NEPTUNE AMBIENT AIR QUALITY MONITORING ANNUAL REPORT

NEPTUNE BULK TERMINALS LTD.

Report Date: March 31st, 2022

envirochem

Neptune TERMINALS

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1 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.

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 AMBIENT AIR QUALITY MONITORING PROGRAM

2.1 WIND MONTORING DATA ANALYSIS

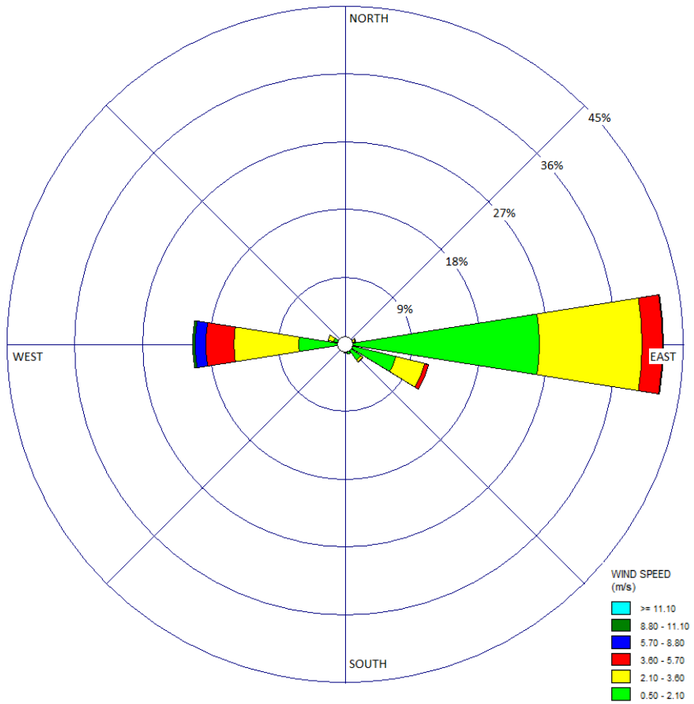
2.1.1 METHODOLOGY

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) from July 9th.

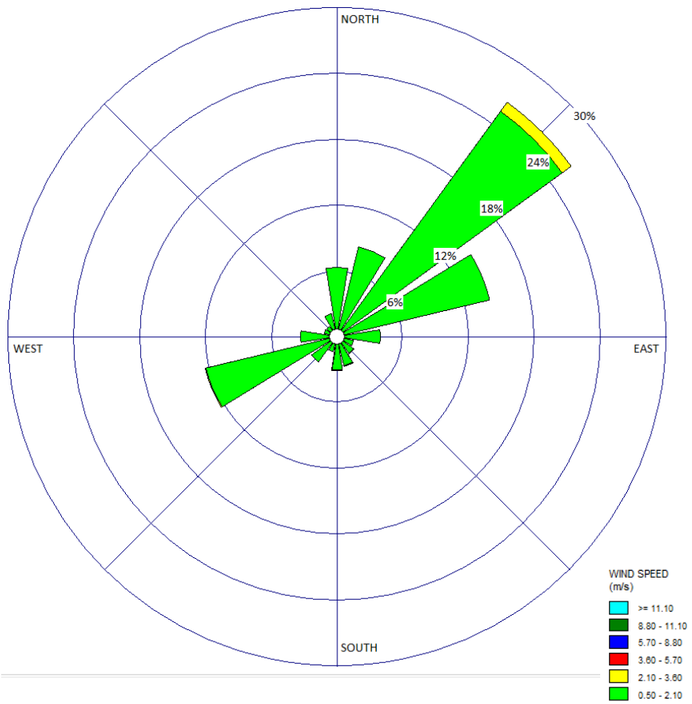
- Using wind data, wind roses for each wind instrument location are prepared for the preceding year. The wind roses are shown in **Figure 1.**
- Envirochem submits these figures to Metro Vancouver for each preceding calendar year as part of the annual air quality monitoring program report.

