To: Zero Waste Committee

From: Brent Kirkpatrick, Lead Senior Engineer, Solid Waste Operations, Solid Waste Services

Date: September 2, 2021 Meeting Date: September 10, 2021

Subject: **Waste-to-Energy Facility Environmental Monitoring and Reporting 2020 Update**

RECOMMENDATION

That the Zero Waste Committee receive for information the report dated September 2, 2021, titled "Waste-to-Energy Facility Environmental Monitoring and Reporting 2020 Update".

EXECUTIVE SUMMARY

The Metro Vancouver Waste-to-Energy Facility operates well within environmental standards. All air emission related parameters monitored during 2020 were in compliance with the Waste-to-Energy Facility Operational Certificate. Metal emissions are less than 5% of regulatory limits. Dioxins/furans and trace organics are less than 2% of regulatory limits, with the exception of chlorobenzenes being less than 25% of the regulatory limit. Nitrogen oxides and fine particulate Waste-to-Energy emissions represent 0.4% and 0.002% of regional airshed totals. The Waste-to-Energy Facility accounts for less than 1% of regional greenhouse gas emissions.

On December 3, 2020, the Operational Certificate was amended to defer the reduction in discharge limits for hydrogen chloride and sulphur dioxide from December 31, 2022 to March 3, 2025. Metro Vancouver installed a new air quality monitoring station immediately adjacent to the Waste-to-Energy Facility and added air quality monitoring equipment to an existing monitoring station near the Waste-to-Energy Facility. Data collected to date shows ambient concentrations of hydrogen chloride and sulphur dioxide are less than 5% of ambient air quality standards, and well below modelling projections.

PURPOSE

The purpose of this report is to provide the Zero Waste Committee with an overview of the Waste-to-Energy Facility's environmental monitoring program and implementation of Operational Certificate requirements.

BACKGROUND

Metro Vancouver continuously monitors the environmental performance of the Metro Vancouver Waste-to-Energy Facility and since 2010, annual environmental performance summaries have been provided to the Zero Waste Committee for information.

This report provides updates on the facility's 2020 environmental performance and the implementation of the Waste-to-Energy Facility Operational Certificate requirements. The report is identified in the Zero Waste Committee annual work plan and as such is being brought forward at this time.

ENVIRONMENTAL MONITORING AND REPORTING UPDATE

Since the Waste-to-Energy Facility opened in 1988, Metro Vancouver has striven to continually reduce emissions through assessment, operational and plant infrastructure improvements and environmental controls. All air emission related parameters monitored during 2020 were in compliance with the requirements of Operational Certificate 107051. A summary of historic annual emission performance, including 2020 data, is attached.

To assess regulatory compliance, measurements from the environmental monitoring program are compared to the regulatory limits specified in the Waste-to-Energy Facility Operational Certificate 107051 issued by the BC Ministry of Environment and Climate Change Strategy. Results are reported in the following ways:

- Monthly compliance reports, which provide a summary of all air emissions monitoring results for each month, are provided to the BC Ministry of Environment and Climate Change Strategy, the City of Burnaby and the Fraser Health Authority, and are posted publicly on the Metro Vancouver website;
- Manual stack testing is conducted by an independent stack testing company four times a year for particulate matter, trace metals, and hydrogen fluoride. Results are provided to the BC Ministry of Environment and Climate Change Strategy, City of Burnaby, Fraser Health Authority and are posted publicly on the Metro Vancouver website;
- Manual stack testing for semi-volatile organic compounds is conducted once a year by an independent stack testing company, and results are provided to the BC Ministry of Environment and Climate Change Strategy, City of Burnaby and Fraser Health Authority, and are posted publicly on the Metro Vancouver website;
- Annual reporting of greenhouse gas emissions is provided to the BC Ministry of Environment and Climate Change Strategy and Environment and Climate Change Canada; and
- Annual reporting of substances emitted to air and contained in ash transferred for off-site disposal is provided to Environment and Climate Change Canada for the National Pollutant Release Inventory.

Environmental Monitoring Program

The 2020 Waste-to-Energy Facility environmental monitoring program consisted of the following:

- Air Emissions Monitoring – Continuous Emission Monitoring System:
    - The Waste-to-Energy Facility is equipped with a real-time flue gas continuous emission monitoring system that measures and records emission parameters at the exit of the air pollution control plant 24 hours per day, seven days a week, using a United States Environmental Protection Agency certified and auditable tracking system.
    - The following parameters are measured: sulphur dioxide, nitrogen oxides, carbon monoxide, carbon dioxide, hydrogen chloride, total hydrocarbons, and opacity.
    - The following key operational parameters are also monitored: furnace temperature, total flue gas flow, flue gas moisture and flue gas oxygen. This monitoring provides

an indication of plant conditions and helps confirm that emissions monitored by manual stack testing are representative of year round conditions.

- Air Emissions Monitoring – Periodic Manual Stack Testing:
    - Triplicate tests are conducted four times per year on each of the three plant lines to measure particulate matter, trace metals, and hydrogen fluoride.
    - A single test is conducted annually on one boiler (rotating between boilers each year) in triplicate to monitor for semi-volatile organic compounds, including dioxins and furans, chlorobenzenes, chlorophenols, polychlorinated biphenyls and polycyclic aromatic hydrocarbons.

