REPORT

METRO VANCOVER ANNUAL AIR PERMIT REPORTING

Neptune Bulk Terminal Ltd

Prepared for:

Neptune Bulk Terminal Ltd.
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North Vancouver, BC, V7L 1A7

Envirochem Project No.: 8005-23

Reporting Period: 2022

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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 annual 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 annual ambient air quality monitoring reporting requirements.

2.0 AMBIENT AIR QUALITY MONITORING PROGRAM

2.1 WIND MONITORING DATA ANALYSIS

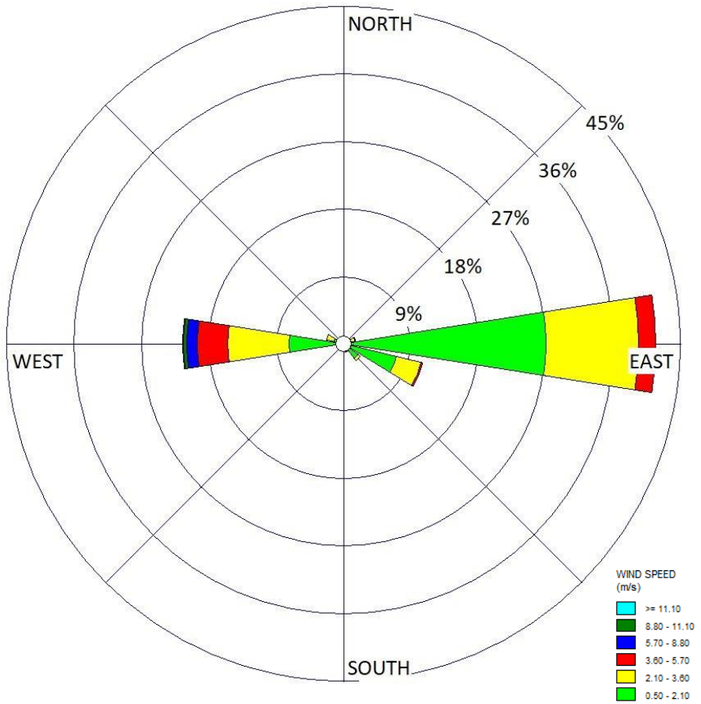
2.1.1 METHODOLOGY

Envirochem retrieves wind data from Neptune's database at the following locations: On-site (Electrical Substation), Neptune Office Building (340 Brooksbank Ave.), and Neighborhood Pole (618 2nd St. East). Due to roof maintenance/repairs at the Neptune Office Building (340 Brooksbank Ave.), the wind sensor normally operated on the roof of the Neptune Office Building was temporarily relocated to the nearby roof of Carlton Tower (1327 Keith Road East) until April 12th.

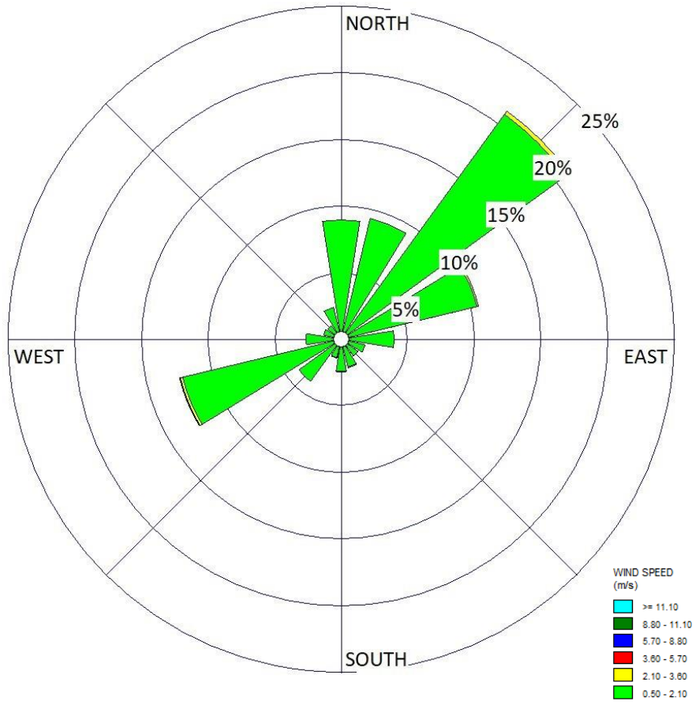
- Using wind data, wind roses for each wind instrument location are prepared for the preceding year. The wind roses are shown in **Figure 1.**
- Envirochem submits these figures to Metro Vancouver for each preceding calendar year as part of the annual air quality monitoring program report.

2.1.2 RESULTS

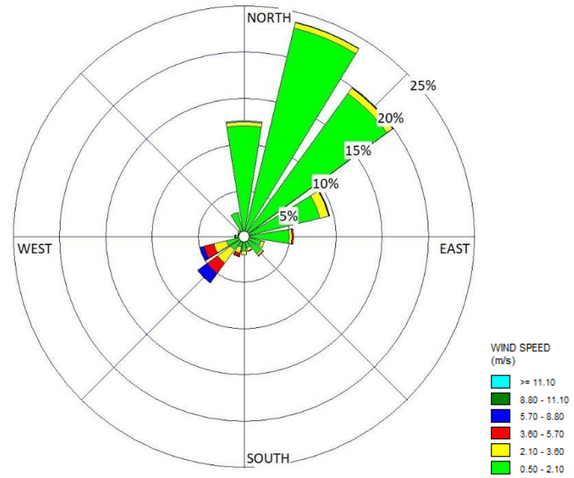
Wind roses are presented in **Figure 1** below representing the distribution of wind direction and wind speed at Neptune on-site (Neptune Electrical Substation) and off-site monitors (Neighbourhood Pole, roof of Neptune Office Building / roof of Carlton Tower) for 2022. Please note that the wind roses presented for the Carlton Tower (1327 Keith Road East) and Neptune Office Building (340 Brooksbank Ave.) are not based on a full year of data and are based on the period of operation at each location during 2022.