2.1.2 RESULTS

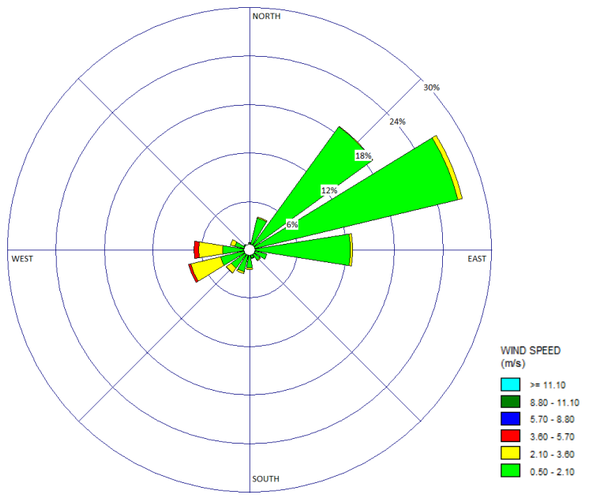
Wind roses are presented in **Figure 1** below representing the distribution of wind direction and wind speed at Neptune on-site (Neptune Electrical Substation) and off-site monitors (Neighbourhood Pole, roof of Neptune Office Building, and Carlton Tower) for 2021. Please note that the wind roses presented for the Neptune Office Building (340 Brooksbank Ave.) and Carlton Tower (1327 Keith Road East) are not based on a full year of data.



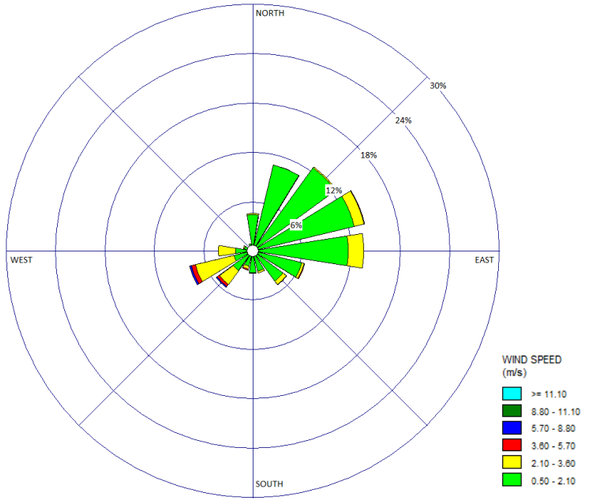
On-Site (Electrical Substation)



Neighbourhood Pole (618 2nd St. East)



Neptune Office Building (340 Brooksbank) *
Data from Jan 1st to June 25th



Carlton Tower (1327 Keith Road East) *
Data from July 9th to Dec 31st

Figure 1: Windroses (direction wind blowing from) at on-site and off-site monitoring stations for Jan 1st – Dec 31st, 2021

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 was temporarily relocated to the nearby roof of 1327 Keith Road East (Carlton Tower) from July 9th.*

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.) and Carlton Tower (1327 Keith Road East), and at 618 2nd St. East. Any gaps in the trend analyses are due to missing or invalid data.

As notified in correspondence with Metro Vancouver dated June 22nd, 2021, $PM_{2.5}$ and PM_{10} units were temporarily taken down at 340 Brooksbank Avenue on June 25th due to required rooftop maintenance/repairs announced by the building's landlord. $PM_{2.5}$ data after June 25th was retrieved from the nearby $PM_{2.5}$ station at the Carlton Tower building (located at 1327 Keith Road East) that is operated by Neptune as part of a due diligence program and outside of the scope of their Ambient Air Monitoring Program. This station is close to 340 Brooksbank Avenue and in the same direction from Neptune Terminals. As notified in correspondence with Metro Vancouver dated July 29th, 2021, the PM_{10} monitor operated at 340 Brooksbank Avenue under the Ambient Air Monitoring Program has been temporarily relocated since July 9th to the rooftop of the Carlton Tower building to operate alongside the $PM_{2.5}$ instrument and maintain

the coherence of the PM_{10} dataset. 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 2021. The exceedances in August 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 April, May, and September. 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.