- Fly and Bottom Ash Monitoring:
    - Each fly ash load is tested prior to transport and disposal.
    - Bottom ash samples are collected from each truck loaded with bottom ash for transport and disposal. Samples are combined to form a weekly composite sample for analysis.
    - On May 20, 2021 the Ministry of Environment and Climate Change Strategy approved Metro Vancouver's 2020 Bottom Ash Management Plan. The 2020 Plan allows for the potential beneficial use of bottom ash that has been processed through the Waste-to-Energy Facility's non-ferrous metal recovery system. Procurement is underway for the beneficial use of bottom ash.

Operational Certificate Implementation

On December 3 2020, the Metro Vancouver Waste-to-Energy Facility Operational Certificate was amended to defer the reduction in discharge limits for hydrogen chloride and sulphur dioxide from December 31, 2022 to March 3, 2025. Dispersion modelling submitted to the Ministry of Environment and Climate Change Strategy in December 2018 indicated that with current emission and operational certificate permitted levels, maximum ambient air concentrations of hydrogen chloride and sulphur dioxide are not expected to exceed ambient air criteria. The extension allows for additional ambient air monitoring to confirm concentration levels.

In the fall of 2020, Metro Vancouver installed an air quality monitoring station in the northwest corner of the Waste-to-Energy Facility site, which is near the location with the highest expected concentrations identified by the dispersion modelling. The station continuously measures hydrogen chloride, sulphur dioxide and nitrogen dioxide.

Metro Vancouver's existing air quality monitoring station at Burnaby South was put in place in advance of the development of the Waste-to-Energy Facility with the goal of monitoring for any potential impacts of the Waste-to-Energy Facility on air quality. The instrumentation at the station, which already includes sulphur dioxide and nitrogen dioxide monitoring, was upgraded in the fall of 2020 with the addition of a hydrogen chloride monitor.

Monitoring data will be collected for a minimum of two years, and the data will be used to compare ambient concentrations to dispersion modelling results and ambient air quality objectives. Metro Vancouver has initiated procurement for a consultant to evaluate the data for reporting to the Ministry of Environment and Climate Change Strategy. Hydrogen chloride, sulphur dioxide, and nitrogen dioxide data collected from both monitoring stations has been posted monthly on the Metro Vancouver website since December 2020.

Data collected to date shows ambient air concentrations of hydrogen chloride and sulphur dioxide are less than 5**%** of ambient air quality objectives, and well below modelling results. Nitrogen oxide levels are within ambient air quality objectives and lower than other monitoring stations within the region. The primary contributor to ambient nitrogen oxides throughout the region is automobile exhaust. One of the objectives of the consulting study will be determining the relative contribution of the Waste-to-Energy Facility to nitrogen oxide levels in the vicinity of the Waste-to-Energy Facility.

Greenhouse Gas Emissions Reporting

In mid-2009, the federal and provincial governments each enacted legislation requiring reporting of greenhouse gas emissions for facilities with annual emissions above specified thresholds 50,000 tonnes (federal) and 10,000 (provincial) tonnes of carbon dioxide equivalent per year. Based on these thresholds, the Waste-to-Energy Facility is subject to federal and provincial reporting on both biogenic (renewable) and anthropogenic (man-made or non-renewable) greenhouse gas emissions.

Greenhouse gas emissions from the Waste-to-Energy Facility are comprised mainly of carbon dioxide with trace amounts of methane and nitrous oxides. 2020 greenhouse gas emissions were verified by PwC Canada, and reported to the provincial and federal governments, at a total of 295,275 tonnes carbon dioxide equivalents, an increase of approximately 8% compared to 2019. This increase is primarily due a change in the composition of the waste stream and increased use of natural gas to meet the response limit requirements of the Operational Certificate. Of these emissions, 47% are anthropogenic and 53% are biogenic. Over the past three years, the anthropogenic portion of greenhouse gas emissions has ranged from 40% to 47%. As in past reporting years, the Waste-to-Energy Facility accounted for less than 1% of all anthropogenic greenhouse gas emissions in the region.

National Pollutant Release Inventory Reporting

The National Pollutant Release Inventory is Canada's legislated, publicly accessible inventory of pollutant releases to air, water and land, as well as from disposal and transfer for recycling. The National Pollutant Release Inventory is managed by Environment and Climate Change Canada and currently tracks over 300 substances and groups of substances. Metro Vancouver is required to report air emissions (e.g., particulate matter, metals, organic compounds and acid gases) and substances transported for off-site disposal, fly ash and bottom ash, for the preceding calendar year to the National Pollutant Release Inventory. Table 1 summarizes the information which has been reported to the National Pollutant Release Inventory.