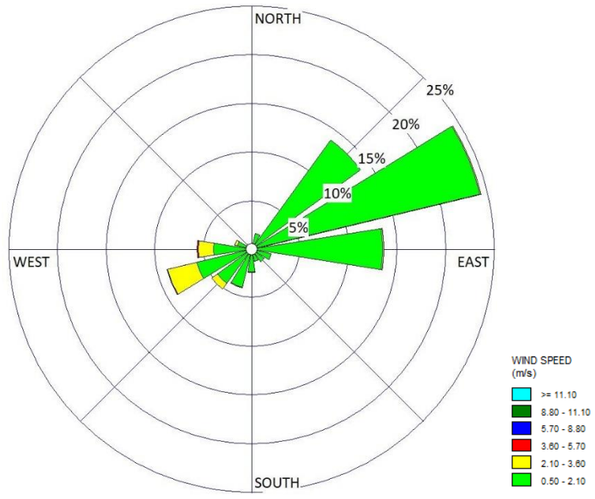
On-Site (Electrical Substation)



Neighbourhood Pole (618 2nd St. East)



Carlton Tower (1327 Keith Road East)*
Data from Jan 1st to April 12th



Neptune Office Building (340 Brooksbank)*
Data from April 12th to Dec 31st

Figure 1: Windroses (direction wind blowing from) at on-site and off-site monitoring stations for Jan 1st – Dec 31st, 2022
Note: *Scales are not consistent between wind roses.*

** Due to roof maintenance/repairs at the Neptune Office Building (340 Brooksbank Ave.), the wind sensor normally operated on the roof of the Neptune Office Building had been temporarily relocated to the nearby roof of 1327 Keith Road East (Carlton Tower) in 2021 where it was operated until it was possible to reinstall on the roof of the Neptune Office Building on April 12th 2022 following the completion of the roof work.*

2.2 PARTICULATE MONITORING DATA ANALYSIS

2.2.1 METHODOLOGY

Neptune is conducting continuous $PM_{2.5}$ and PM_{10} monitoring. 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.

The vetted monitoring data are used to summarize the results of on-site and off-site monitoring. Envirochem retrieves the preceding calendar year's 24-hr rolling averages for $PM_{2.5}$ and PM_{10} at each instrument location from Neptune's database.

Using the wind and hourly average concentration data, six pollution roses are prepared (both $PM_{2.5}$ and PM_{10} at each location) and corresponding frequency distributions are prepared for the preceding year.

2.2.2 TREND ANALYSES

Using Neptune's data management system, Envirochem:

- Converts and tabulates the vetted $PM_{2.5}$ and PM_{10} data to 24-hour rolling averages and performs QA/QC;
- Submits the graphs (**Figure 2** - **Figure 7**) to Metro Vancouver.

The trend analyses represent 24-hour rolling averages of $PM_{2.5}$ and PM_{10} data measured on-site (Electrical Substation), at the Neptune Office Building (340 Brooksbank Ave.), which was temporarily located at Carlton Tower (1327 Keith Road East) until April 12th 2022, and at 618 2nd St. East. Any gaps in the trend analyses are due to missing or invalid data.

Due to roof maintenance/repairs announced by the building's landlord, $PM_{2.5}$ and PM_{10} units that are usually operated on the roof of the Neptune Office Building were temporarily relocated to the nearby roof of 1327 Keith Road East (Carlton Tower) where Neptune also operates a $PM_{2.5}$ monitor (SHARP 5030i) as notified in correspondence with Metro Vancouver dated June 22nd, 2021. The $PM_{2.5}$ and PM_{10} monitors were re-installed at the Neptune Office Building (340 Brooksbank Ave.) on April 12th, 2022. The time series of data presented in **Figure 4** and **Figure 5** below show a combination of these two locations.

The on-site and off-site $PM_{2.5}$ and PM_{10} ambient air quality monitors showed a few AAQO exceedances in 2022. The exceedances in September and October were primarily caused by wildfire smoke. Exceedances were discussed in detail in the quarterly ambient air quality monitoring reports. Outside of this period, some exceedances of the PM_{10} objective at the on-site air quality monitor were observed in February, March, May, June, and July. These exceedances were likely due to other off-site sources in the area. All exceedances were discussed in more detail in the quarterly ambient air quality monitoring reports.