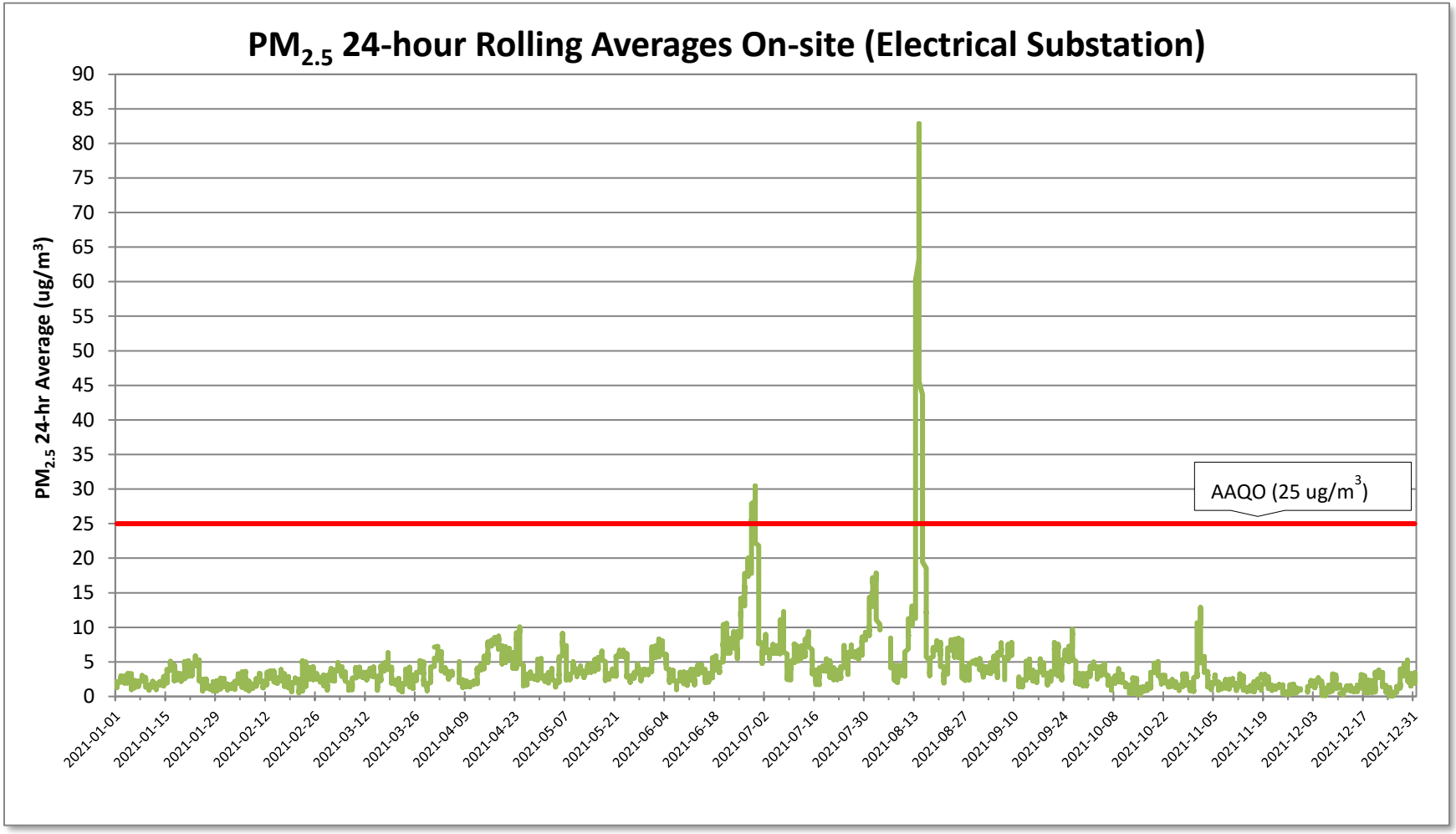


Figure 2: 24-hour rolling averages of $PM_{2.5}$ from on-site monitor (Electrical Substation) for Jan 1st – Dec 31st, 2021