Table 1: 2020 National Pollutant Release Inventory Substance Reporting Summary

	Reported Quantity (tonnes)	
Substance	**Stack Emissions**	**Ash Disposal**
Nitrogen Oxides	221.4	N/A
Carbon Monoxide	53.9	N/A
Sulphur Dioxide	111.2	N/A
Hydrogen Chloride/Hydrochloric Acid	93.0	N/A
Aluminum (dust)	0.009	N/A
Arsenic	0.00071	1.70
Cadmium	0.00017	1.58
Cobalt	0.00017	1.40
Copper	0.00041	101.7
Lead	0.00112	25.9
Manganese	0.00083	28.5
Mercury	0.0019	0.056
Phosphorus	0.0021	518.6
Zinc	0.0042	240.9
Particulate Matter ≤ 10µm	0.79	N/A
Particulate Matter ≤ 2.5µm	0.63	N/A
Dioxins and Furans	N/A	N/A
Hexachlorobenzene	N/A	N/A

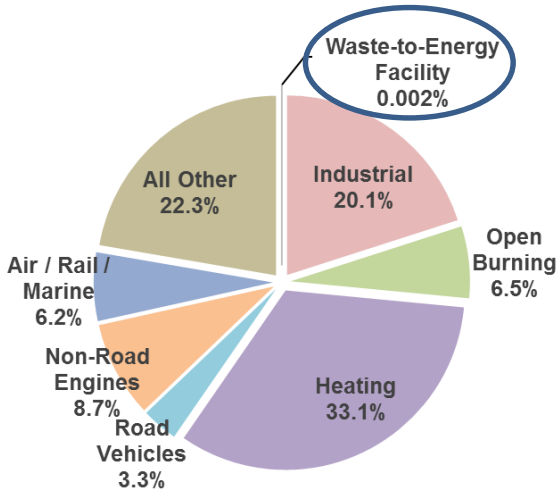
Notes:
- All other substances are below the National Pollutant Release Inventory level of quantification and are not required to be reported.
- 'N/A' indicates value is either below the level of quantification, below the detection limit, or the substance is not found in ash.
- Ash tonnages reported on a dry basis.

Waste-to-Energy Facility in a Regional Context

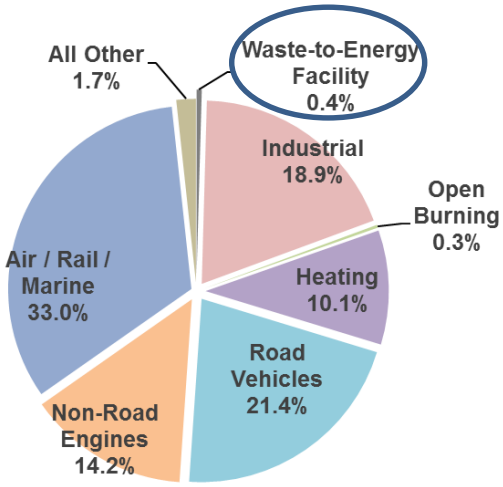
Figure 1 compares Waste-to-Energy Facility emissions to total emissions from all regional sources for two key air contaminants in the Lower Fraser Valley – fine particulate matter and nitrogen oxides (a key smog forming pollutant). In 2020, the Waste-to-Energy Facility accounted for 0.002% of regional fine particulate matter emissions and 0.4% of regional nitrogen oxide emissions. The Nitrogen Oxide Reduction Project, completed in October 2014, reduced nitrogen oxide emissions from 0.9% of the regional total in 2013 to 0.4% in 2020.

Figure 1: Regional Emissions Distribution (2020) – Fine Particulate Matter and Nitrogen Oxides

2020 Lower Fraser Valley Fine Particulate Matter Emission Sources



2020 Lower Fraser Valley Nitrogen Oxide Emission Sources



ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

Activities related to emissions monitoring and reporting are included in the approved Solid Waste Services operational budget.

CONCLUSION

The Waste-to-Energy Facility operates well within environmental standards and regulatory limits. A range of projects that continuously improve the facility's environmental performance have been completed or are underway. All air emission related parameters monitored during 2020 were in compliance with Operational Certificate 107051. Continuous emissions monitoring data and all compliance reports are available on the Metro Vancouver website.

Attachments *(Orbit #46499548)*

1. Metro Vancouver Waste-to-Energy Facility Summary of Air Emissions 1988-2020
2. Ambient Air Quality Report for Metro Vancouver Waste-to-Energy Facility– July 2021

