REPORT

METRO VANCOVER QUATERLY AIR PERMIT REPORTING

Neptune Bulk Terminal Ltd

Prepared for:

Neptune Bulk Terminal Ltd.
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Envirochem Project No.: 8005

Reporting Period: 2022 – Q4

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1.0 BACKGROUND

To meet Metro Vancouver Air Permit GVA0081 (issued September 23rd, 2016) requirements, Neptune Bulk Terminals Ltd. (Neptune) has implemented a procedure for periodic permit reporting requirements to Metro Vancouver including this quarterly reporting.

Fulfilling these requirements requires processing and checking large amounts of data. The procedures in this report provide an efficient means of processing large amounts of data and ensuring that all calculations and outputs generated are completed accurately. In order to increase the efficiency of this process, Neptune has implemented a data management system which allows for uploading of data to the Neptune database and generation of outputs. Envirochem Services Inc. (Envirochem) has been retained to calculate, tabulate and report these requirements to Metro Vancouver and ensure that:

- Raw data being collected and used for generating outputs is valid,
- Correct methodologies are used to generate these outputs, and
- Any outputs being generated undergo quality assurance/quality control (QA/QC) before being submitted electronically to Metro Vancouver.

All of the procedures contained within this report detail methodologies in conformance with Section 3 Schedules A and B of the current version of the permit (September 23rd, 2016).

This report includes quarterly particulate matter monitoring reporting requirements.

2.0 QUARTERLY REPORTING

2.1 ON-SITE $PM_{2.5}$ AND PM_{10} MONITORING – 24 HR ROLLING AVERAGES

2.1.1 METHODOLOGY

Neptune is conducting continuous $PM_{2.5}$ and PM_{10} monitoring using two Met-One E-BAM Plus monitors on-site near the northwest boundary of Neptune Terminals on the roof of the terminal's electrical substation building.

Ambient Air Monitoring data for $PM_{2.5}$ and PM_{10} are stored in Neptune's database. These data are retrieved and verified by Envirochem. QA/QC is performed on the raw data and any invalid data are flagged. Neptune's data management system is then updated accordingly.

2.1.2 RESULTS

Using Neptune's data management system, Envirochem:

- Converts the vetted $PM_{2.5}$ and PM_{10} data to 24-hour rolling averages and performs QA/QC;
- On a quarterly basis, submits the graphs (**Figure 1** and **Figure 2**) to Metro Vancouver.

During Quarter 4 of 2022, there were some exceedances of the 24-hour $PM_{2.5}$ and PM_{10} AAQOs at Neptune's on-site monitors (**Figure 1** and **Figure 2**). Many of them corresponded to high ambient particulate levels in the entire region. To support this observation, $PM_{2.5}$ and PM_{10} concentrations at the nearby Metro Vancouver monitoring stations (T04, T06, T24, and T26) are presented in **Figure 5** and **Figure 6**. It should be noted that Metro Vancouver Air Quality Advisories were in place from October 14th to October 21st for high concentrations of fine particulate matter in the region.

There were also a few 24-hour PM_{10} AAQO exceedances at Neptune's on-site monitor (electrical substation) outside of Metro Vancouver Air Quality Advisory periods. To investigate the attributable particulate for exceedances of the 24-hour PM_{10} AAQO outside of Metro Vancouver Air Quality Advisory periods:

- Wind speed and direction during hours with PM_{10} concentrations at or above 50 µg/m^3 were analyzed (**Figure 3**).
- Optical (microscopic) analysis of the E-BAM filter tape was performed (**Figure 4**).

Results and findings are summarized below.

