

To: Zero Waste Committee

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

Date: September 7, 2023

Meeting Date: September 14, 2023

Subject: **Waste-to-Energy Facility Environmental Monitoring and Reporting 2022 Update**

RECOMMENDATION

That the Zero Waste Committee receive for information the report dated September 7, 2023, titled "Waste-to-Energy Facility Environmental Monitoring and Reporting 2022 Update."

EXECUTIVE SUMMARY

This report provides the Waste-to-Energy environmental performance update for 2022.

All air emission related parameters monitored during 2022 were similar to 2021, and well below regulatory limits in the Waste-to-Energy Facility Provincial Operational Certificate. The Waste-to-Energy Facility's contributions of nitrogen dioxide, fine particulates and anthropogenic (human caused) greenhouse gases are less than 1% of regional emissions.

In the fall of 2020 Metro Vancouver began monitoring ambient air parameter concentrations at a temporary air monitoring station immediately adjacent to the Waste-to-Energy Facility, and installed additional monitoring equipment at an existing monitoring station near the facility. Sulphur dioxide and hydrogen chloride ambient levels at less than 10% of ambient air objectives at both stations. Ninety-eight percent of the time, ambient sulfur dioxide and hydrogen chloride concentrations were less than 3% of ambient objectives. Ambient nitrogen dioxide levels are within ambient air quality objectives and lower than many other monitoring stations within the region. Analysis suggests that other regional sources are the primary drivers of ambient concentrations of these pollutants at both ambient air monitoring stations. Metro Vancouver is working on a request to the Province of British Columbia to amend the Waste-to-Energy Operational certificate to reflect the low ambient concentrations of sulfur dioxide and hydrogen chloride.

PURPOSE

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

This report provides updates on the facility's 2022 environmental performance and the implementation of the Waste-to-Energy Facility Provincial Operational Certificate requirements. The report is identified in the Zero Waste Committee annual work plan.

ENVIRONMENTAL MONITORING AND REPORTING UPDATE

Since the Waste-to-Energy Facility opened in 1988, Metro Vancouver has continually reduced emissions through assessment, operational and plant infrastructure improvements, and environmental controls. All air emission related parameters monitored during 2022 were in compliance with the requirements of Operational Certificate 107051. A summary of historic annual emission performance, including 2022 data, is found in Attachment 1.

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, City of Burnaby, and 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 per 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, and Fraser Health Authority; and are posted publicly on the Metro Vancouver website;
- Manual stack testing for semi-volatile organic compounds is conducted once per 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 2022 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 operational conditions and helps confirm that emissions monitored by manual stack testing are accurate.
- 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 at cement plants. Metro Vancouver has contracted Birco Environmental Services to conduct a pilot test in support of the beneficial use of bottom ash.

Comparison with Regulatory Limits

Table 1 and Attachment 1 show comparisons for various emission parameters with regulatory limits. Overall, the Metro Vancouver Waste-to-Energy Facility operates well within environmental standards.

Table 1: 2022 Emissions Summary Table

Parameter (Average Values)	Units	Regulatory Levels	2022 Emissions Data	Percentage of Limit
<i>Manual Stack Tests:</i>				
Particulate Matter	mg/dscm	9	1.5	17%
Hydrogen Fluoride (HF)	mg/dscm	1	0.01	1%
Sum of Lead, Arsenic, and Chromium	ug/dscm	64.0	6.7	10%
Cadmium (Cd)	ug/dscm	7.0	0.6	9%
Mercury (Hg)	ug/dscm	20.0	0.1	0.5%
<i>Trace Organics Tests:</i>				
Dioxins/Furans (PCDD/PCDF)	ng/dscm	0.08	ND	-
Chlorophenols	ug/dscm	1	0.006	0.6%
Chlorobenzenes	ug/dscm	1	0.22	22%
Polycyclic Aromatic Hydrocarbons (PAHs)	ug/dscm	5	0.17	3%
Polychlorinated Biphenyls (PCBs)	ug/dscm	1	0.017	2%
<i>Continuous Emissions Monitoring System:</i>				
Nitrogen Oxides (NOx)		190	125	66%
Carbon Monoxide (CO)		50	24	48%
Sulphur Dioxide (SO ₂)		200	64	32%

Operational Certificate Implementation and Ambient Air Monitoring

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 allowed 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 Burnaby South air quality monitoring station 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 included sulphur dioxide and nitrogen dioxide monitoring, was upgraded in the fall of 2020 with the addition of a hydrogen chloride monitor.