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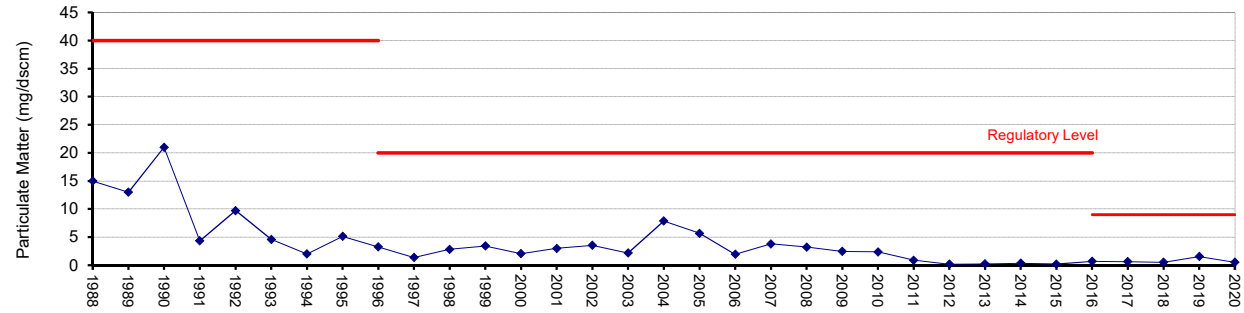
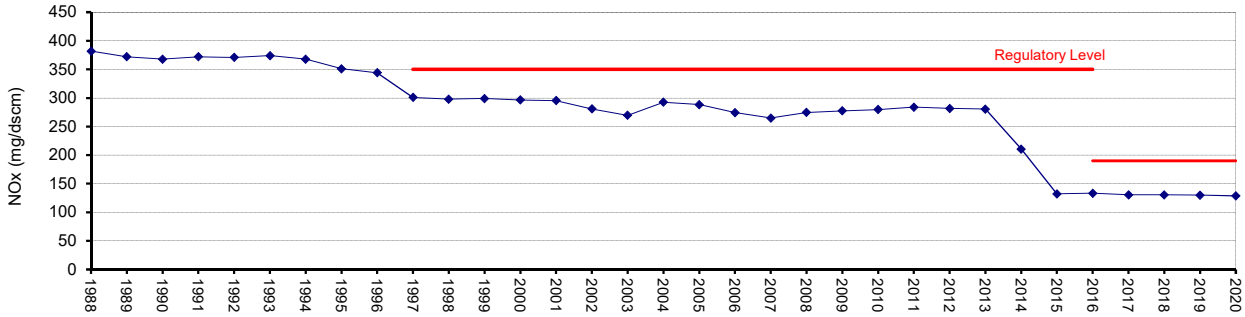
Metro Vancouver Waste-To-Energy Facility Summary of Air Emissions 1988 - 2020