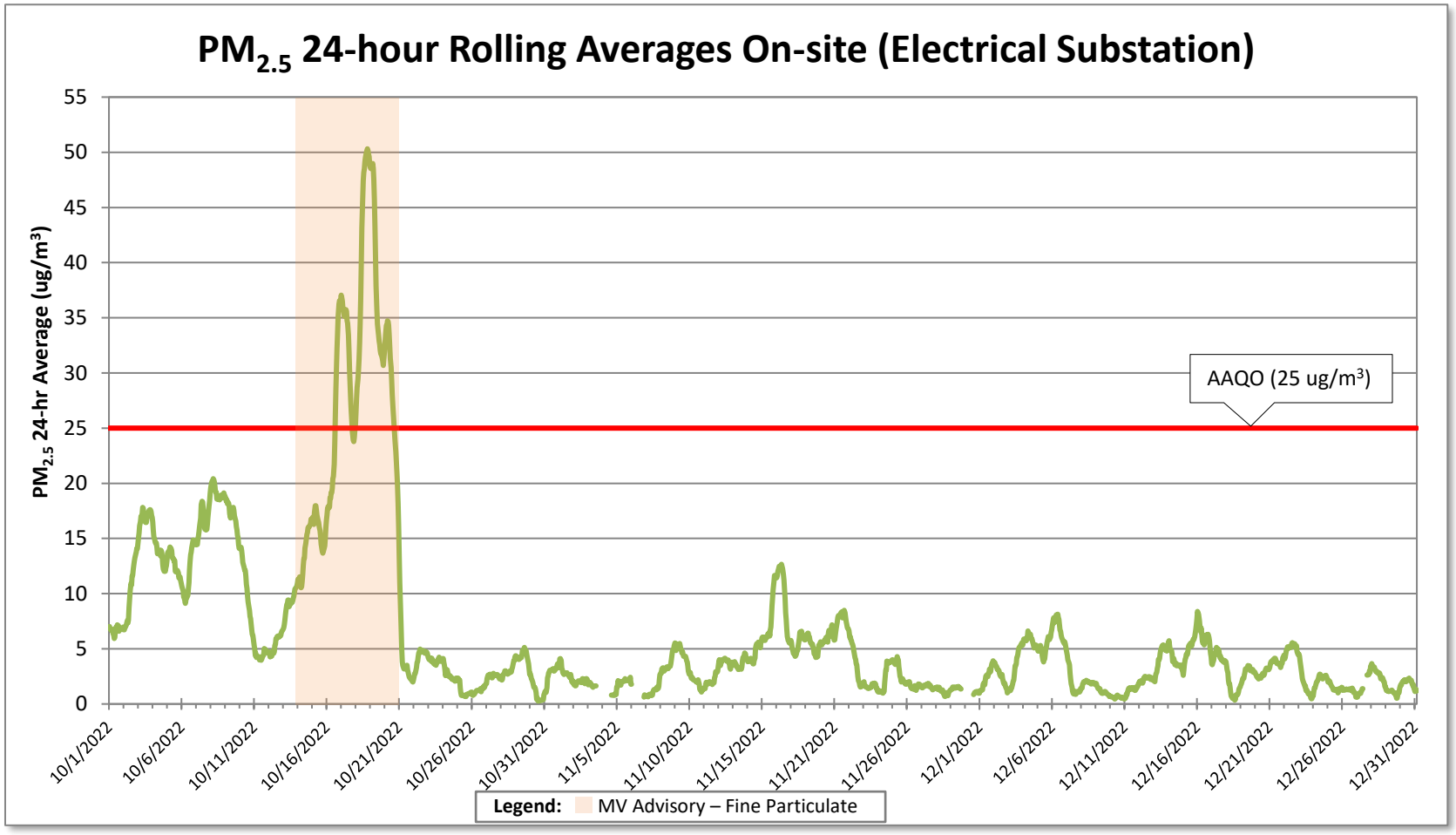

Figure 1: 24-hour rolling averages of $PM_{2.5}$ data from on-site monitor for the fourth calendar quarter 2022 (October 1st to December 31st, 2022)

Note 1: *Blank space indicates that no data is available due to power failure or instrument maintenance.*
Note 2: *Highlighted periods indicate dates where Metro Vancouver Air Quality Advisories were in effect.*