Note: *Blank spaces indicates no data available.*

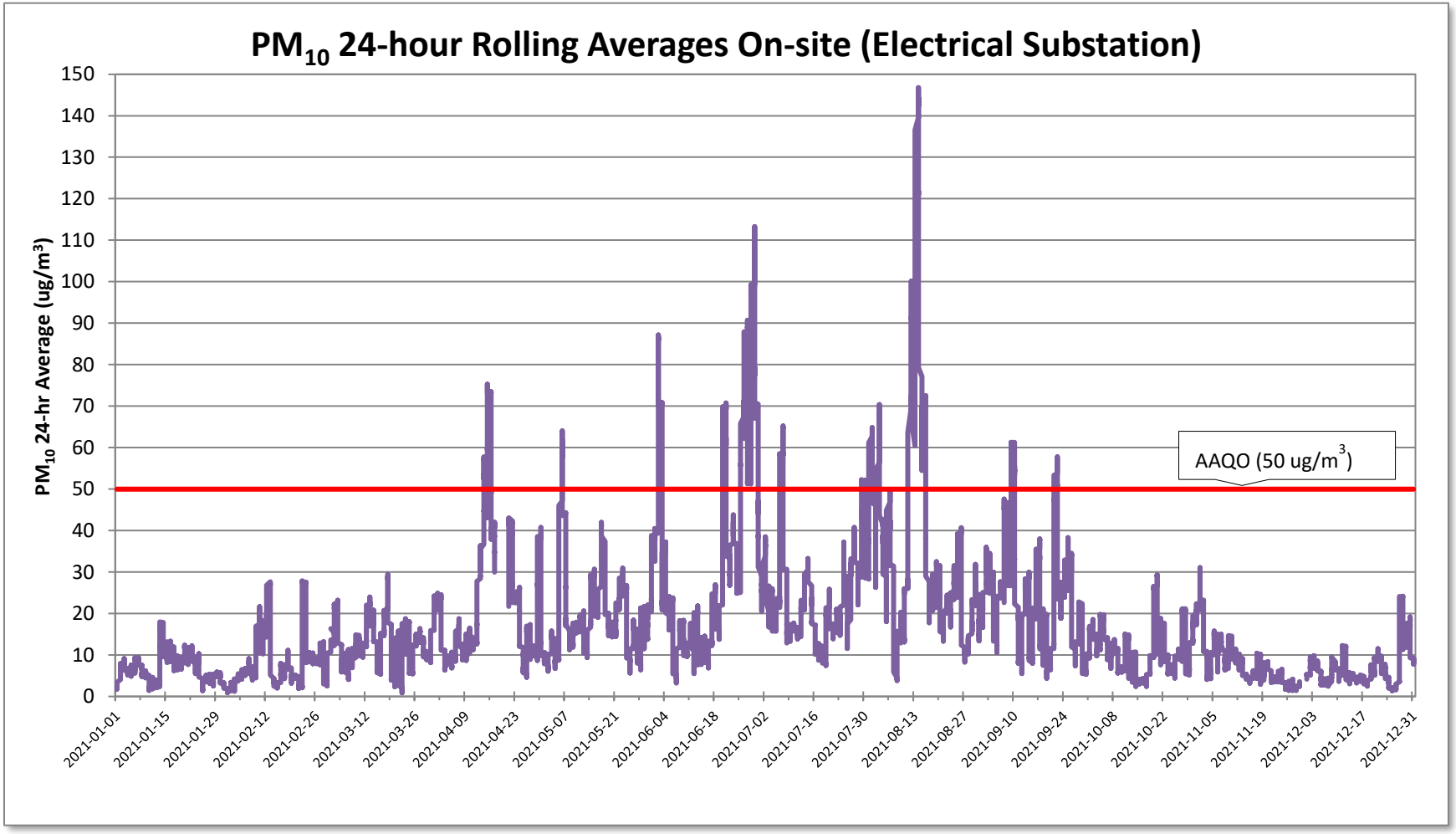


Figure 3: 24-hour rolling averages of PM_{10} from on-site monitor (Electrical Substation) for Jan 1st – Dec 31st, 2021