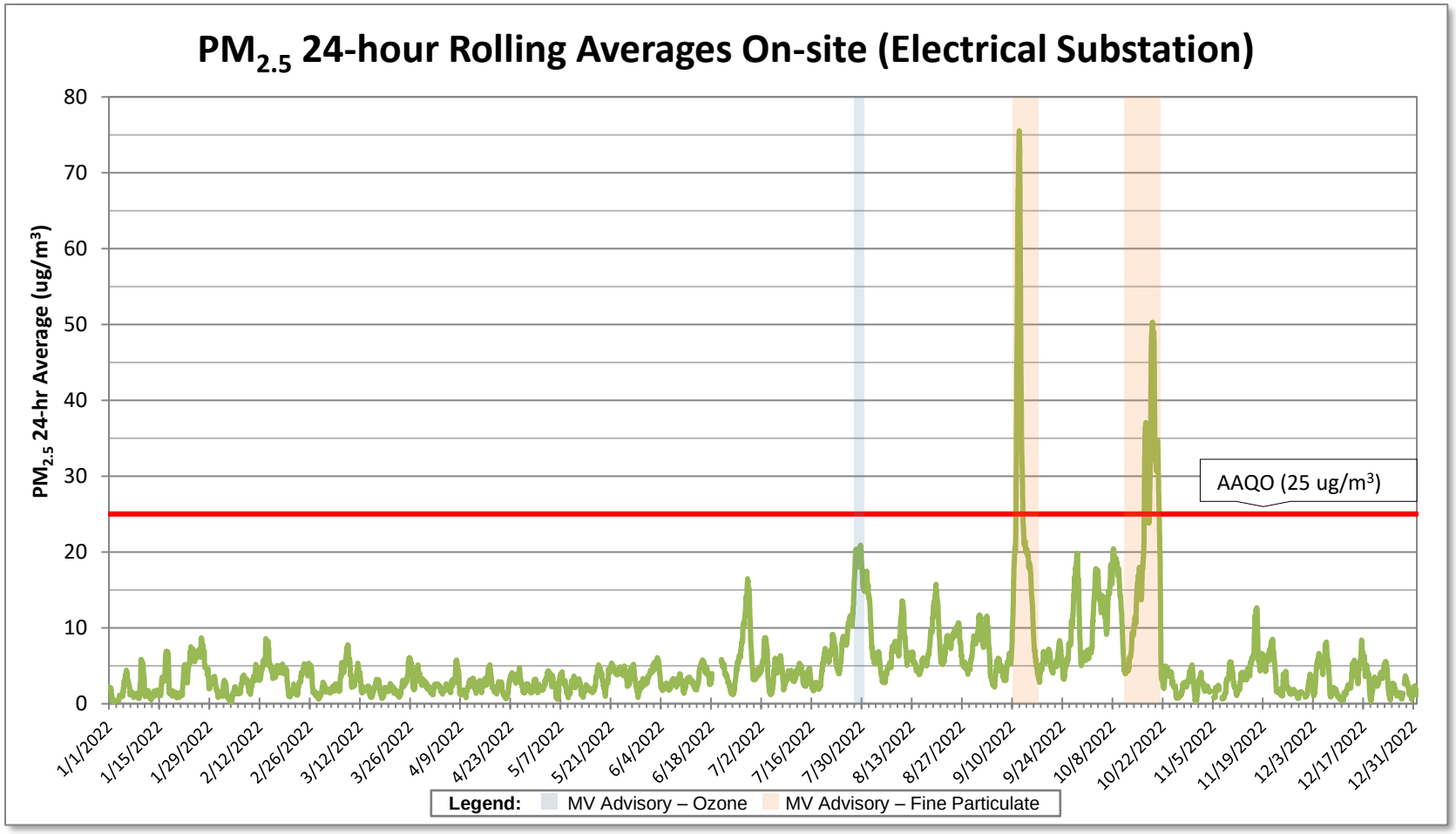


Figure 2: 24-hour rolling averages of $PM_{2.5}$ from on-site monitor (Electrical Substation) for Jan 1st – Dec 31st, 2022

Note 1: *Blank spaces indicates no data available.*

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

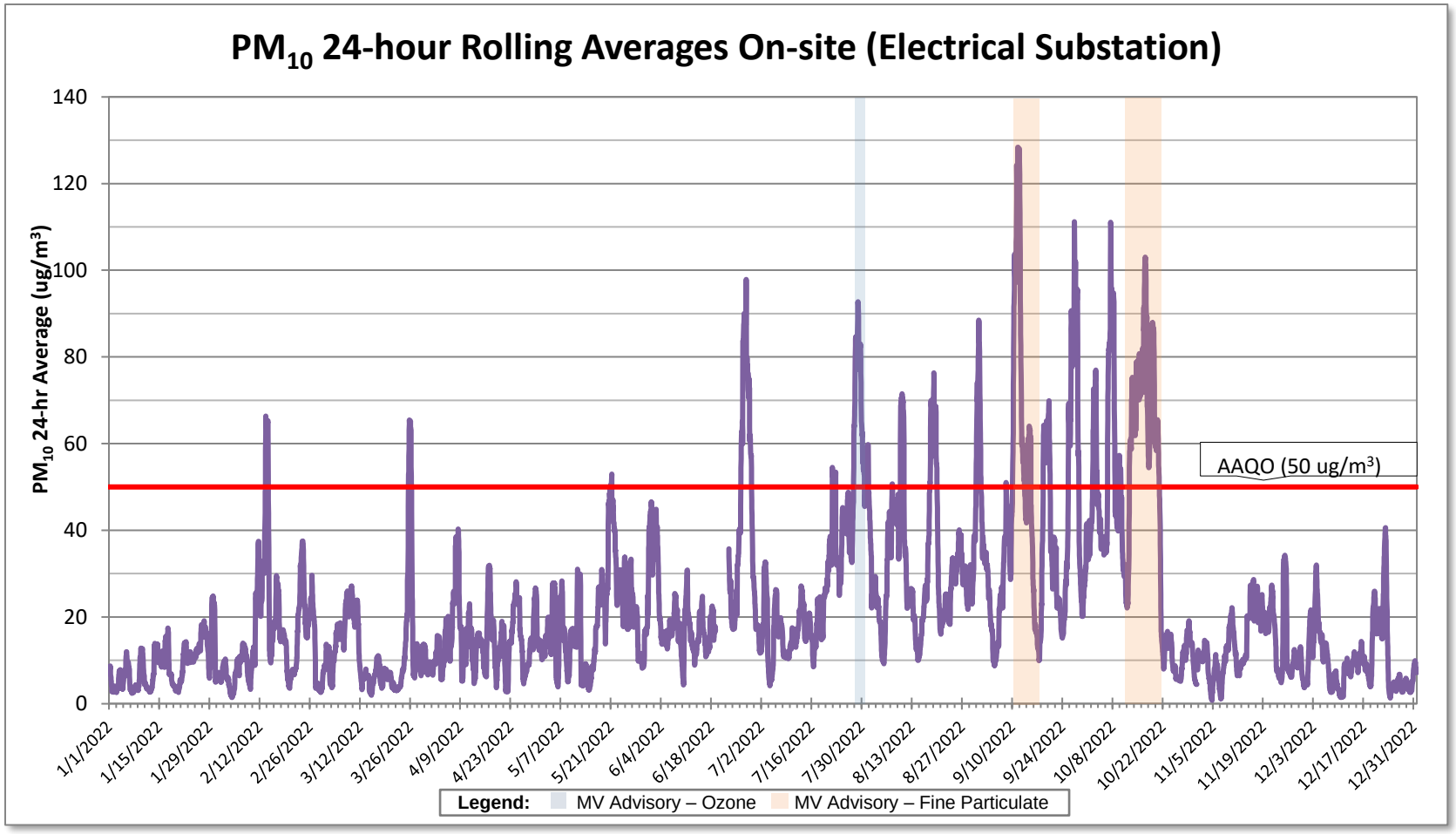


Figure 3: 24-hour rolling averages of PM_{10} from on-site monitor (Electrical Substation) for Jan 1st – Dec 31st, 2022