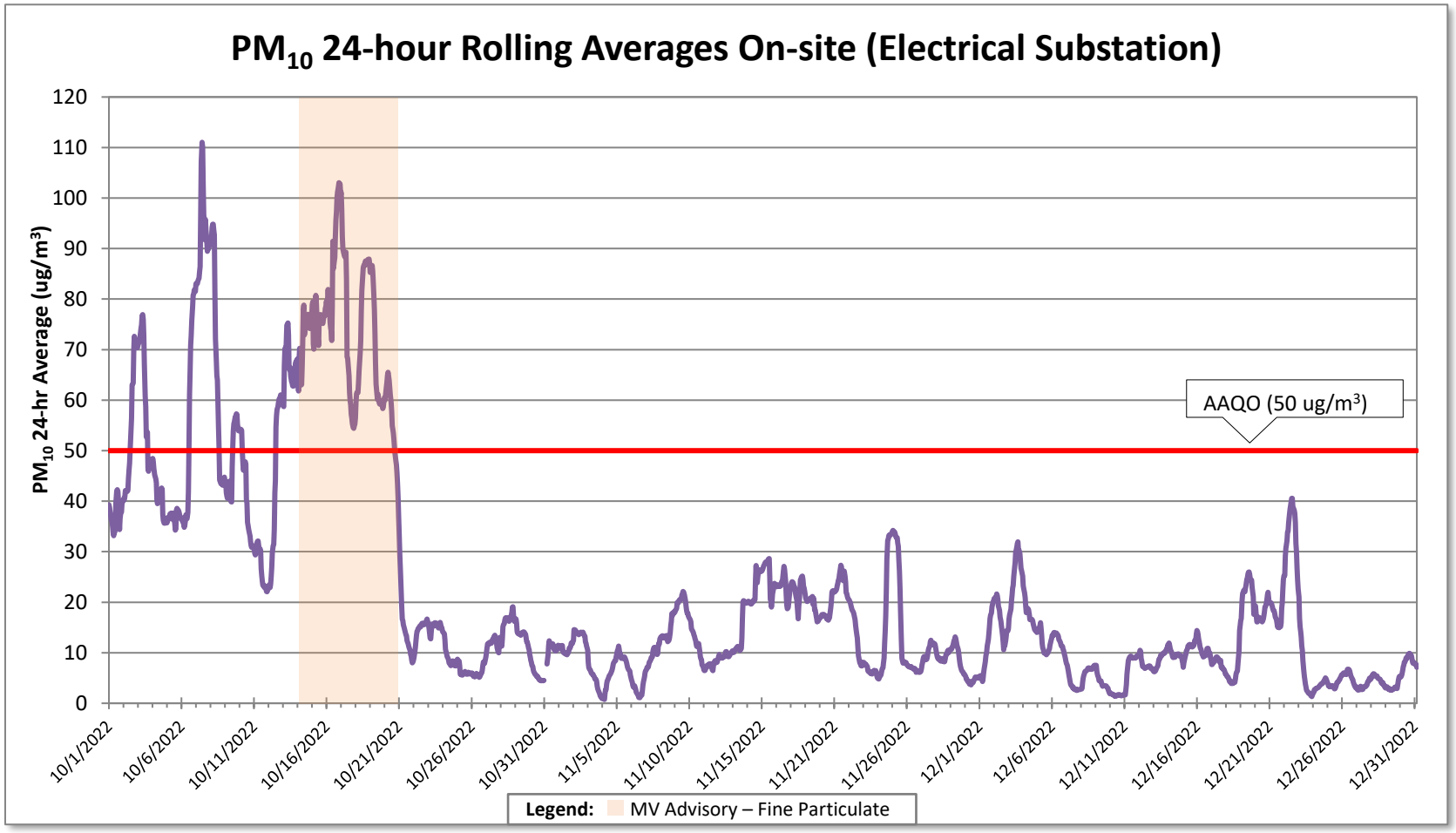

Figure 2: 24-hour rolling averages of PM_{10} data from on-site monitor for the fourth calendar quarter 2022 (October 1st to December 31st, 2022)

Note 1: *Blank space indicates that no data is available due to power failure or instrument maintenance.*

Note 2: *Highlighted periods indicate dates where Metro Vancouver Air Quality Advisories were in effect.*