In 2022, Metro Vancouver installed a meteorological station on the roof of the Waste-to-Energy Facility to provide more information on local meteorological conditions and allow comparison of measured ambient air quality concentrations to operations at the Waste-to-Energy Facility.

Metro Vancouver has engaged 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. Within the 2-year monitoring period, no exceedances of short-term nor long-term (1-hour, 24-hour, and annual) ambient air quality objectives for nitrogen dioxide, sulphur dioxide and hydrogen chloride were recorded at either monitoring station.

Data collected to date (Attachment 2) shows 1-hour maximum ambient air concentrations of hydrogen chloride were 6% of the ambient air quality objectives at the Waste-to-Energy monitoring station, and 9% of the ambient objectives at the Burnaby South monitoring station. 98% of the time, ambient concentrations of hydrogen chloride are less than 3% of the ambient air quality objectives at both stations. A diurnal pattern in hydrogen chloride has been noted during the summer months.

1-hour maximum ambient air concentrations of sulphur dioxide were 10% of ambient air quality objectives at the Waste-to-Energy monitoring station, and 6% of the ambient objectives at the Burnaby South Station. 98% of the time, ambient concentrations of sulphur dioxide are less than 2% of the ambient air quality objectives at both stations. Peak 1-hour average SO₂ concentrations occurred midday on all days of the week, whereas operations at the Waste-to-Energy Facility are continuous.

Nitrogen dioxide levels were 76% and 62% of the 1-hour ambient air quality objective at the Waste-to-Energy Facility monitoring station and the Burnaby South station respectively, and lower than many other monitoring stations in the region, such as the Vancouver Airport and Vancouver Clarke Drive. The primary contributor to ambient nitrogen dioxide throughout the region is automobile exhaust, with peak readings at both monitoring stations occurring during peak traffic conditions. 95% of the time, ambient concentrations of nitrogen dioxide are 50% or less of the ambient air quality objectives at both stations.

Linear regression analysis determined that there was no statistically significant linear correlation between the Waste-to-Energy Facility continuous emissions monitoring system data and ambient air quality data for all three pollutants. This suggests other regional emission sources are the primary drivers of the ambient levels of nitrogen dioxide, sulphur dioxide and hydrogen chloride recorded at both the Waste-to-Energy Facility station and the Burnaby South station.

Metro Vancouver is working on a draft request to amend the Operational Certificate to reflect the results of the monitoring program analysis that shows observed ambient sulphur dioxide and hydrogen chloride concentrations are well below ambient objectives and suggests that observed ambient concentrations are primarily due to other regional emission sources and meteorological factors.

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 of 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. The 2022 greenhouse gas emissions were verified by a third party consultant and reported to the provincial and federal governments. Non-biogenic emissions from the facility were 113,352 tonnes carbon dioxide equivalents, a 16% decrease from 2021. This decrease is primarily due to annual fluctuations in waste composition. Over the past five years, the non-biogenic portion of greenhouse gas emissions has ranged from 40% to 48%. In 2022 it was 40%.

Overall greenhouse gas emissions from the facility in 2022, including both non-biogenic and biogenic, were 285,747 tonnes carbon dioxide equivalents, a decrease of approximately 8% compared to 2021. This decrease is primarily due to decreased waste throughput at the Waste-to-Energy Facility as a result of ongoing capital upgrades. 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, including fly ash and bottom ash for the preceding calendar year, to the National Pollutant Release Inventory. Table 2 summarizes the information which has been reported to the National Pollutant Release Inventory.

Table 2: 2022 National Pollutant Release Inventory Substance Reporting Summary

Substance	Reported Quantity (tonnes)	
	Stack Emissions	Ash Disposal
Nitrogen Oxides	222	N/A
Carbon Monoxide	46	N/A
Sulphur Dioxide	113	N/A
Hydrogen Chloride/Hydrochloric Acid	75.8	N/A
Aluminum (dust)	0.022	N/A
Arsenic	0.00077	1.34
Cadmium	0.00036	1.38
Cobalt	0.0002	2.2
Copper	0.0024	85.2
Lead	0.004	23.0
Manganese	0.0014	28.0
Mercury	0.00007	0.049
Phosphorus	0.0037	587.9
Zinc	0.027	202.7
Particulate Matter $\leq 10\mu\text{m}$	1.81	N/A
Particulate Matter $\leq 2.5\mu\text{m}$	1.45	N/A
Dioxins and Furans	N/A	N/A
Hexachlorobenzene	N/A	N/A