Note 1: *Blank spaces indicates no data available.*

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

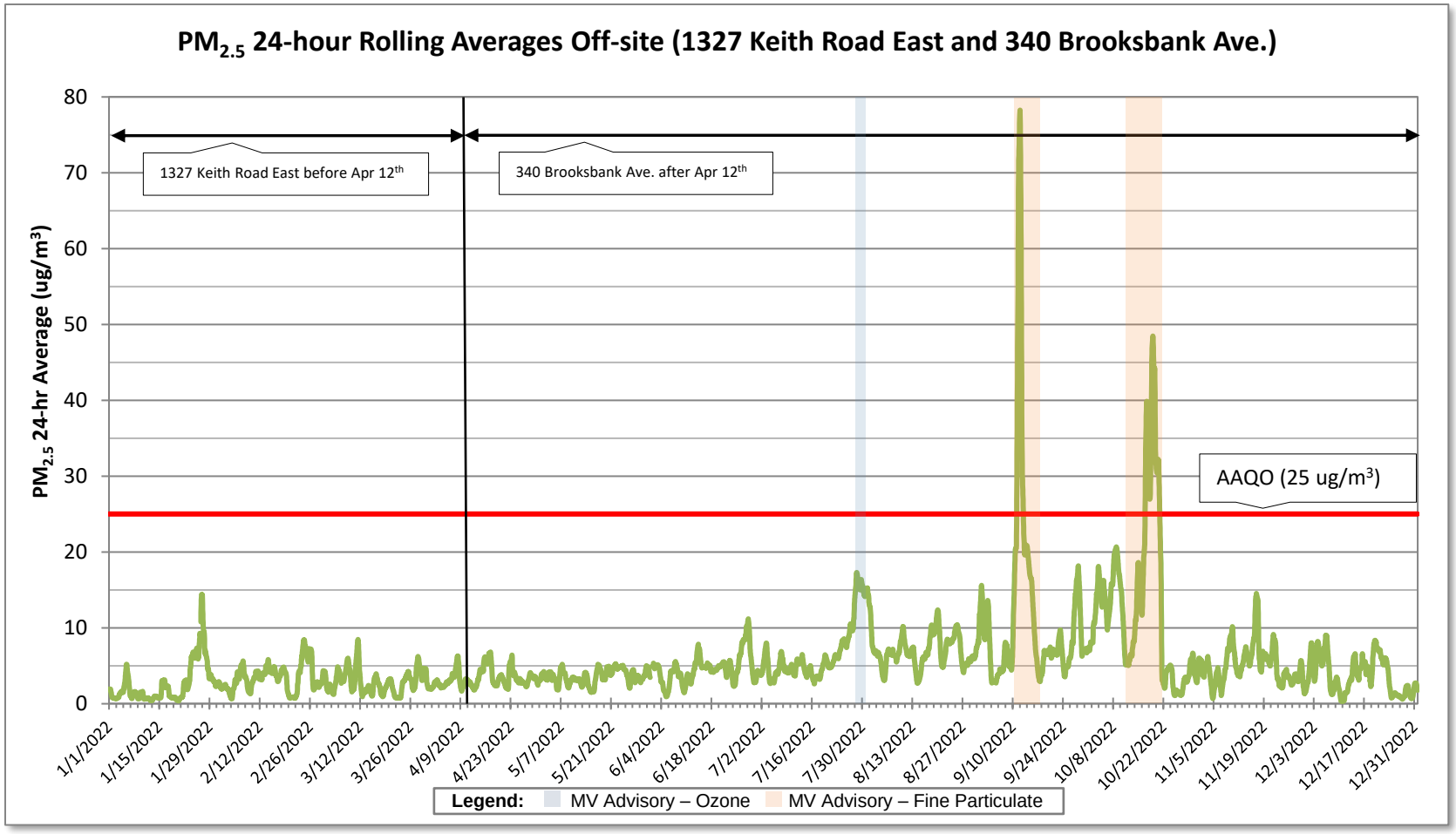


Figure 4: 24-hour rolling averages of $PM_{2.5}$ from off-site monitor at the Carlton Tower (1327 Keith Road East) for Jan 1st - Apr 12th, 2022 and at the Neptune Office Building (340 Brooksbank Ave.) for Apr 12th - Dec 31st, 2022.