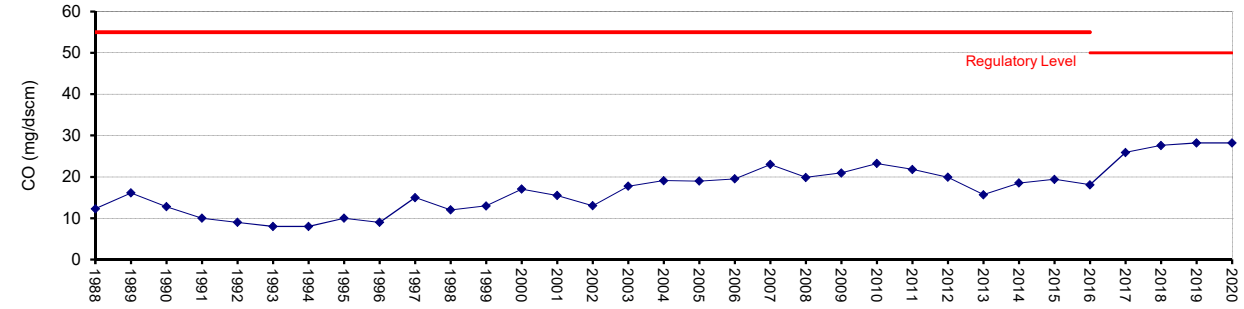
Particulate Matter



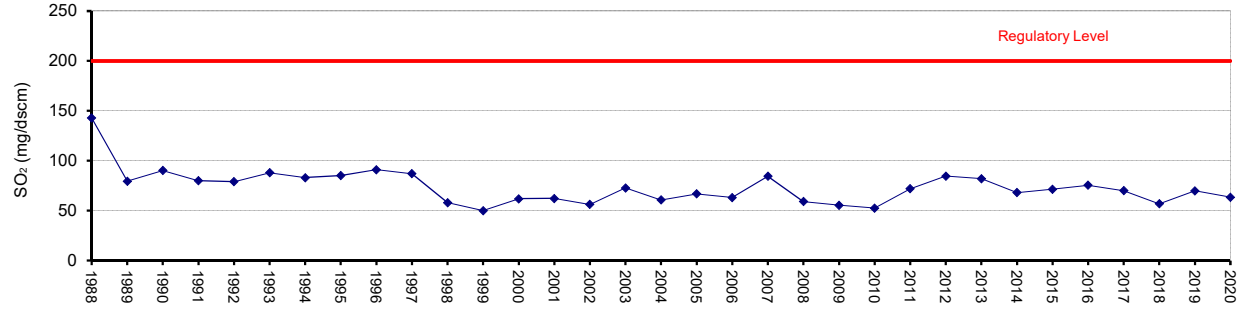
Nitrogen Oxides



Carbon Monoxide

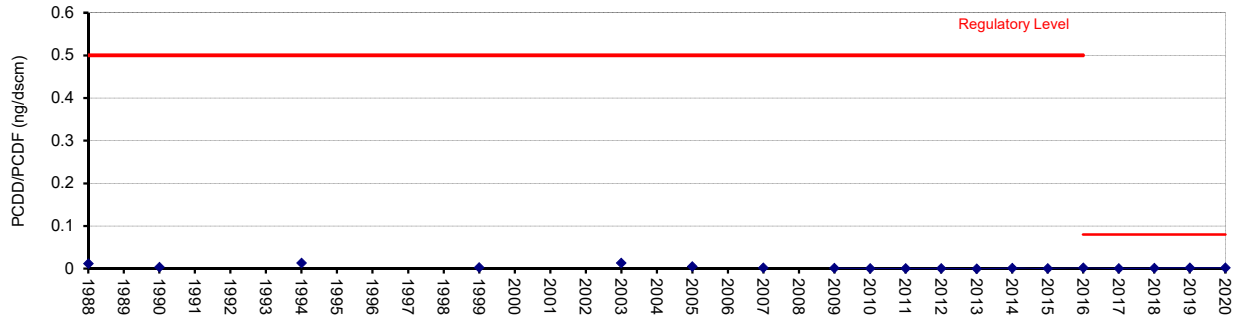


Sulfur Dioxide

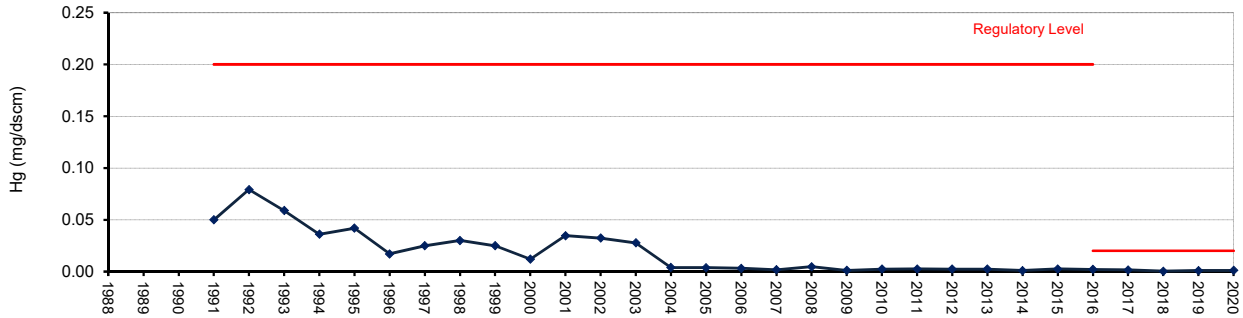


Metro Vancouver Waste-To-Energy Facility Summary of Air Emissions 1988 - 2020

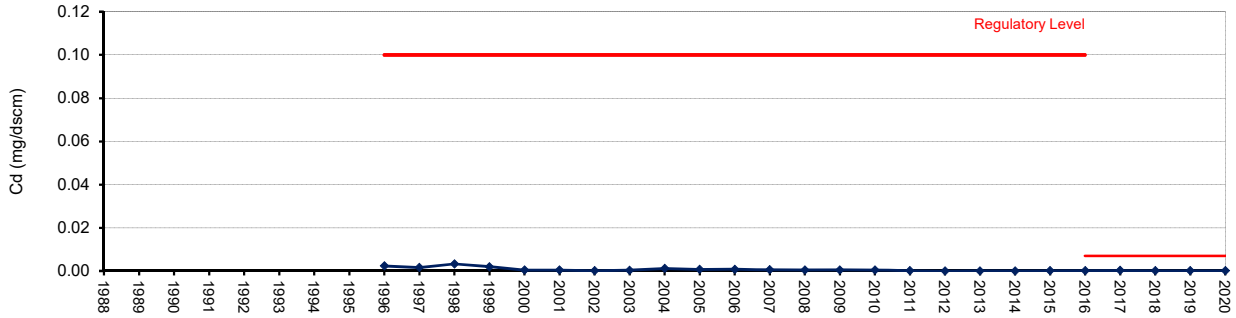
Dioxins/Furans



Mercury



Cadmium



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Ambient Air Quality Report for Metro Vancouver Waste-to-Energy Facility

Monthly Summary Report - July 2021

Prepared August 26, 2021

Metro Vancouver operates a network of ambient air quality monitoring station in Metro Vancouver and the Fraser Valley. Two of these monitoring stations Burnaby South (T018) and WTEF (S150) are located near to Metro Vancouver's Waste-to-Energy Facility.

Data in this summary report is considered preliminary. While some preliminary quality assurance and quality control has been applied to the data, it is subject to change, without notice pending the completio of additiona quality assurance, quality control and verifi atio procedures by Metro Vancouver at a future time

Data in this report are compared to ambient air quality objecti es. More informatio on ambient air quality objecti es can be found at: http://www.metrovancouver.org/services/air-quality/about/air-quality-monitoring/ambient-air-quality-objectives/