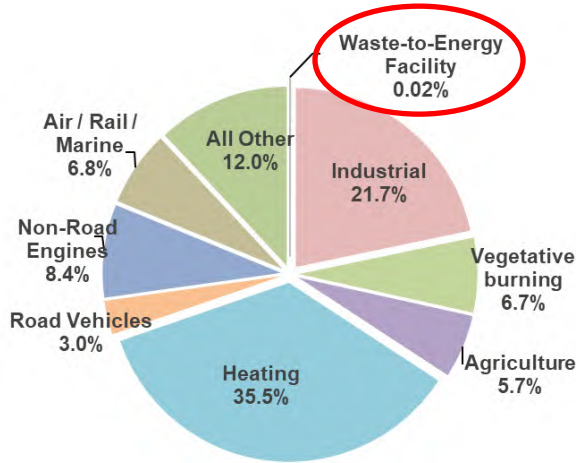
Notes: - All other substances are below the National Pollutant Release Inventory level of quantification and are not required to be reported.
- 'N/A' indicates value is either below the level of quantification, below the detection limit, or the substance is not found in ash.

Waste-to-Energy Facility in a Regional Context

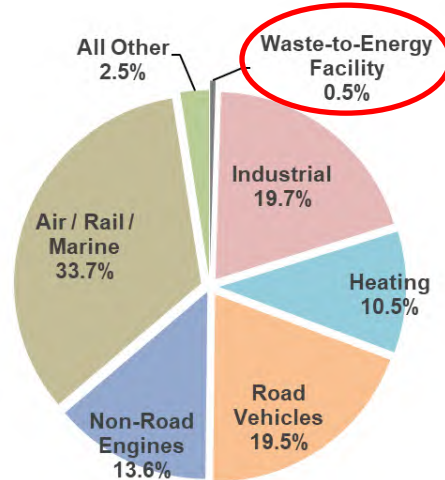
Figure 1 compares Waste-to-Energy Facility emissions to total emissions from all regional sources for two key air contaminants in the Lower Fraser Valley – fine particulate matter and nitrogen oxides (a key smog forming pollutant). In 2022, the Waste-to-Energy Facility accounted for 0.02% of regional fine particulate matter emissions and 0.5% 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 0.5% in 2022.

Figure 1: Regional Emissions Distribution (2022) – Fine Particulate Matter and Nitrogen Oxides

2022 Lower Fraser Valley Fine Particulate Matter Emission Sources



2022 Lower Fraser Valley Nitrogen Oxide Emission Sources



Comparison to Previous Year

Environmental performance data from 1988 to 2022 is included in Attachment 1. Environmental performance for the Waste-to-Energy Facility for 2022 was similar to 2021. Fine particulates and metals emissions showed some variability between the two years, but all continue to be well within regulatory limits.

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 2022 were in compliance with Operational Certificate 107051. Continuous emissions monitoring data and all compliance reports are available on the Metro Vancouver website. Ambient air monitoring at the Waste-to-Energy Facility and the nearby Burnaby South monitoring station show low levels of hydrogen chloride, sulfur dioxide and nitrogen dioxide, with analysis showing other emission sources as the primary drivers of the observed ambient concentrations for these parameters.

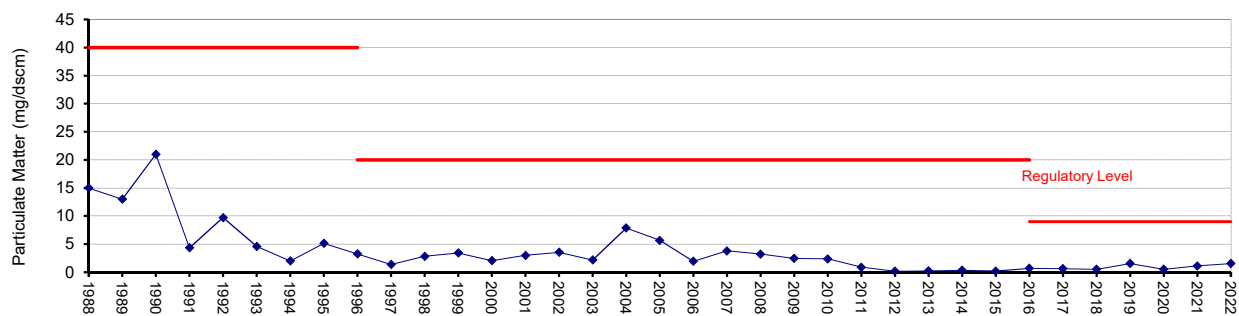
Attachments

1. Metro Vancouver Waste-to-Energy Facility Summary of Air Emissions 1988-2022
2. Metro Vancouver Waste-to-Energy Facility 2022 Ambient Air Quality Report