2.1.3 WIND ANALYSIS

To investigate the attributable particulate to the observed PM_{10} exceedances, wind speed and direction during hours of those events with hourly average PM_{10} concentrations of 50 µg/m^3 or greater were analyzed. 50 µg/m^3 was conservatively chosen as it is the 24-hour AAQO for PM_{10}. Hence, hours with 50 µg/m^3 PM_{10} or above were considered to have a possible contribution to the AAQO exceedances. Hours during periods impacted by Metro Vancouver Air Quality Advisories were not considered. As can be seen in **Figure 3**, during hours with 50 µg/m^3 of PM_{10} or higher, the wind direction was primarily from the west, blowing from offsite of the Neptune property toward the monitor.

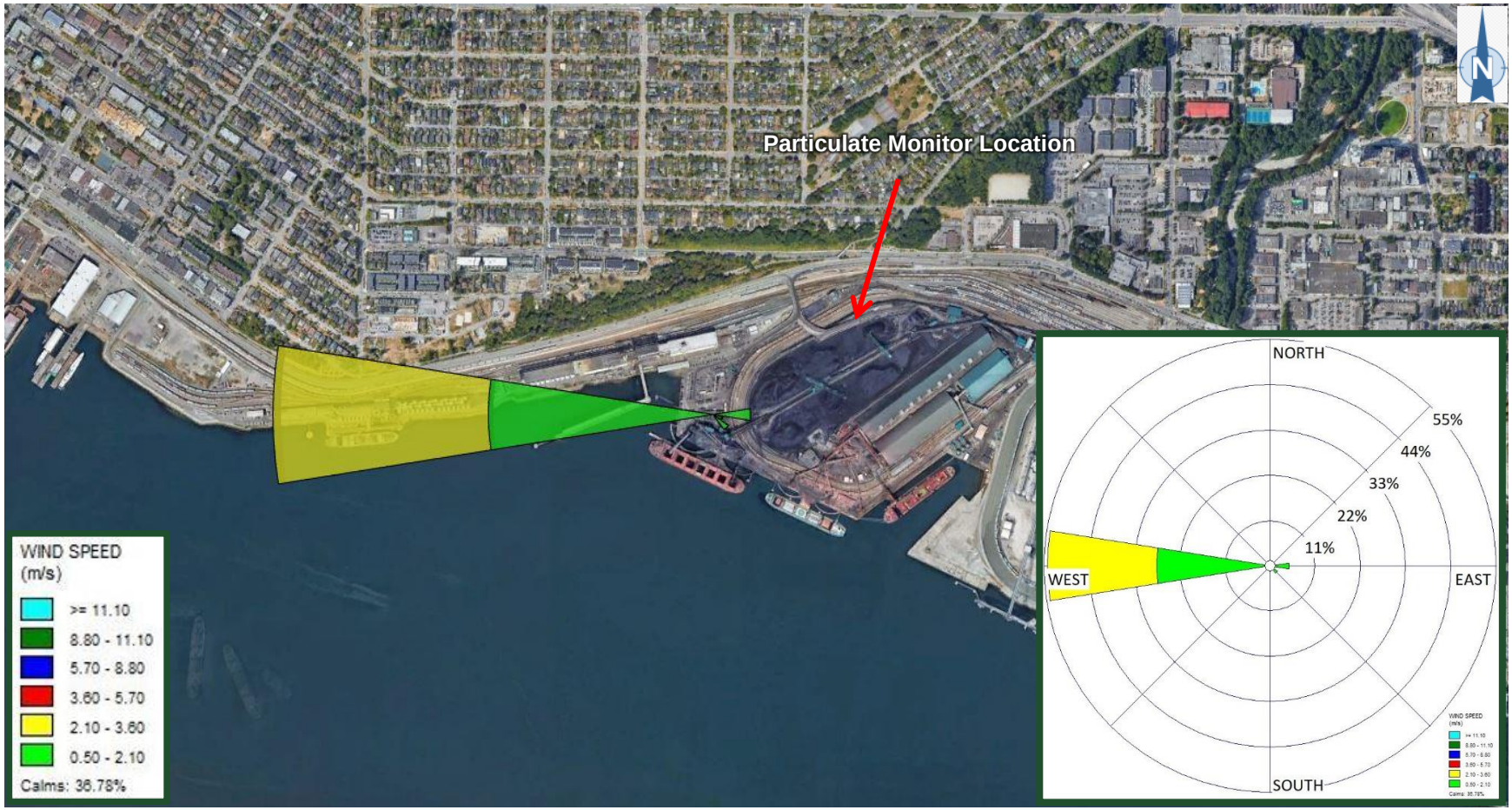

Figure 3: Wind rose during hours contributing to PM_{10} 24-hr rolling average AAQO exceedance (not including hours associated with Metro Vancouver Air Quality Advisories) with PM_{10} concentrations greater than 50 µg/m^3 for the fourth calendar quarter (October 1st to December 31st, 2022)

Note: *The presented wind rose is based on "winds blowing from"*

2.1.4 OPTICAL (MICROSCOPIC) ANALYSIS

To support the findings from the wind data, optical analysis was performed for some E-BAM Plus filter tape spots during hours with PM_{10} concentrations greater than 50 µg/m^3 that contributed to PM_{10} 24-hr rolling average AAQO exceedances that were not associated with a Metro Vancouver Air Quality Advisory. An example spot is shown in **Figure 4**.