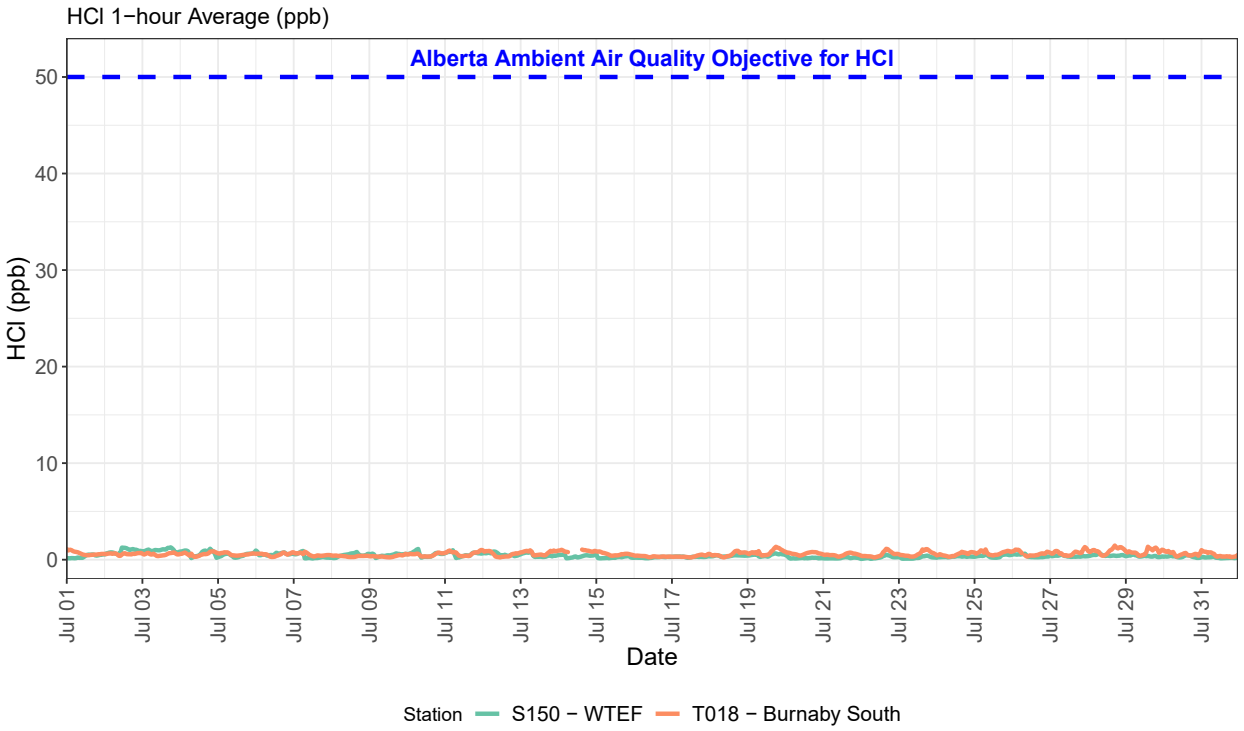
For additiona information please see:

Current Air Quality (http://airmap.ca)

Air Quality Monitoring (http://www.metrovancouver.org/services/air-quality/about/air-quality-monitoring)

HCl (hydrogen chloride) Monthly Summary - WTEF and Burnaby South

Metro Vancouver does not have an ambient air quality objecti e for hydrogen chloride (HCl). The Province of Alberta has a 1-hour objecti e for HCl of 50 ppb.



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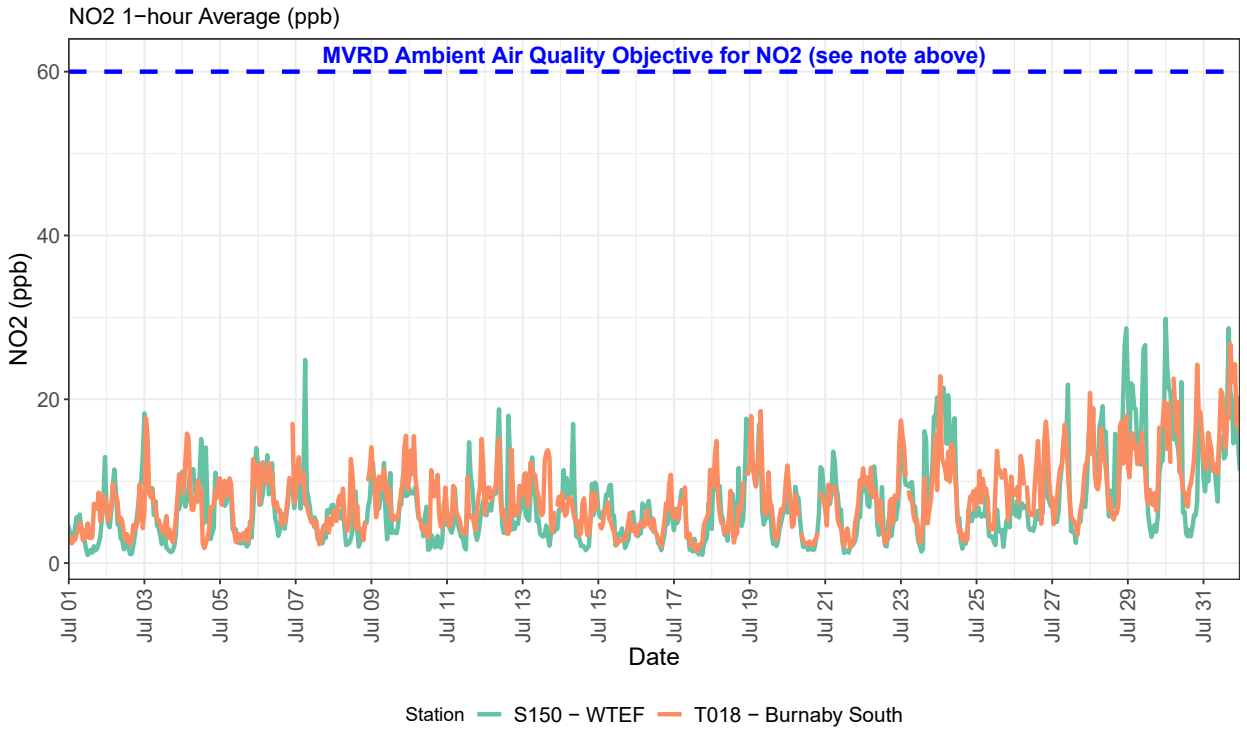
PRELIMINARY DATA