Note 1: *Blank spaces indicates no data available.*

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

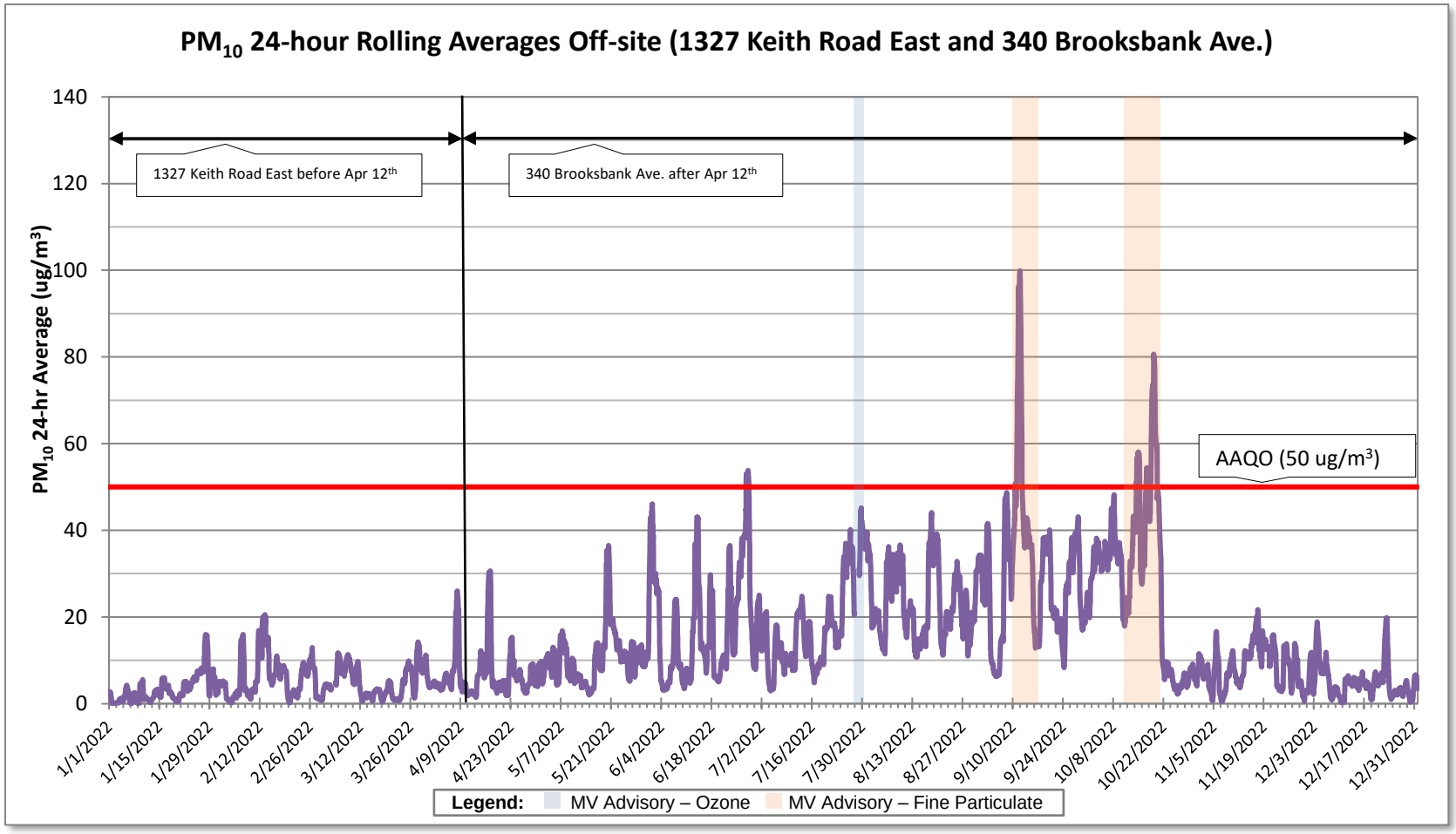


Figure 5: 24-hour rolling averages of PM_{10} from off-site monitor at the Carlton Tower (1327 Keith Road East) for Jan 1st - Apr 12th, 2022 and at the Neptune Office Building (340 Brooksbank Ave.) for Apr 12th - Dec 31st, 2022.

Note 1: *Blank spaces indicates no data available.*

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

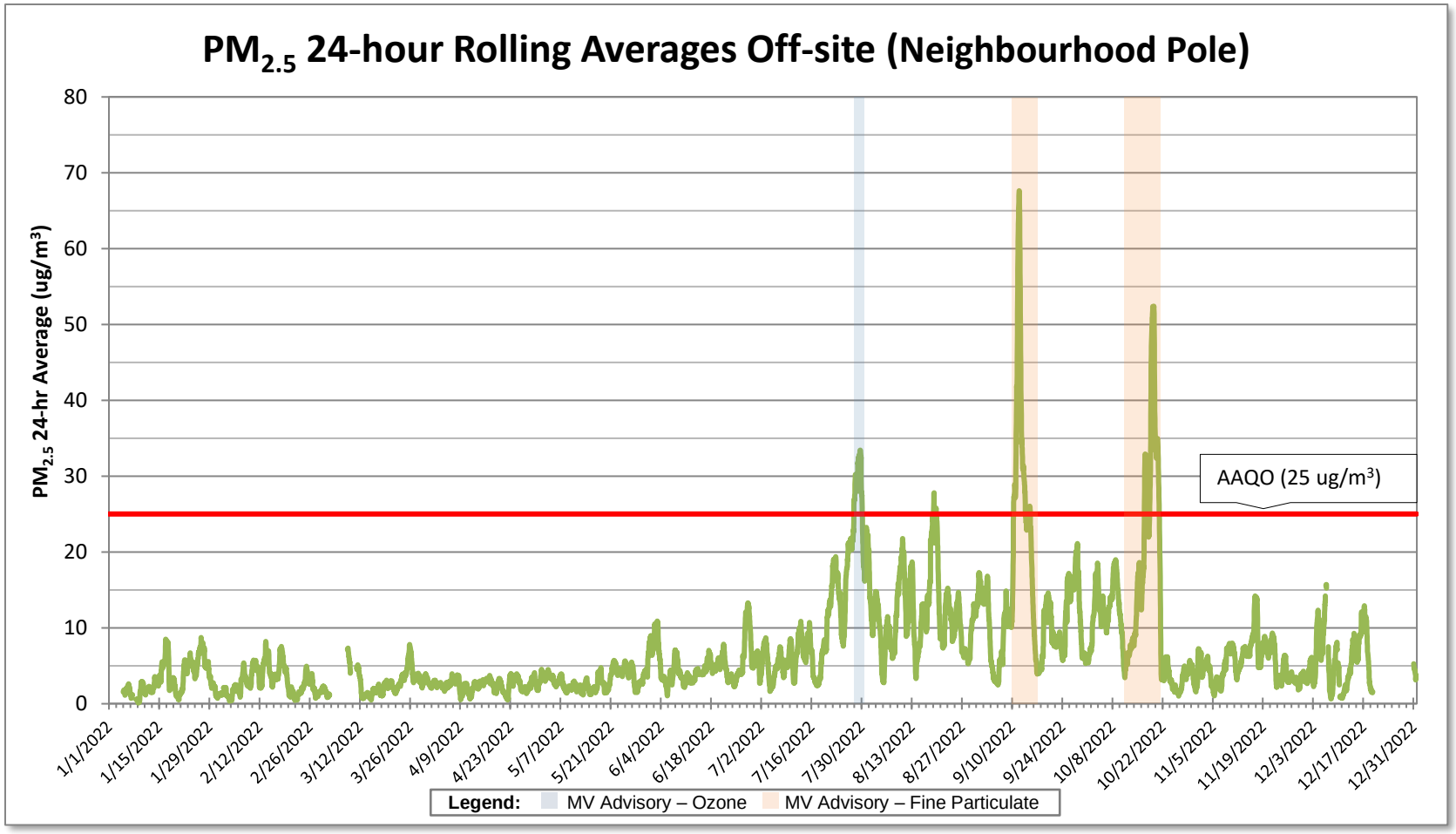


Figure 6: 24-hour rolling averages of $PM_{2.5}$ from off-site monitor at 618 2nd St. East for Jan 1st – Dec 31st, 2022