- **Oct 7th, 2022 11:00**
- **PM_{10} Hourly Average = 310.15 µg/m^3**
- **Contributed to 24-hour PM_{10} exceedance**
- **Westerly wind**
- **Brown colour particles**

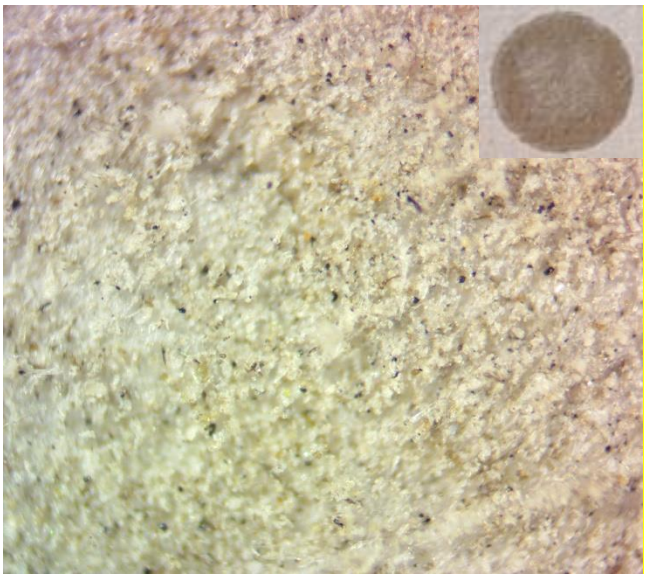

Figure 4: Microscopic analysis of E-BAM filter tape showing an example hour with westerly wind and Brown colour particles

The optical analysis was conducted to elucidate the major components of the particulate on the E-BAM filter tape with respect to coal dust and other particles. For this analysis, a light microscope (OMAX 40x-2500x) with a 10x ocular lens, 4x/10x/40x objective lenses, and a 0.5x mountable camera (OMAX A3RDF50) was used. E-BAM filter tape is made of glass fibres that are visible in the microscopic pictures.

The microscopic analyses indicated that hours with westerly winds often show a majority of grain particles (chaff and flake with a brown color) associated with offsite sources from the west of the site boundary. The microscopic analysis therefore supports the wind analysis and suggests that there are significant sources of dust in the area that contribute to monitored particulate concentrations that are not coal (e.g. grain dust etc.).

