contaminants

Criteria air contaminants are commonly measured pollutants with well-understood health impacts. These pollutants include:

- Ozone (O_3)
- Ammonia (NH_3)
- Particulate Matter ($PM_{2.5}$, PM_{10})
- Nitrogen oxides (NO_X)
- Carbon Monoxide (CO)
- Sulphur Oxides (SO_X)

Ambient Air Quality Trends

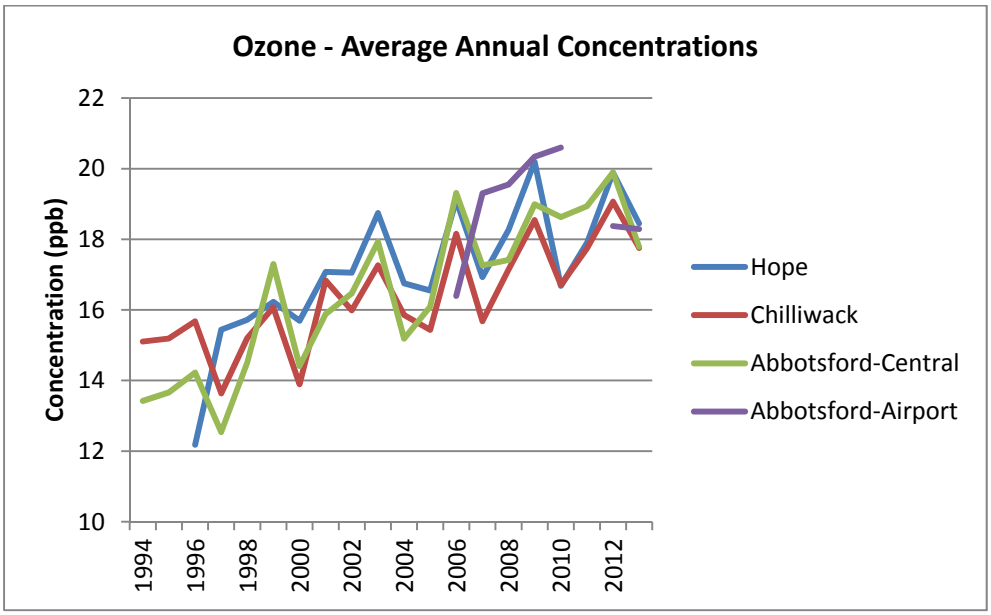
The following figures (2-8) show the measured annual average pollutant concentrations at the Abbotsford-Airport, Abbotsford-Central, Chilliwack and Hope locations from 1994-2013, as data is available. Not all of the pollutants have been measured at all of these stations through this time period, accounting for some of the data gaps. Where a BC ambient air quality objective[1] for the pollutant shown exists (on an annual basis), concentrations are compared to the objective.

Notable findings:

- Ozone annual average concentrations have been rising across the FVRD
- Ammonia concentrations have generally been rising
- Particulate matter, nitrogen oxides, carbon monoxide, and sulphur dioxide concentrations have generally been decreasing

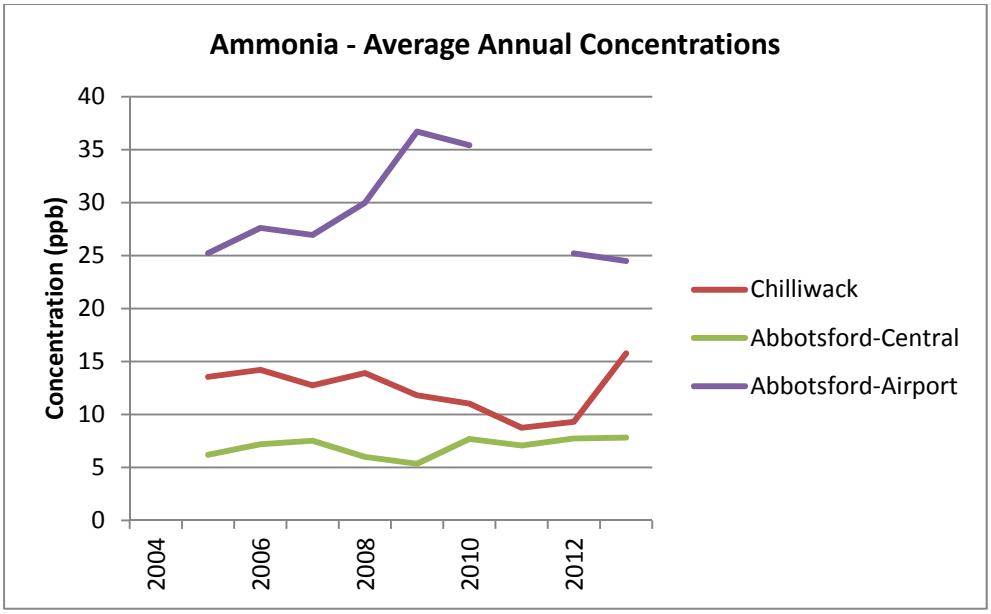
[1]BC Ministry of Environment. 2014. http://www.bcairquality.ca/reports/pdfs/aqotable.pdf