Note 1: *Blank spaces indicates no data available.*

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

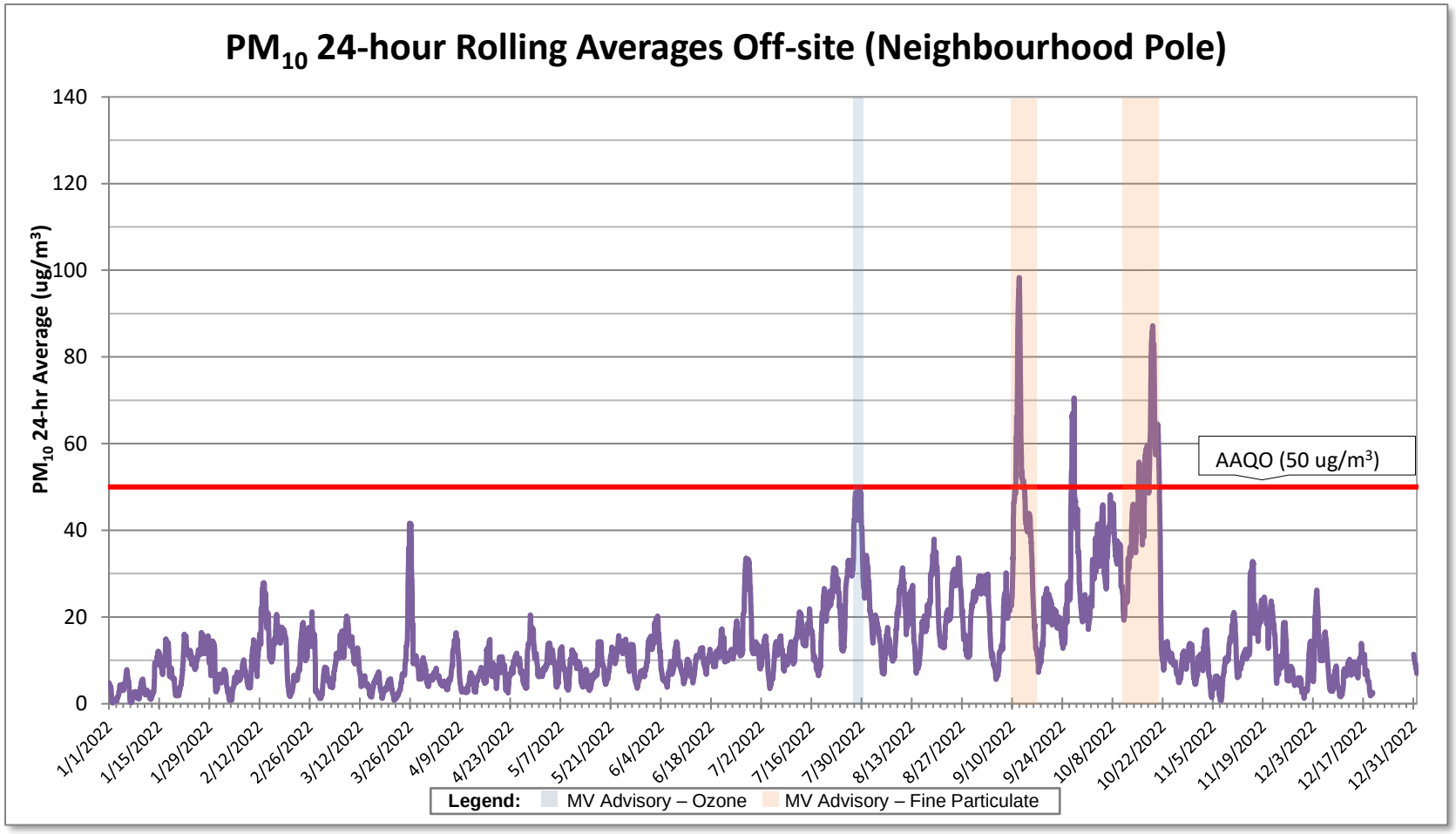


Figure 7: 24-hour rolling averages of PM_{10} from off-site monitor at 618 2nd St. East for Jan 1st – Dec 31st, 2022

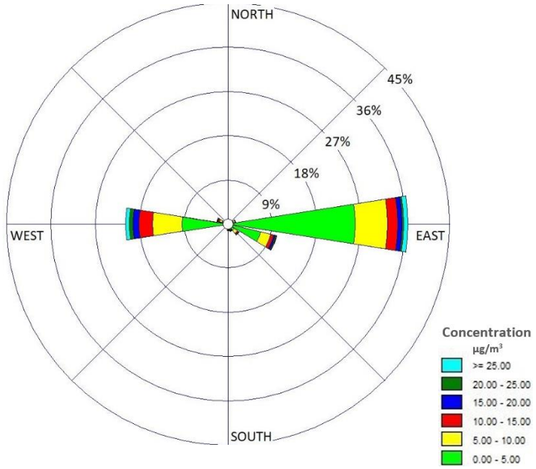
Note 1: *Blank spaces indicates no data available.*

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

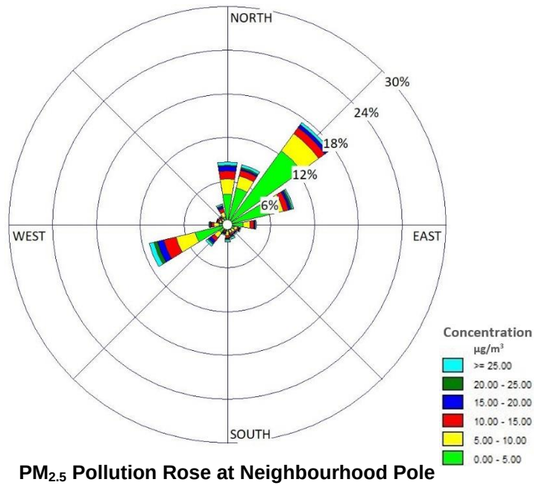
2.2.3 POLLUTION ROSES AND FREQUENCY DISTRIBUTION ANALYSES

Pollution roses are shown in **Figure 8** and the frequency distributions are shown in **Figure 9**. The pollution roses and frequency distributions represent the distribution of wind direction temporally correlated with $PM_{2.5}$ and PM_{10} concentrations at the on-site (Electrical Substation) and off-site monitors (roof of Neptune Office Building (340 Brooksbank Ave.), which was temporarily located on the roof of Carlton Tower (1327 Keith Road East) until April 12th 2022, and pole mounted monitors at 618 2nd St. East) for 2022.