2.2 OFF-SITE $PM_{2.5}$ AND PM_{10} MONITORING – 24 HR ROLLING EXCEEDANCES OF $PM_{2.5}$ AND PM_{10} FROM AAQO

2.2.1 METHODOLOGY

Neptune is conducting continuous $PM_{2.5}$ and PM_{10} monitoring off-site from the terminal at these two locations (in the neighbouring areas):

- To the northeast of the Neptune Terminals, on the roof of 340 Brooksbank Avenue (Neptune's office) equipped with a PM_{10} monitor (Met One E-BAM Plus) and a $PM_{2.5}$ monitor (SHARP 5030i).
- To the northwest of the Neptune Terminals in the residential area at 618 2nd Street East using two pole mounted $PM_{2.5}$ and PM_{10} monitors (Met One E-BAM Plus).

Ambient Air Monitoring data for $PM_{2.5}$ and PM_{10} is stored in Neptune's database. These data are retrieved and verified by Envirochem. QA/QC is performed on the raw data and any invalid data are flagged. Neptune's data management system is then updated accordingly.

2.2.2 RESULTS

Using Neptune's data management system, Envirochem:

- Converts the vetted $PM_{2.5}$ and PM_{10} data to 24-hour rolling averages;
- Retrieves the quarterly 24-hour rolling averages from Neptune's database;
- Identifies and flags any 24-hour rolling averages which exceed Metro Vancouver Ambient Air Quality Objectives (AAQOs) for $PM_{2.5}$ and PM_{10};
- On a quarterly basis, tabulates all exceedances (**Table 1**) and submits them to Metro Vancouver.

Table 1: Off-Site 24-hour rolling average $PM_{2.5}$ and PM_{10} AAQO exceedances for the fourth quarter (October 1st to December 31st, 2022)

METRO VANCOUVER PERMIT GVA 0081	
Neptune Bulk Terminals (Canada) Ltd.	
OFF-SITE 24-HR ROLLING AVERAGE $PM_{2.5}$ AND PM_{10} AAQO EXCEEDANCES	
Reporting Period:	**October 1st – December 31st, 2022**

Exceedance Event	MV AAQO		Neptune Office (340 Brooksbank Ave)	Neighbourhood Pole (618 E 2nd St.)	Possible Cause
	Contaminant	µg/m³	Period of Exceedance		
1	$PM_{2.5}$	25	No exceedances	No exceedances	N/A
	PM_{10}	50	13:00 October 14th – 09:00 October 15th	09:00 October 15th – 19:00 October 15th	Wildfire Smoke (MV Air Quality Advisory)
2	$PM_{2.5}$	25	23:00 October 16th – 00:00 October 21st	23:00 October 16th – 23:00 October 17th And 10:00 October 18th – 02:00 October 21st	Wildfire Smoke (MV Air Quality Advisory)
	PM_{10}	50	05:00 October 17th – 20:00 October 17th and 13:00 October 18th – 07:00 October 20th	00:00 October 17th – 01:00 October 18th and 07:00 October 18th – 03:00 October 21st	Wildfire Smoke (MV Air Quality Advisory)

Note: *AAQOs are based on 24-hour rolling averages. For hours presented above, periods are representative of the previous 24 hours.*

2.2.3 Metro Vancouver Monitoring Station Analysis

Particulate concentrations at nearby Metro Vancouver monitoring stations are presented for comparison below. **Figure 5** presents $PM_{2.5}$ data at T06 and T26, while **Figure 6** presents PM_{10} data at T04 and T24. The $PM_{2.5}$ monitoring stations show AAQO exceedances during the same period as the off-site Neptune monitors. The PM_{10} stations are further afield in Burnaby and show the same general trends.