Figure 2. Ozone (O_3) average annual concentrations



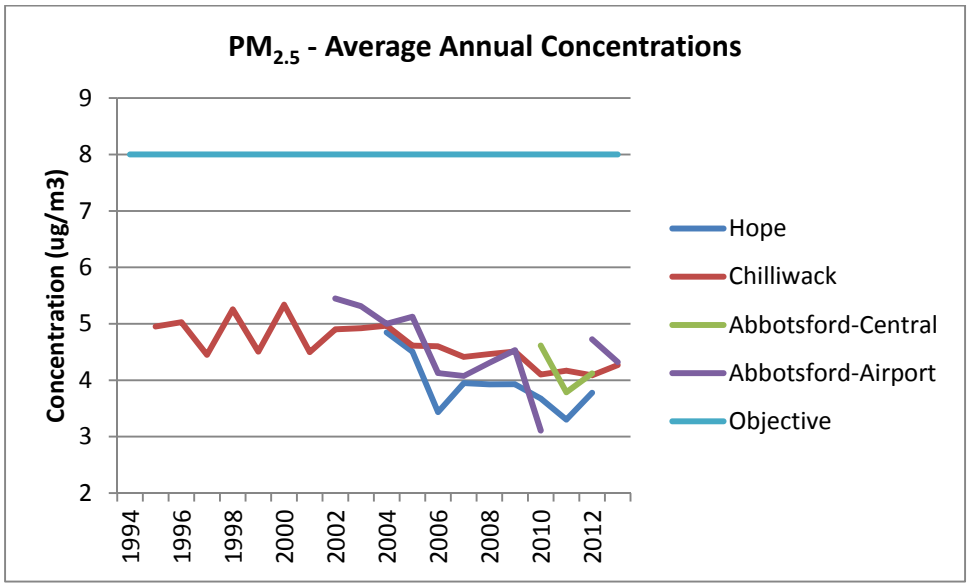
Annual ozone concentrations have been increasing at all four FVRD monitoring stations over the past twenty years. Additional actions are needed to reduce ozone concentrations.

Figure 3. Ammonia (NH_3) average annual concentrations



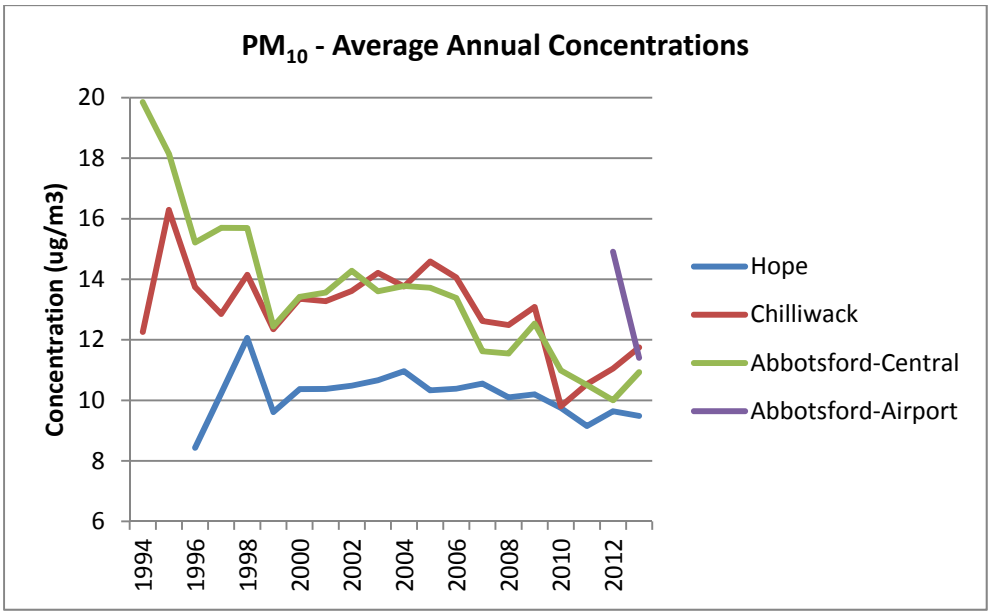
Ammonia has only been monitored at a few air monitoring stations since 2005 and does not have an objective in BC. Measured concentrations in the FVRD have been increasing at two of the three stations monitoring ammonia (Abbotsford-Central and Chilliwack). Ammonia concentrations may increase in the future, unless additional actions are taken. The monitoring data also exemplifies the need to review the monitoring network, and determine if additional ammonia monitoring locations should be considered.