	Daily Average HCl Concentratio (ppb)		Daily 1-hour Maximum HCl Concentratio (ppb)	
Date	S150 - WTEF	T018 - Burnaby South	S150 - WTEF	T018 - Burnaby South
2021-07-01	0.3	0.7	0.6	1.1
2021-07-02	0.9	0.6	1.3	0.7
2021-07-03	1.0	0.6	1.3	0.8
2021-07-04	0.7	0.6	1.1	0.9
2021-07-05	0.5	0.6	0.8	0.8
2021-07-06	0.6	0.5	0.9	0.8
2021-07-07	0.3	0.5	0.9	0.8
2021-07-08	0.5	0.4	0.8	0.4
2021-07-09	0.5	0.4	0.7	0.6
2021-07-10	0.6	0.5	1.1	0.7
2021-07-11	0.6	0.7	1.0	1.0
2021-07-12	0.6	0.6	0.8	1.0
2021-07-13	0.5	0.7	0.9	1.0
2021-07-14	0.4	0.9	0.5	1.0
2021-07-15	0.2	0.6	0.6	0.9
2021-07-16	0.2	0.3	0.3	0.4
2021-07-17	0.3	0.4	0.4	0.6
2021-07-18	0.4	0.6	0.5	0.9
2021-07-19	0.5	0.8	0.7	1.3
2021-07-20	0.2	0.6	0.5	0.8
2021-07-21	0.2	0.5	0.3	0.7
2021-07-22	0.2	0.5	0.5	1.1
2021-07-23	0.2	0.6	0.4	1.1
2021-07-24	0.3	0.5	0.4	0.8
2021-07-25	0.4	0.7	0.5	1.1
2021-07-26	0.4	0.6	0.6	1.0
2021-07-27	0.4	0.7	0.5	1.3
2021-07-28	0.5	0.9	0.7	1.5
2021-07-29	0.4	0.8	0.5	1.3
2021-07-30	0.3	0.6	0.5	1.0
2021-07-31	0.2	0.5	0.3	1.0

NO2 (nitrogen dioxide) Monthly Summary - WTEF and Burnaby South

Metro Vancouver's ambient air quality objecti e for 1-hour NO2 is based on the analysis of three consecuti e years of data, the annual 98th percentil of the daily maximum 1-hour concentratio is averaged over three consecuti e years. The dashed blue line in the figu e below shows the numerical value of Metro Vancouver's 1-hour NO2 ambient air quality objecti e (60 ppb). If the preliminary NO2 data shown in this report has a concentratio above the numerical value, it does not necessarily indicate an exceedance of the Metro Vancouver objecti e. Achievement of the objecti e is determined at the end of each calendar year.



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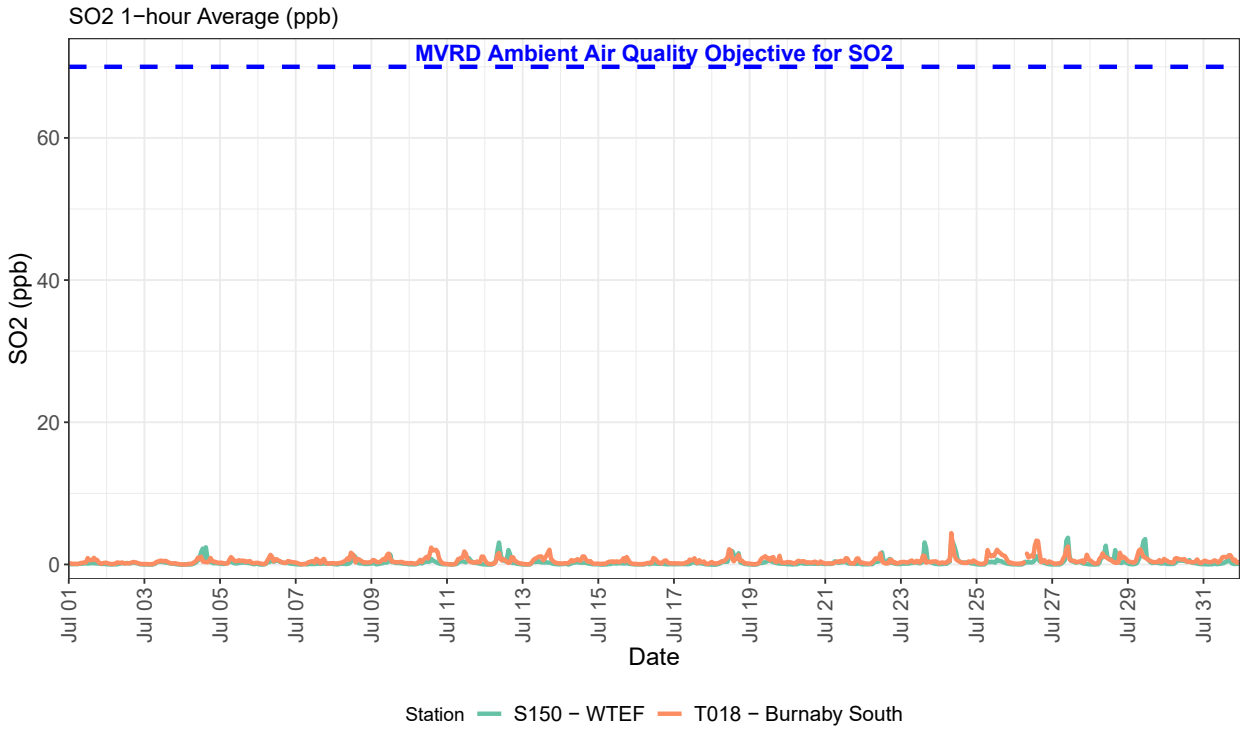
PRELIMINARY DATA