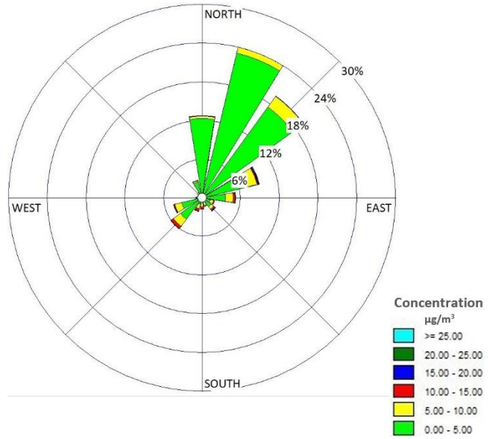
It should be noted that there was heavy construction and demolition in the neighbourhood immediately surrounding the neighbourhood pole monitor (618 2nd St. East) during 2022.



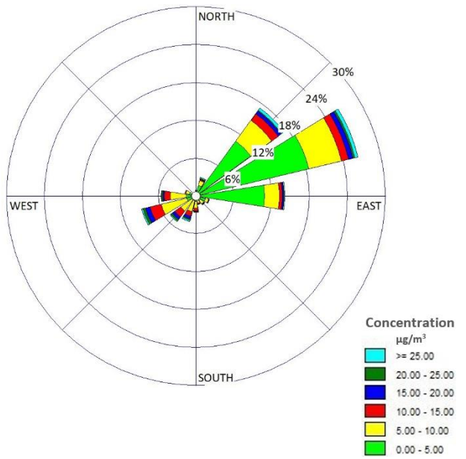
$PM_{2.5}$ Pollution Rose at Neptune Electrical Substation



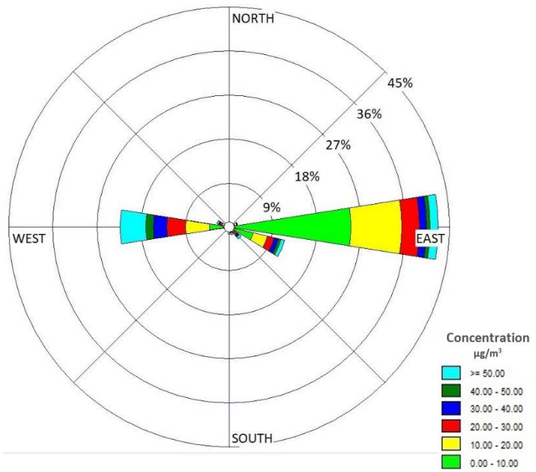
$PM_{2.5}$ Pollution Rose at Neighbourhood Pole (618 2nd St. East)



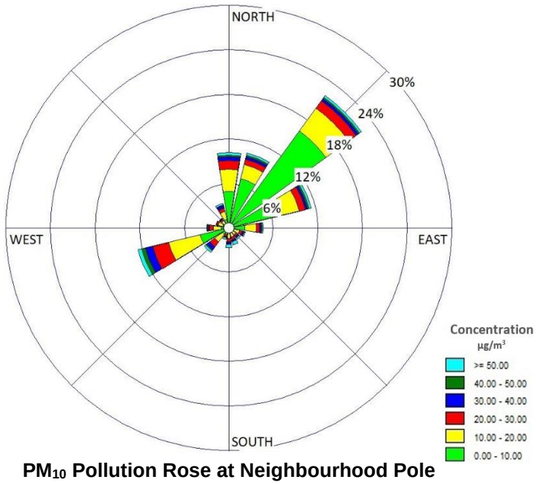
$PM_{2.5}$ Pollution Rose at Carlton Tower * (1370 Keith Road East) from Jan 1st to Apr 12th



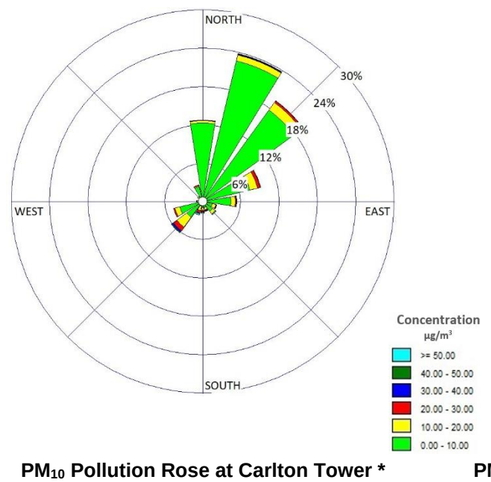
$PM_{2.5}$ Pollution Rose at Neptune Office Building * (340 Brooksbank Ave.) from Apr 12th to Dec 31st



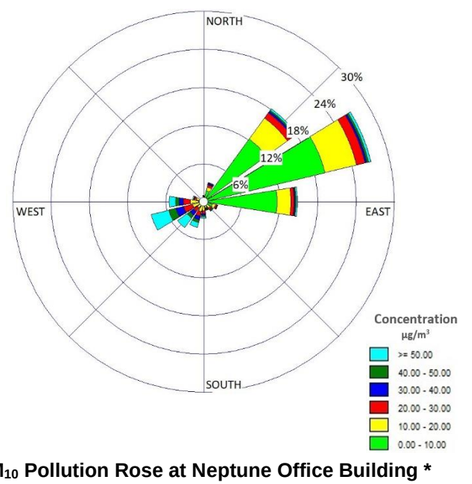
PM_{10} Pollution Rose at Neptune Electrical Substation



PM_{10} Pollution Rose at Neighbourhood Pole (618 2nd St. East)