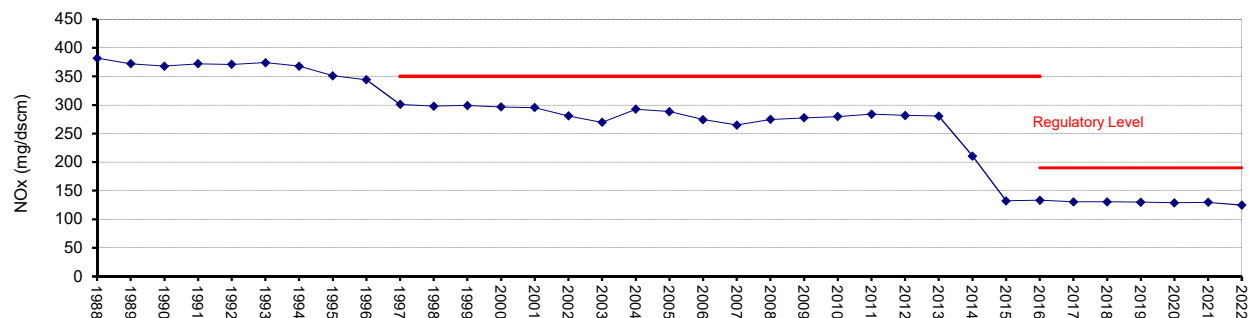
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Metro Vancouver Waste-To-Energy Facility Summary of Air Emissions 1988 - 2022