	Daily Average NO2 Concentratio (ppb)		Daily 1-hour Maximum NO2 Concentratio (ppb)	
Date	S150 - WTEF	T018 - Burnaby South	S150 - WTEF	T018 - Burnaby South
2021-07-01	3.7	4.6	13.0	8.6
2021-07-02	5.4	5.5	13.2	9.7
2021-07-03	5.6	6.8	18.3	17.7
2021-07-04	8.8	7.9	15.2	15.8
2021-07-05	5.7	6.5	14.0	12.7
2021-07-06	7.9	8.9	13.2	17.0
2021-07-07	7.0	6.2	24.8	12.9
2021-07-08	5.0	6.6	8.8	12.7
2021-07-09	7.4	9.0	12.3	15.6
2021-07-10	5.0	7.6	9.3	15.5
2021-07-11	5.6	6.6	14.8	15.2
2021-07-12	7.8	7.9	18.8	15.2
2021-07-13	5.6	9.0	12.9	13.8
2021-07-14	6.5	6.2	17.0	8.6
2021-07-15	5.2	4.3	9.6	7.4
2021-07-16	4.8	5.0	8.3	10.8
2021-07-17	4.0	4.8	8.9	11.4
2021-07-18	7.5	7.1	17.6	14.9
2021-07-19	7.7	8.8	16.9	18.6
2021-07-20	5.3	5.1	11.7	11.9
2021-07-21	5.6	5.6	13.6	10.1
2021-07-22	6.6	7.6	11.8	14.6
2021-07-23	10.0	8.5	20.2	17.4
2021-07-24	10.8	9.2	21.4	22.8
2021-07-25	5.0	8.5	8.9	13.7
2021-07-26	6.7	9.9	13.5	17.3
2021-07-27	8.5	9.0	21.8	16.9
2021-07-28	14.0	11.8	28.7	20.8
2021-07-29	13.5	11.9	26.6	19.8
2021-07-30	12.9	14.4	29.8	24.2
2021-07-31	14.2	16.8	28.7	26.7

SO2 (sulphur dioxide) Monthly Summary - WTEF and Burnaby South

Metro Vancouver's ambient air quality objecti e for 1-hour SO2 is a never to exceed objecti e. The dashed blue line in the figu e below shows the numerical value of the SO2 objecti e, 70 ppb.



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PRELIMINARY DATA

	Daily Average SO2 Concentratio (ppb)		Daily 1-hour Maximum SO2 Concentratio (ppb)	
Date	S150 - WTEF	T018 - Burnaby South	S150 - WTEF	T018 - Burnaby South
2021-07-01	0.1	0.3	0.2	0.9
2021-07-02	0.1	0.2	0.2	0.3
2021-07-03	0.1	0.2	0.5	0.5
2021-07-04	0.5	0.4	2.4	1.1
2021-07-05	0.2	0.4	0.5	1.0
2021-07-06	0.2	0.4	0.6	1.4
2021-07-07	0.1	0.3	0.2	0.8
2021-07-08	0.2	0.5	1.3	1.6
2021-07-09	0.2	0.5	1.4	1.5
2021-07-10	0.2	0.8	0.8	2.4
2021-07-11	0.2	0.5	0.9	1.8
2021-07-12	0.6	0.5	3.1	1.6
2021-07-13	0.2	0.6	0.5	2.1
2021-07-14	0.1	0.4	0.3	1.1
2021-07-15	0.1	0.3	0.2	1.0
2021-07-16	0.1	0.3	0.1	0.9
2021-07-17	0.1	0.3	0.3	0.9
2021-07-18	0.5	0.6	1.9	2.1
2021-07-19	0.2	0.5	0.6	1.2
2021-07-20	0.1	0.3	0.4	0.5
2021-07-21	0.2	0.4	0.4	0.9
2021-07-22	0.3	0.4	1.7	1.6
2021-07-23	0.4	0.4	3.1	1.2
2021-07-24	0.6	0.7	3.5	4.4
2021-07-25	0.2	0.9	0.7	2.1
2021-07-26	0.3	0.9	1.2	3.4
2021-07-27	0.5	0.6	3.8	2.5
2021-07-28	0.6	0.7	2.6	1.7
2021-07-29	0.6	0.7	3.6	2.1
2021-07-30	0.3	0.5	0.6	0.9
2021-07-31	0.2	0.6	1.3	1.3