Figure 4. Fine particulate matter ($PM_{2.5}$) average annual concentrations



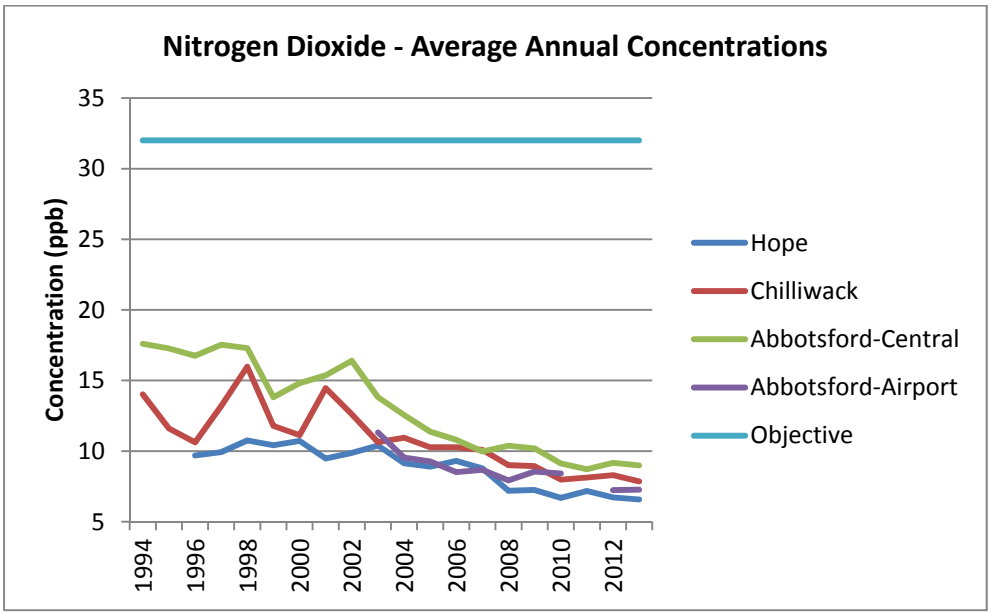
Fine particulate matter has been measured at multiple stations in the FVRD since 2002. While concentrations are generally decreasing, and are below the BC air quality objective, additional actions will be required to ensure concentrations continue trending downward.

Figure 5. Particulate matter (PM_{10}) average annual concentrations



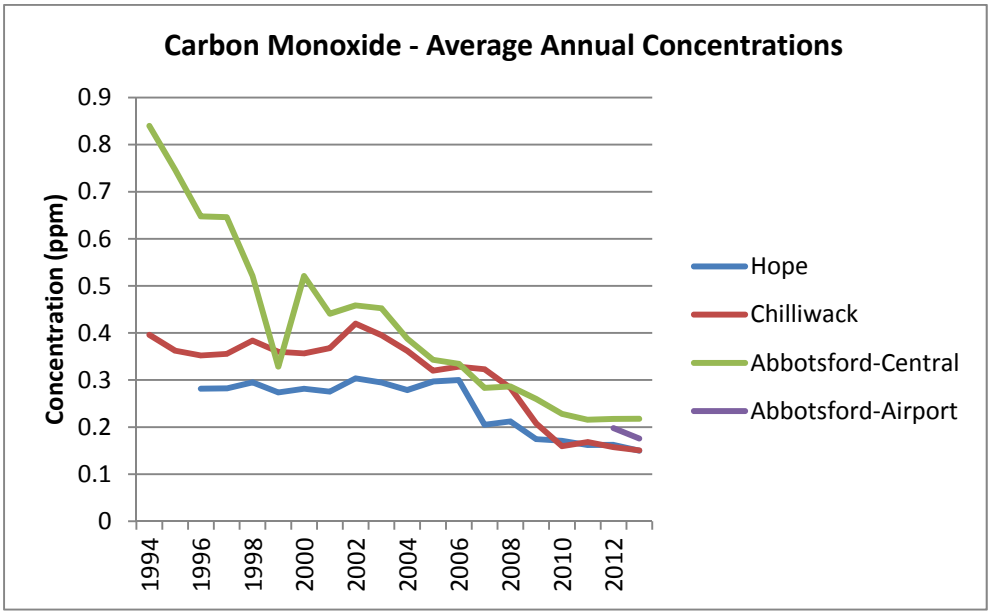
Particulate matter concentrations have generally been decreasing in the FVRD in the 1990s, though additional actions will be required to ensure concentrations continue trending downward.