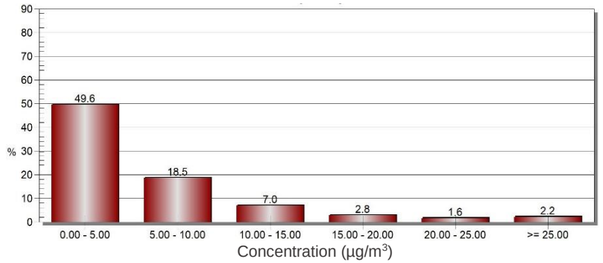
PM_{10} Pollution Rose at Carlton Tower * (1370 Keith Road East) from Jan 1st to Apr 12th



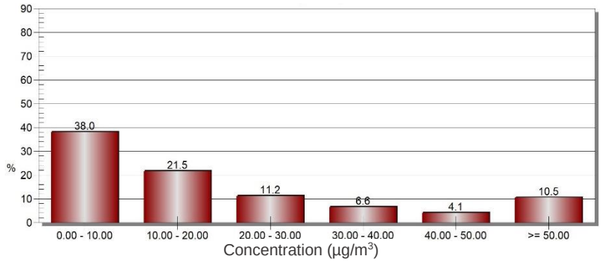
PM_{10} Pollution Rose at Neptune Office Building * (340 Brooksbank Ave.) from Apr 12th to Dec 31st

Figure 8: Pollution roses (direction wind blowing from) at on-site and off-site monitoring stations for Jan 1st – Dec 31st, 2022
Note: Scales are not consistent between wind roses.

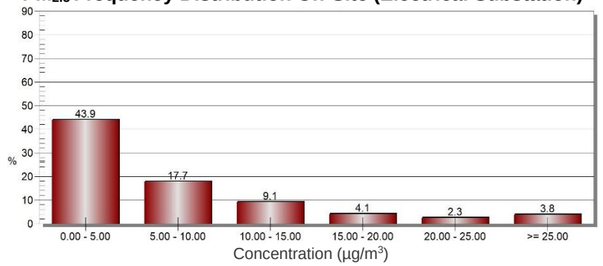
** Due to roof maintenance/repairs at the Neptune Office Building (340 Brooksbank Ave.), the wind sensor and particulate monitor normally operated on the roof of the Neptune Office Building was temporarily relocated to the nearby roof of 1327 Keith Road East (Carlton Tower)) in 2021 where it was operated until it was possible to reinstall on the roof of the Neptune Office Building on April 12th 2022 following the completion of the roof work.*



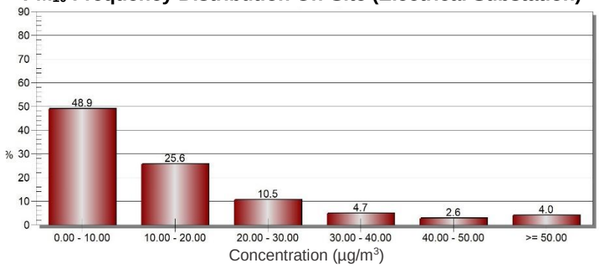
$PM_{2.5}$ Frequency Distribution On-Site (Electrical Substation)



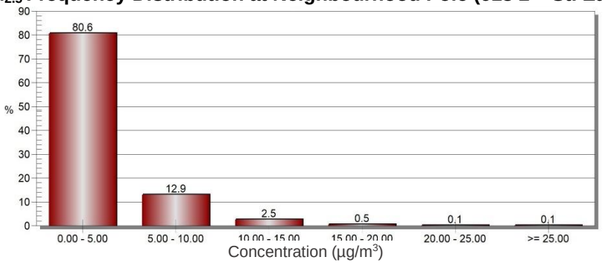
PM_{10} Frequency Distribution On-Site (Electrical Substation)



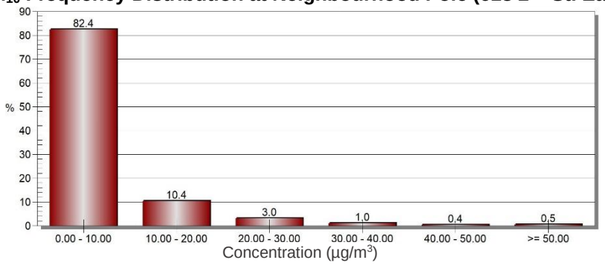
$PM_{2.5}$ Frequency Distribution at Neighbourhood Pole (618 2nd St. East)



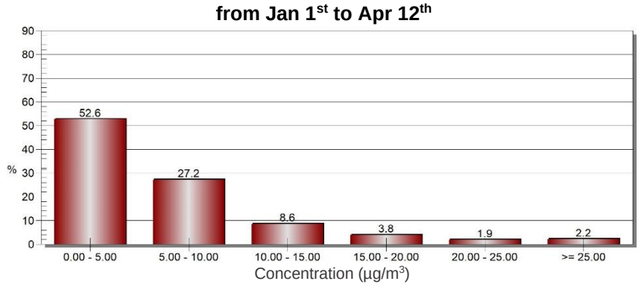
PM_{10} Frequency Distribution at Neighbourhood Pole (618 2nd St. East)



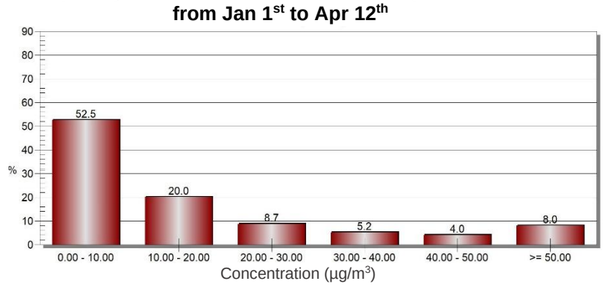
$PM_{2.5}$ Frequency Distribution at Carlton Tower (1370 Keith Road East.) from Jan 1st to Apr 12th



PM_{10} Frequency Distribution at Carlton Tower (1370 Keith Road East.) from Jan 1st to Apr 12th



$PM_{2.5}$ Frequency Distribution at Neptune Office Building (340 Brooksbank Ave.) from Apr 12th to Dec 31st



PM_{10} Frequency Distribution at Neptune Office Building (340 Brooksbank Ave.) from Apr 12th to Dec 31st

Figure 9: Frequency distributions at on-site and off-site monitoring stations for Jan 1st – Dec 31st, 2022