Note: *Blank spaces indicates no data available.*

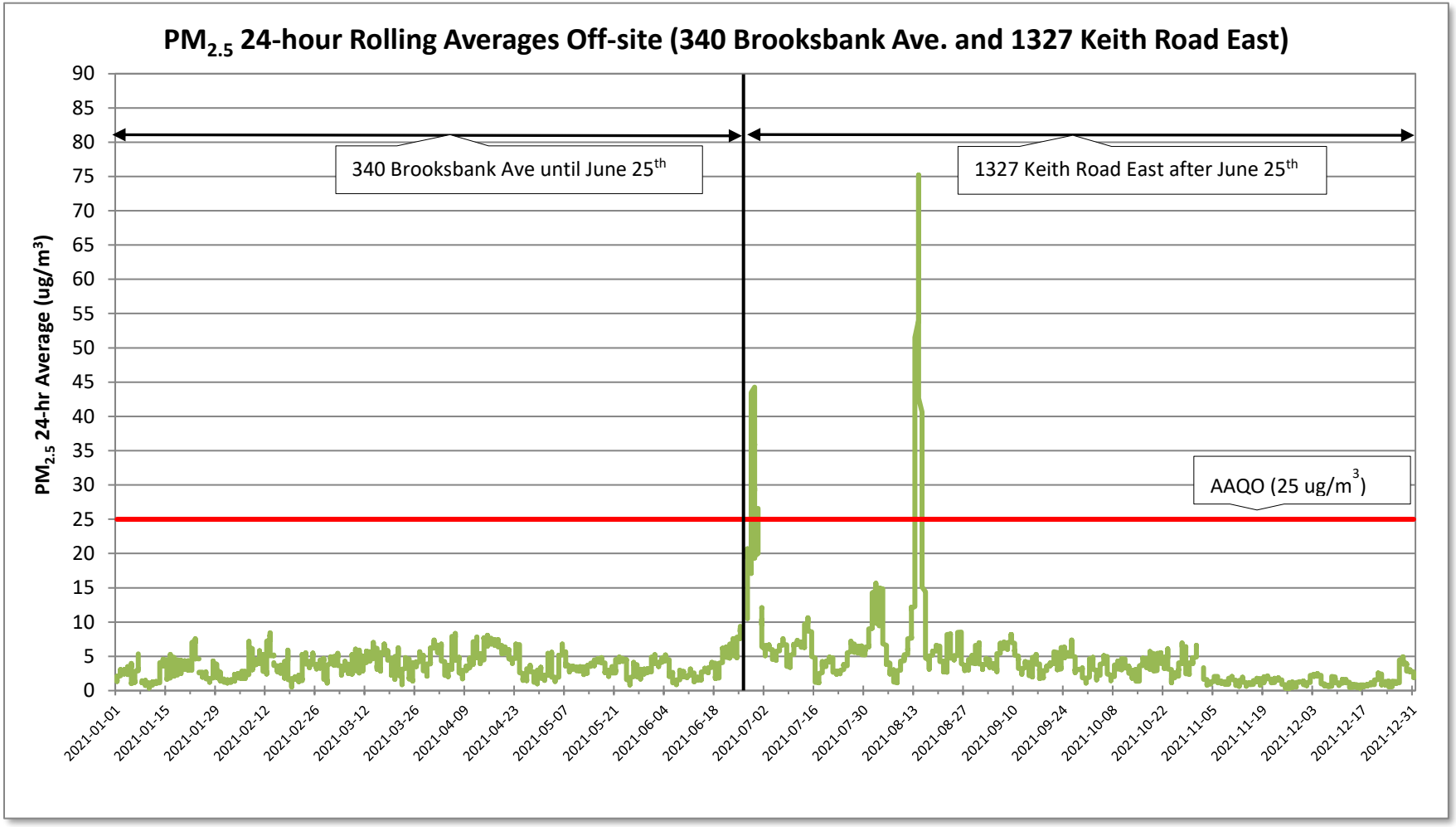


Figure 4: 24-hour rolling averages of $PM_{2.5}$ from off-site monitor at the Neptune Office Building (340 Brooksbank Ave.) for Jan 1st - Jun 25th, 2021 and at the Carlton Tower (1327 Keith Road East) for Jun 25th - Dec 31st, 2021.