Figure 6. Nitrogen dioxide (NO_2) average annual concentrations



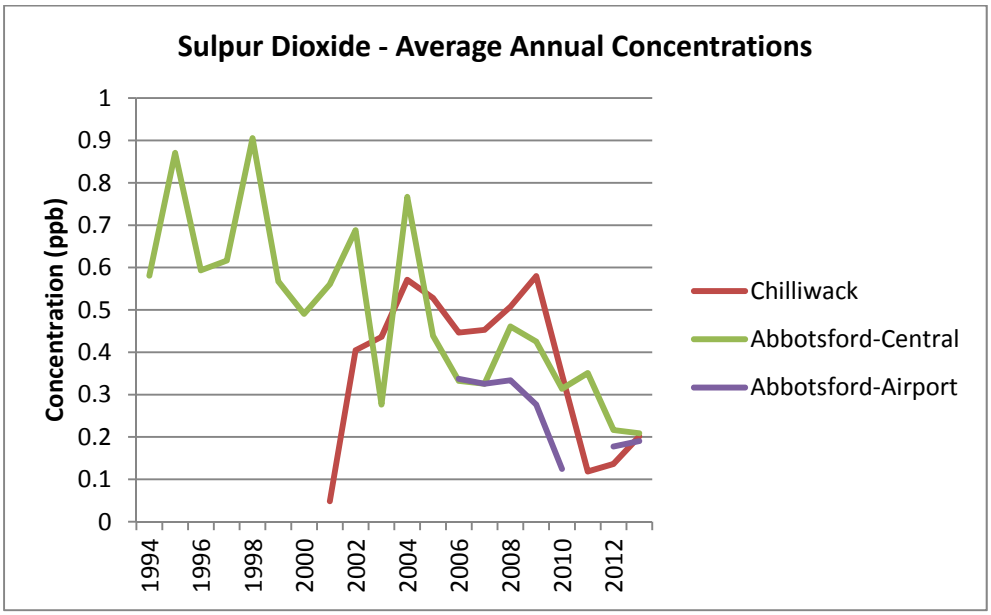
Nitrogen dioxide concentrations have generally decreased in the 1990s and have been below the BC air quality objective. A continuing downward trend into the future will have additional air quality benefits.

Figure 7. Carbon monoxide (CO) average annual concentrations



Carbon monoxide concentrations have been decreasing at all four FVRD monitoring stations.

Figure 8. Sulphur dioxide (SO_2) average annual concentrations



Sulphur dioxide concentrations have generally been decreasing at FVRD monitoring stations. Further, while there is no annual objective for sulphur dioxide in BC, levels in the FVRD are generally well below the 1-hour objective of 75 ppb.

Emission Trends

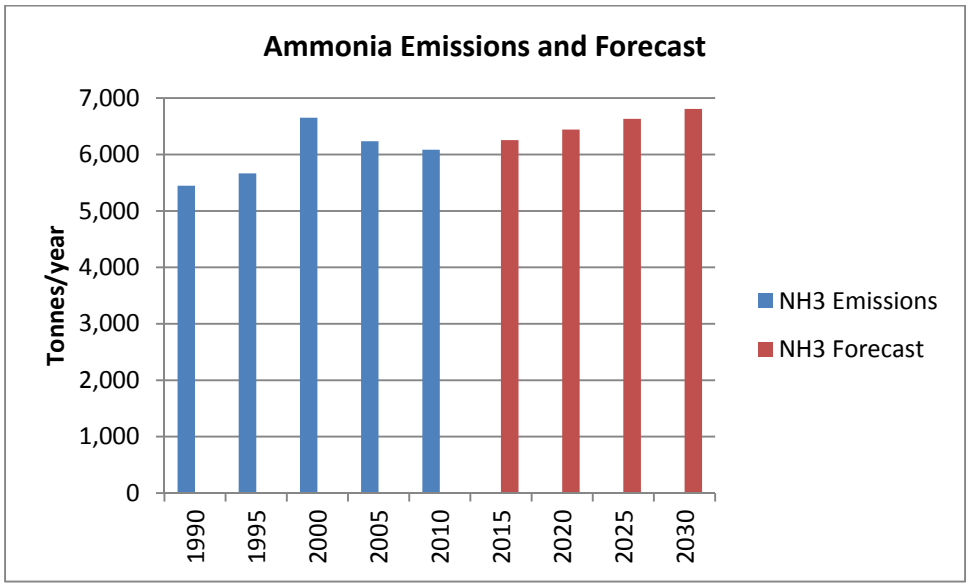
The following figures (9-16) show the total quantity of emissions of a given pollutant across the entire FVRD in the year indicated. These figures are distinct from the previous figures, in that they show total amount of contaminants emitted in the FVRD, while the previous figures show the measurement of pollutants in the ambient air.