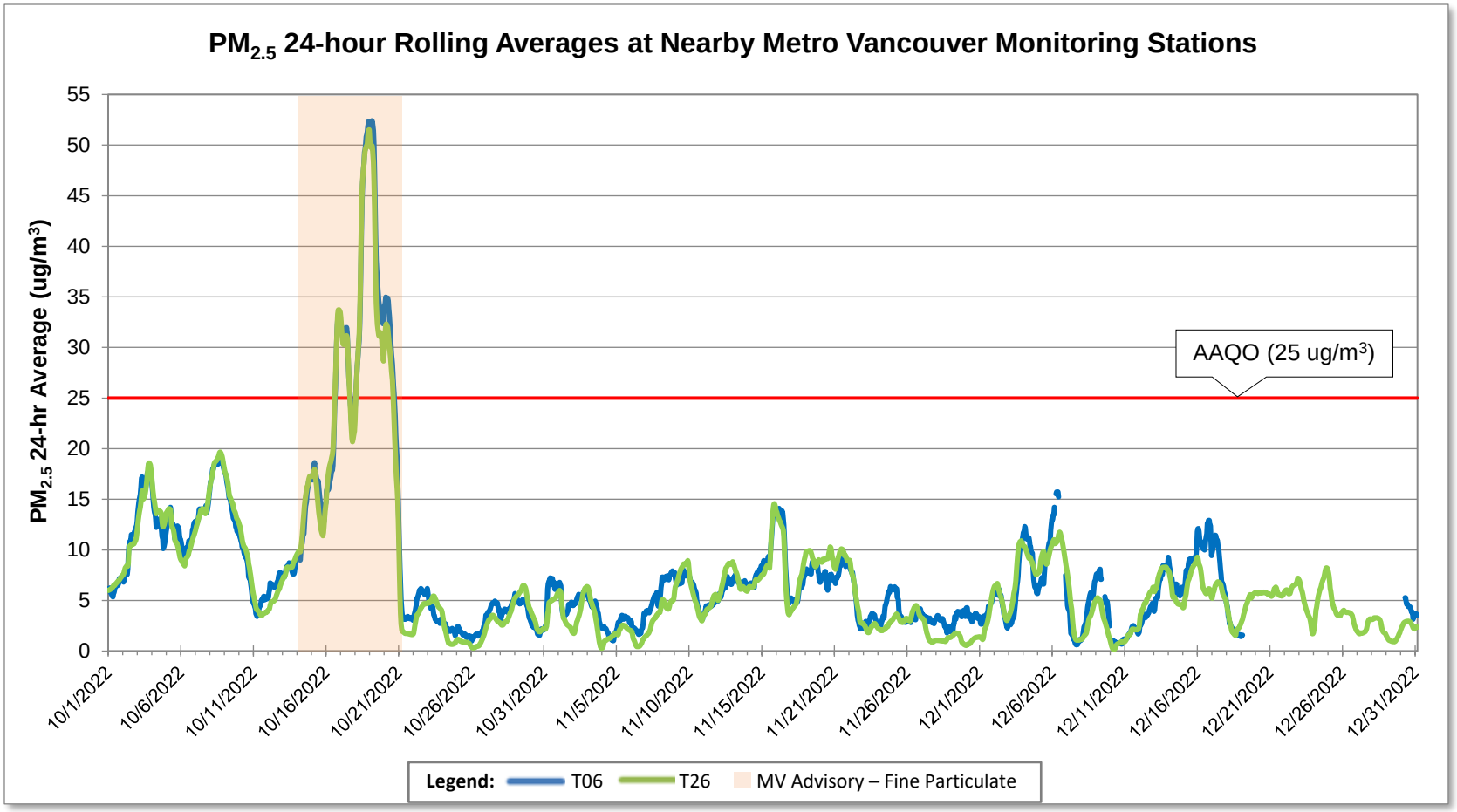

Figure 5: 24-hour rolling averages of $PM_{2.5}$ data for comparison from nearby monitoring stations during the fourth calendar quarter (October 1st to December 31st, 2022)