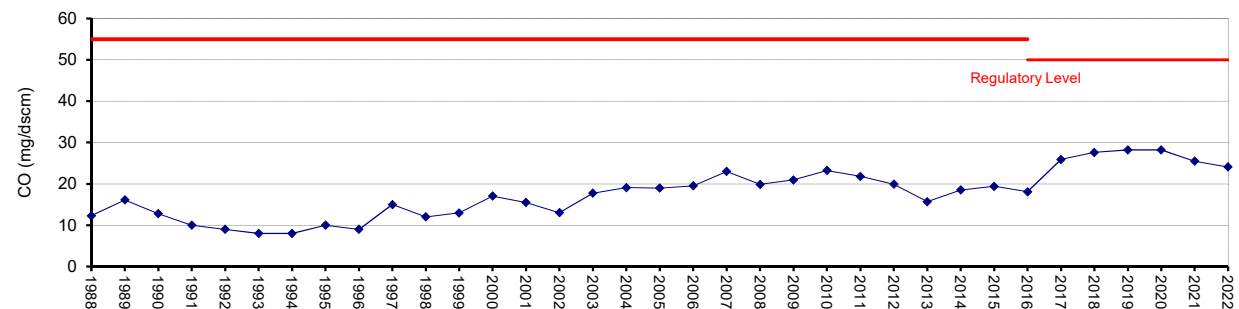
Particulate Matter



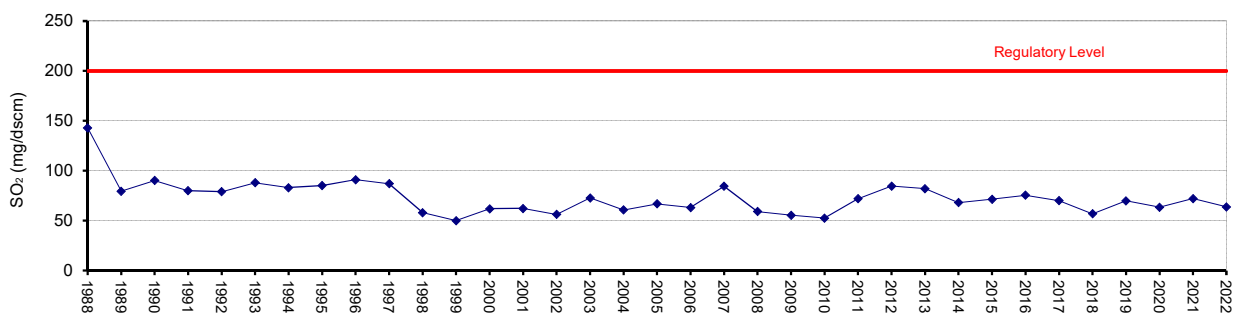
Nitrogen Oxides



Carbon Monoxide

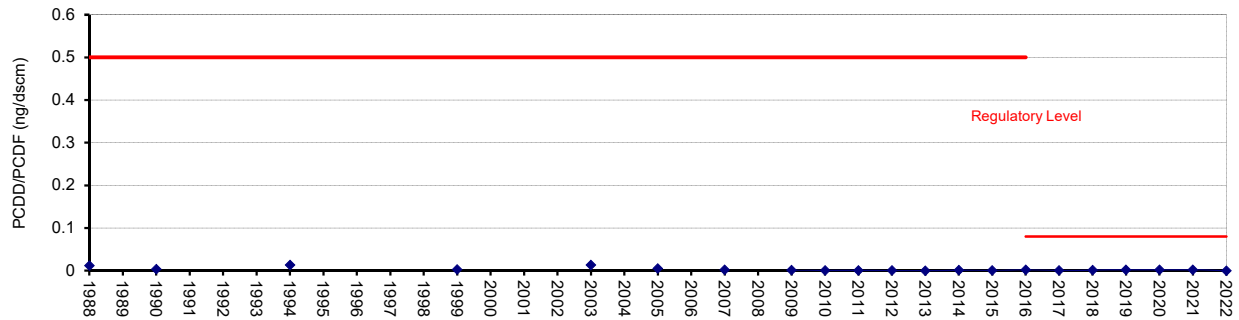


Sulfur Dioxide

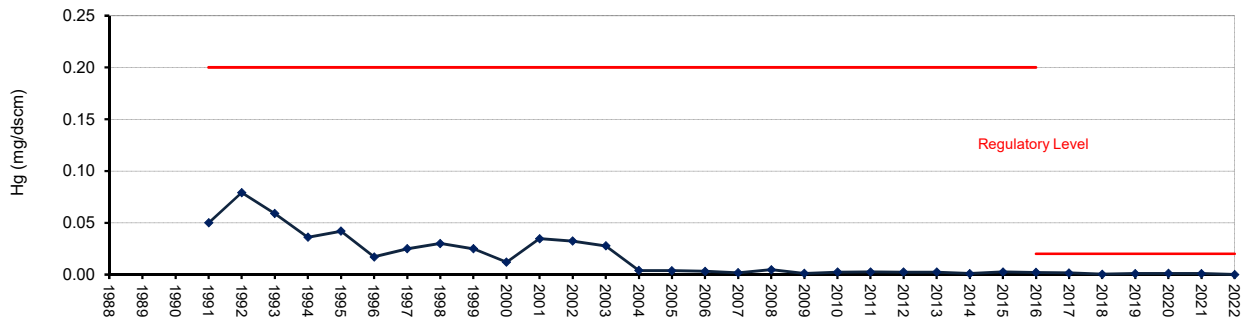


Metro Vancouver Waste-To-Energy Facility Summary of Air Emissions 1988 - 2022

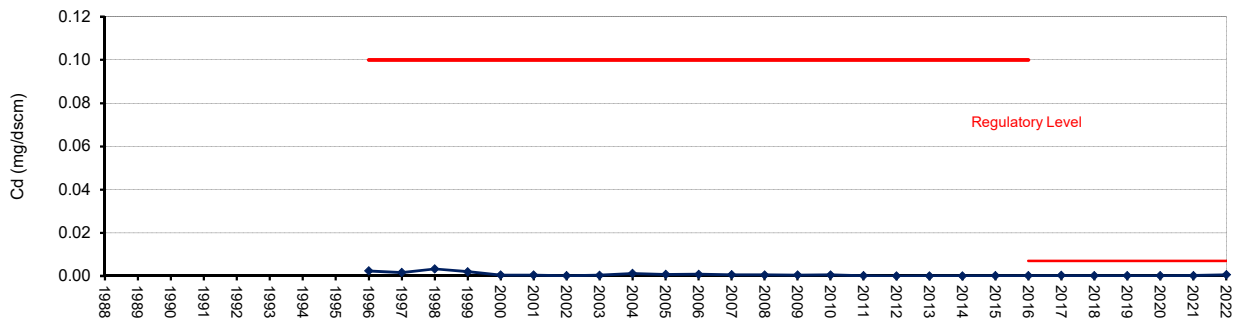
Dioxins/Furans



Mercury



Cadmium



Metro Vancouver Waste-to-Energy Facility 2022 Ambient Air Quality Report