Emissions of most criteria air contaminants have decreased since 1990, however, largely due to population growth, some emissions are forecast to rise over the next fifteen years. An increase in emissions will likely result in poorer, not better, air quality which will be shown as higher concentrations of pollutants at the monitoring stations. Emissions of ammonia, volatile organic compounds, fine particulate matter ($PM_{2.5}$), particulate matter (PM_{10}), nitrogen oxides, carbon monoxide, sulphur oxides, and greenhouse gases (as carbon dioxide equivalent) from 1990-2030 are shown below.

Notable findings:

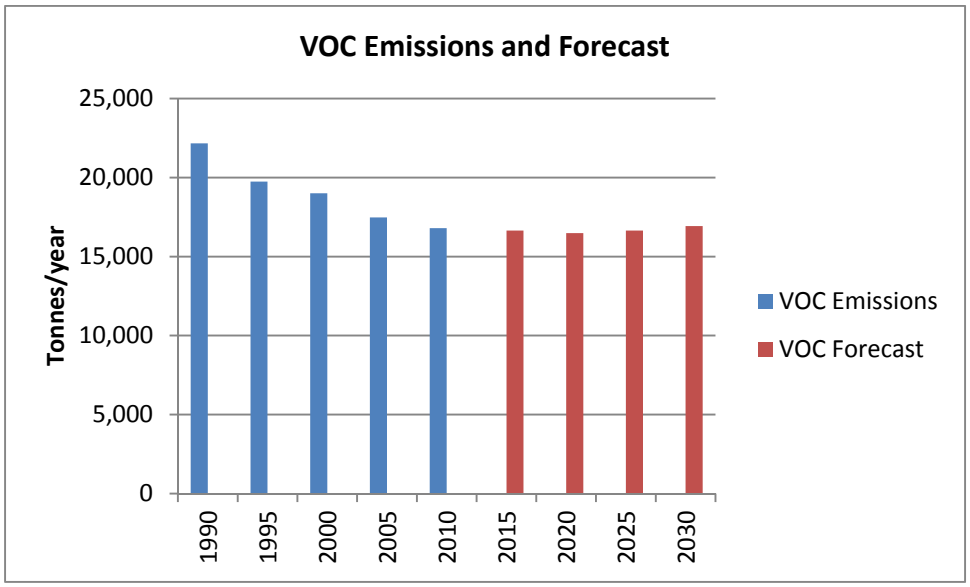
- Particulate matter emissions (including fine particulate matter) are forecast to increase
- Volatile organic compound emissions are forecast to increase
- Ammonia emissions are forecast to increase (to above 1990 levels)
- Greenhouse gas emissions are forecast to increase (to above 1990 levels)

Figure 9. Ammonia (NH_3) emissions and forecast, 1990-2030



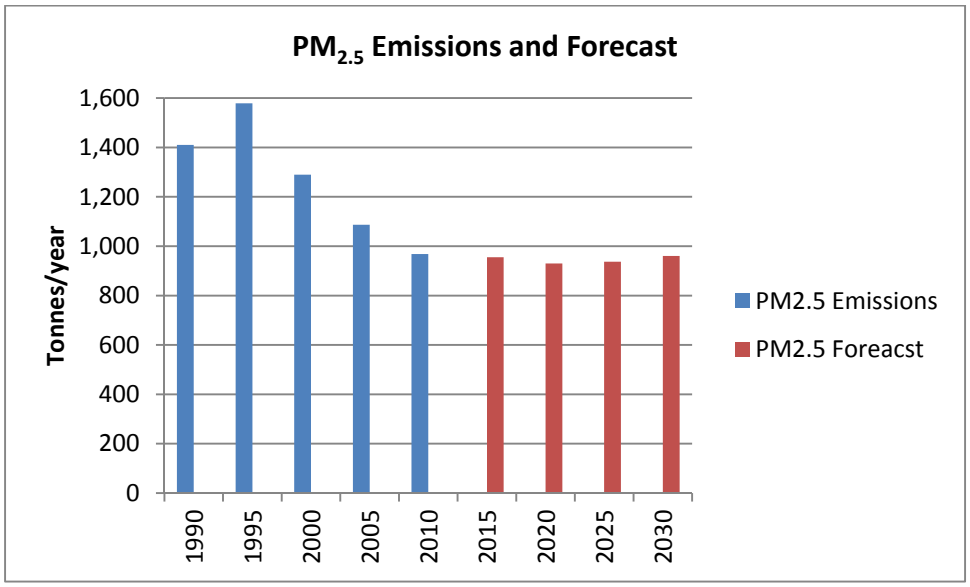
Emissions of ammonia have been generally increasing since 1990, and are forecast to continue increasing from 2015-2030, unless additional action is taken.