T06 – North Vancouver - Second Narrows, T26 – North Vancouver - Mahon Park

***Note:** Highlighted periods indicate dates where Metro Vancouver Air Quality Advisories were in effect.*

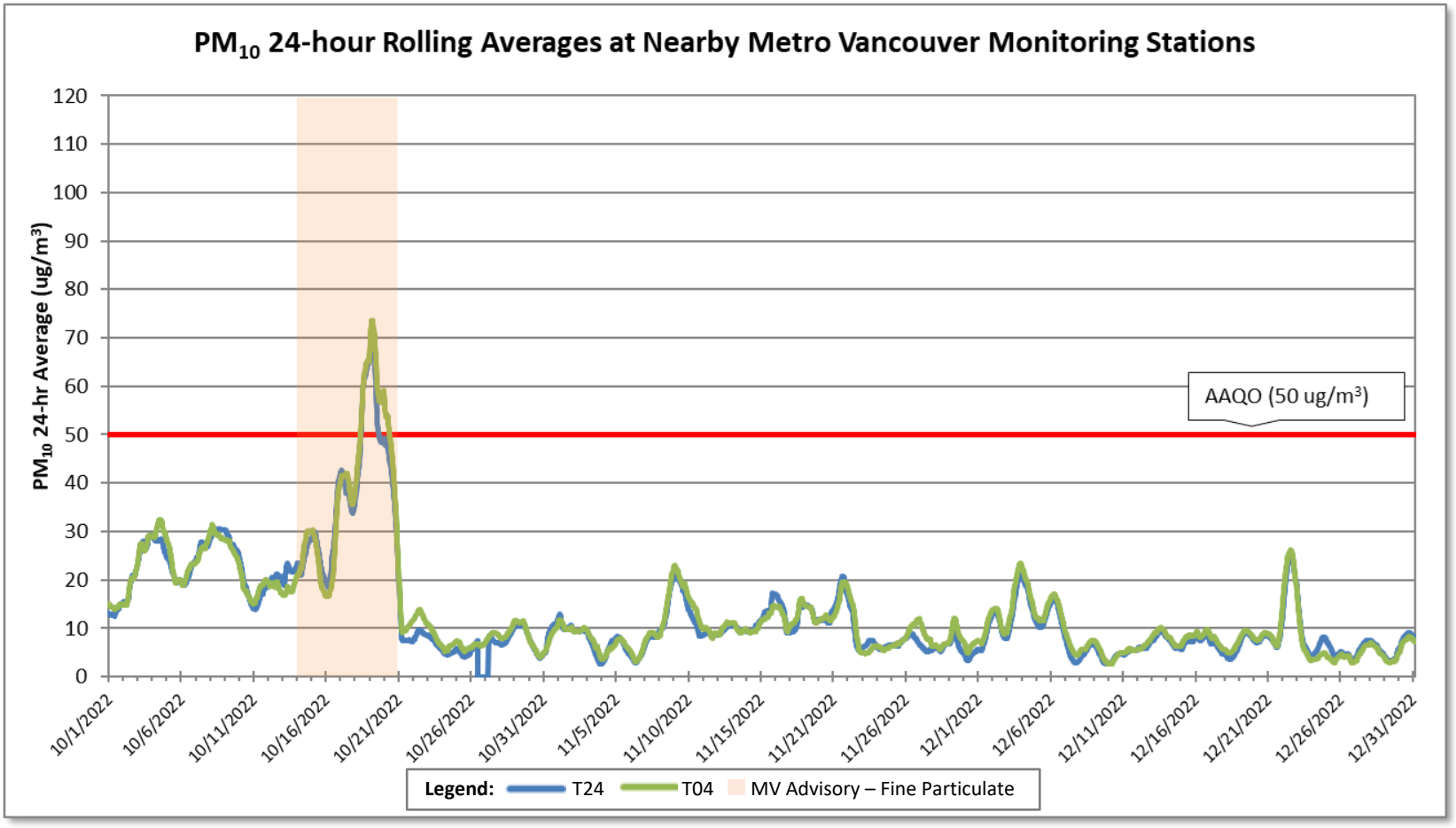

Figure 6: 24-hour rolling averages of PM_{10} data for comparison from nearby monitoring stations during the fourth calendar quarter (October 1st to December 31st, 2022)

T24 – Burnaby North Eton, T04 – Burnaby North Kensington Park

Note 1: *There are no PM_{10} stations in North Vancouver. The Burnaby stations shown here indicate a similar trend to other stations in the region.*

Note 2: *Highlighted periods indicate dates where Metro Vancouver Air Quality Advisories were in effect.*