Figure 10. Volatile Organic Compound (VOC) emissions and forecast, 1990-2030



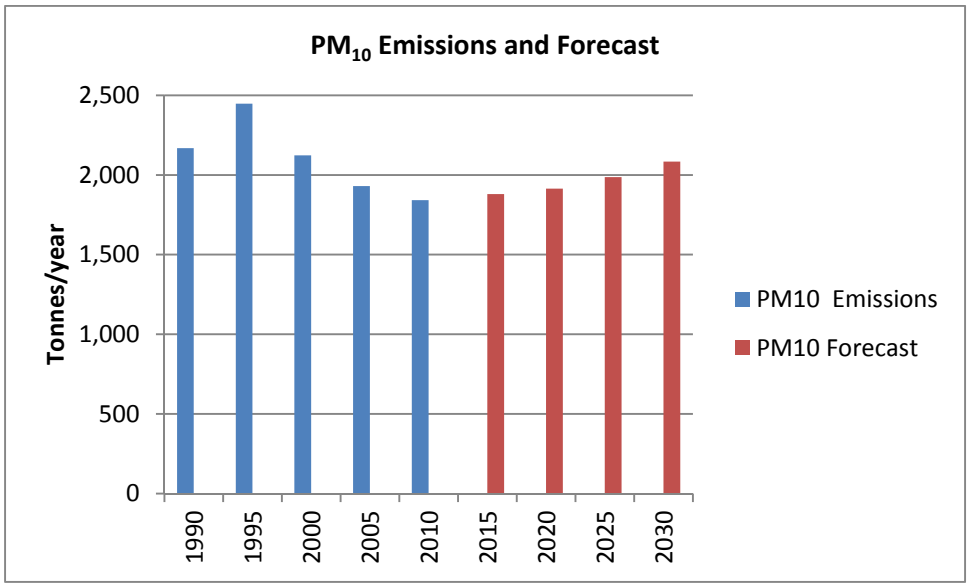
Volatile organic compounds are one of two precursor pollutants (the other is nitrogen oxides) that react to form ozone, which is a secondary pollutant. Emissions of VOCs have decreased since 1990, but are forecast to increase from 2015-2030, unless additional action is taken.

Figure 11. Fine particulate matter ($PM_{2.5}$) emissions and forecast, 1990-2030



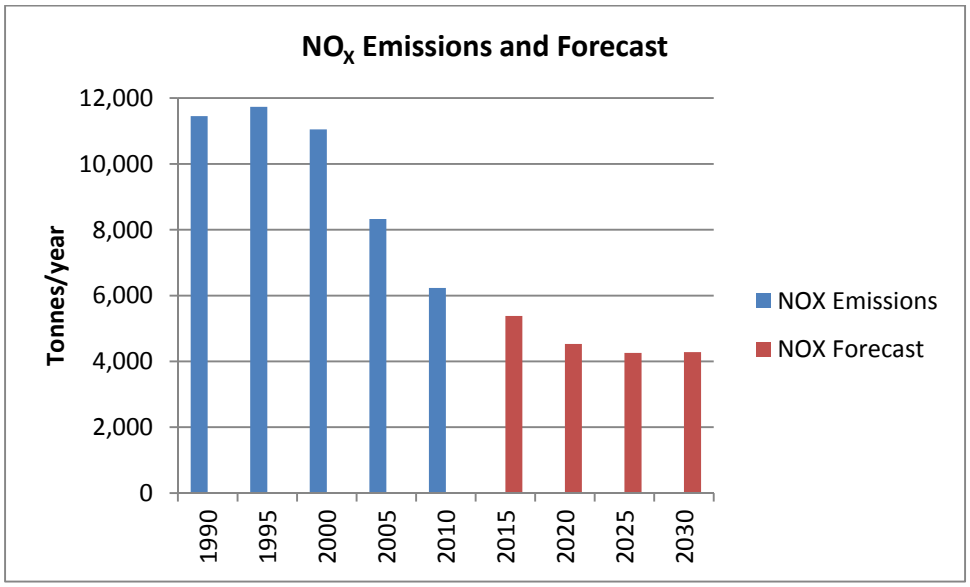
Emissions of fine particulate matter ($PM_{2.5}$) have generally decreased since 1990, but are forecast to increase from 2015-2030, unless additional action is taken.

Figure 12. Particulate matter (PM_{10}) emissions and forecast, 1990-2030



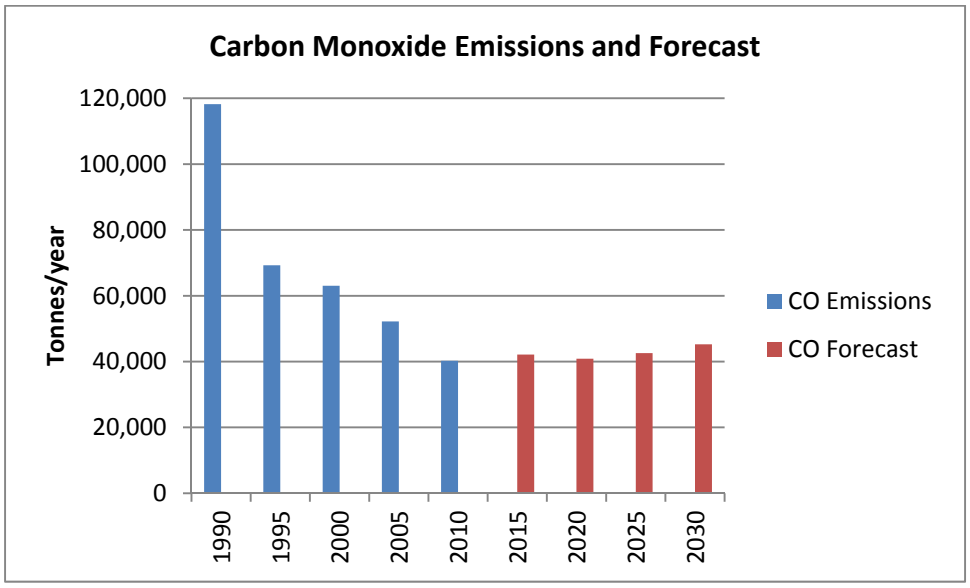
Emissions of particulate matter (PM_{10}) have generally decreased since 1990, but are forecast to increase from 2015-2030, unless additional action is taken.

Figure 13. Nitrogen oxides (NO_X) emissions and forecast, 1990-2030



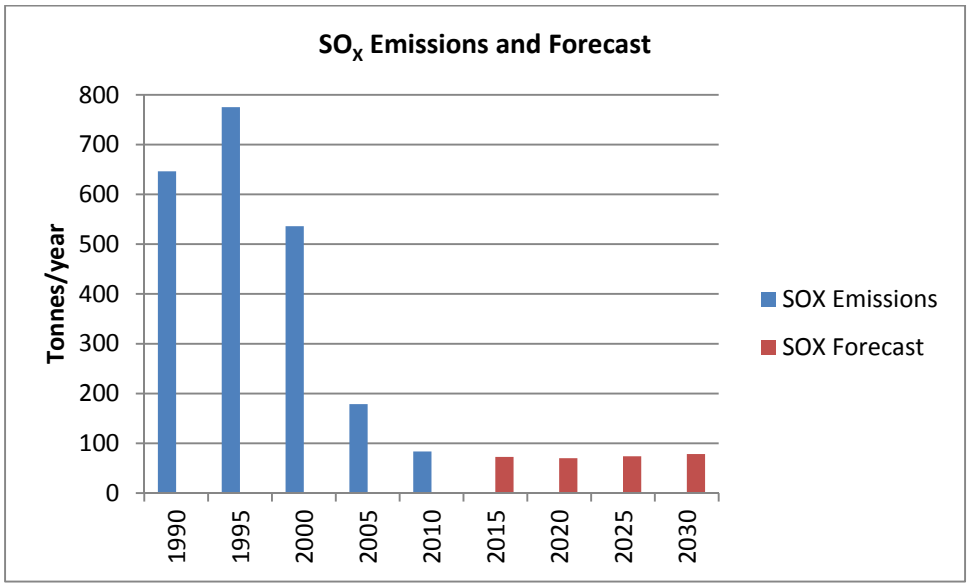
Emissions of nitrogen oxides (NO_X) have generally decreased since 1990, and are forecast to continue decreasing from 2015-2030.

Figure 14. Carbon monoxide (CO) emissions and forecast, 1990-2030



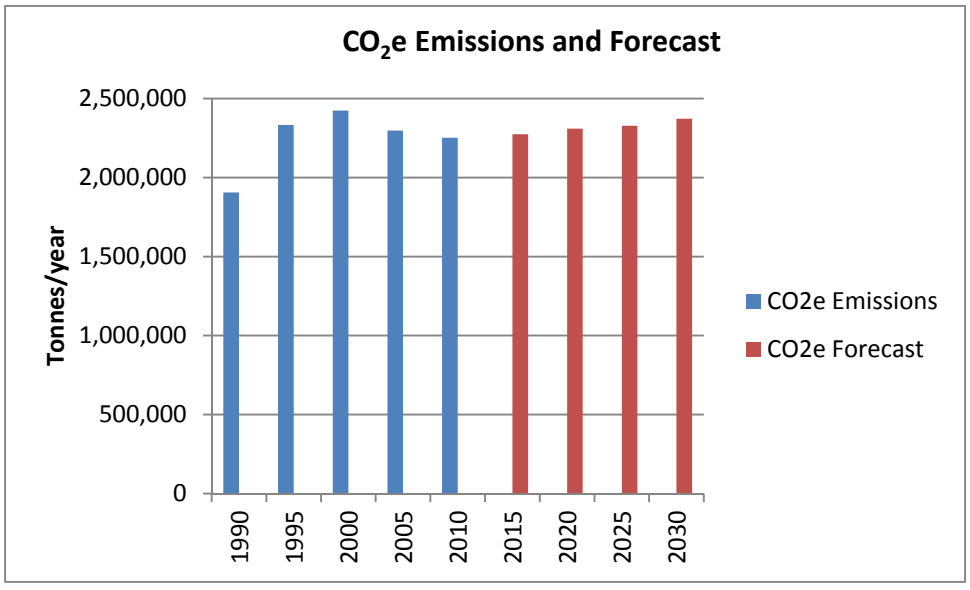
Emissions of carbon monoxide (CO) have generally decreased since 1990, but may increase slightly from 2015-2030, unless additional action is taken.

Figure 15. Sulphur oxides (SO_X) emissions and forecast, 1990-2030



Emissions of sulphur oxides (SO_X) have decreased markedly since 1990, and are forecast to remain low from 2015-2030.

Figure 16. Greenhouse gas emissions (carbon dioxide equivalent, CO_2e) and forecast, 1990-2030



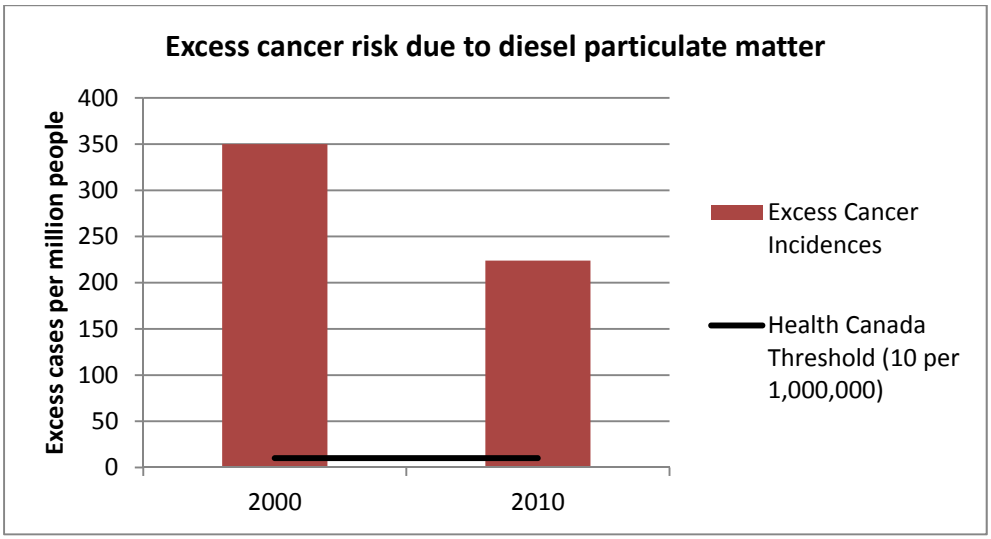
Emissions of greenhouse gases (CO_2e) have been generally increasing since 1990, and are forecast to continue increasing from 2015-2030, unless additional action is taken.

Toxic Air Pollutants

Toxic air pollutants include substances that are typically less commonly measured than criteria air contaminants, are emitted in lower quantities, but that may cause significant adverse health impacts, including cancer. These include substances such as metals and persistent organic pollutants. Two emissions inventories and human health risk assessments for toxic air pollutants in the Lower Fraser Valley have been completed to date, based on emissions data from 2000 and 2010. The highlights of these studies have shown:

- Diesel particulate matter (emissions from diesel engines) levels in the FVRD poses a health risk for developing cancer more than 20 times the Health Canada acceptable threshold[2], which has decreased since 2000, but remains high
- Acrolein levels in the FVRD poses a risk for non-cancer health outcomes more than 15 times the Health Canada acceptable threshold

Figure 17. Excess cancer risk (number of cases) due to diesel particulate matter



Conclusion

This document showcases trend highlights from more than twenty years of ambient air quality monitoring and emission inventory calculations in the FVRD. It does not present detailed analyses and statistics for the wealth of air quality data that is available in the region; this information is currently available as part of more comprehensive monitoring and emissions inventory reports for the entire Lower Fraser Valley Airshed. This document showcases that concentrations of some pollutants, particularly ozone, have been increasing in the FVRD, and that emissions of others, such as particulate matter and ammonia are forecast to rise in the coming years, which will degrade air quality unless additional action is taken.

[2] Health Canada. 2010. http://publications.gc.ca/collections/collection_2012/sc-hc/H128-1-11-632-eng.pdf