Note: *Blank spaces indicates no data available.*

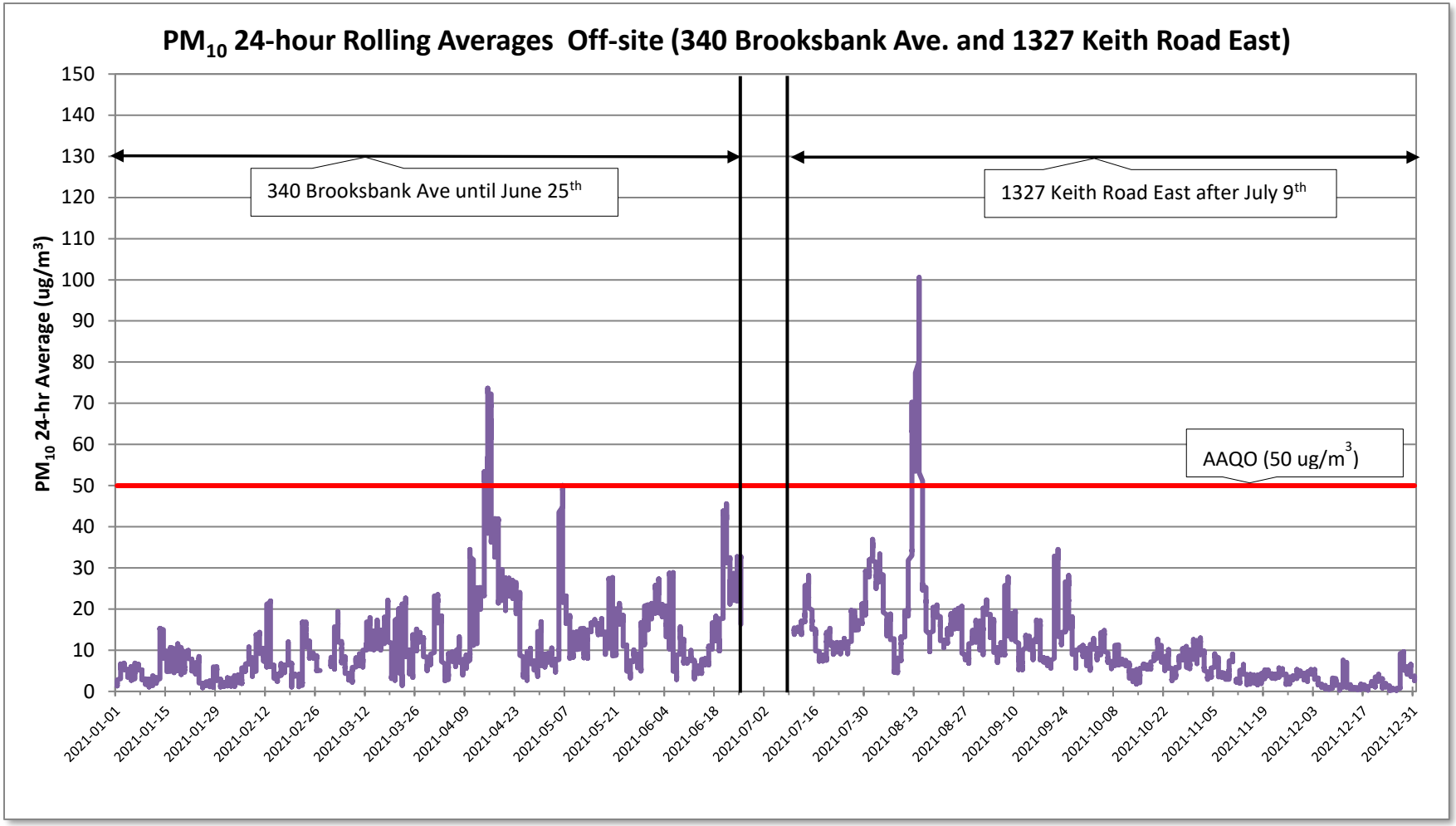


Figure 5: 24-hour rolling averages of PM_{10} from off-site monitor at Neptune Office Building (340 Brooksbank Ave.) for Jan 1st - Jun 25th and at the Carlton Tower (1327 Keith Road East) for Jul 9th - Dec 31st.

Note: *Blank spaces indicates no data available.*

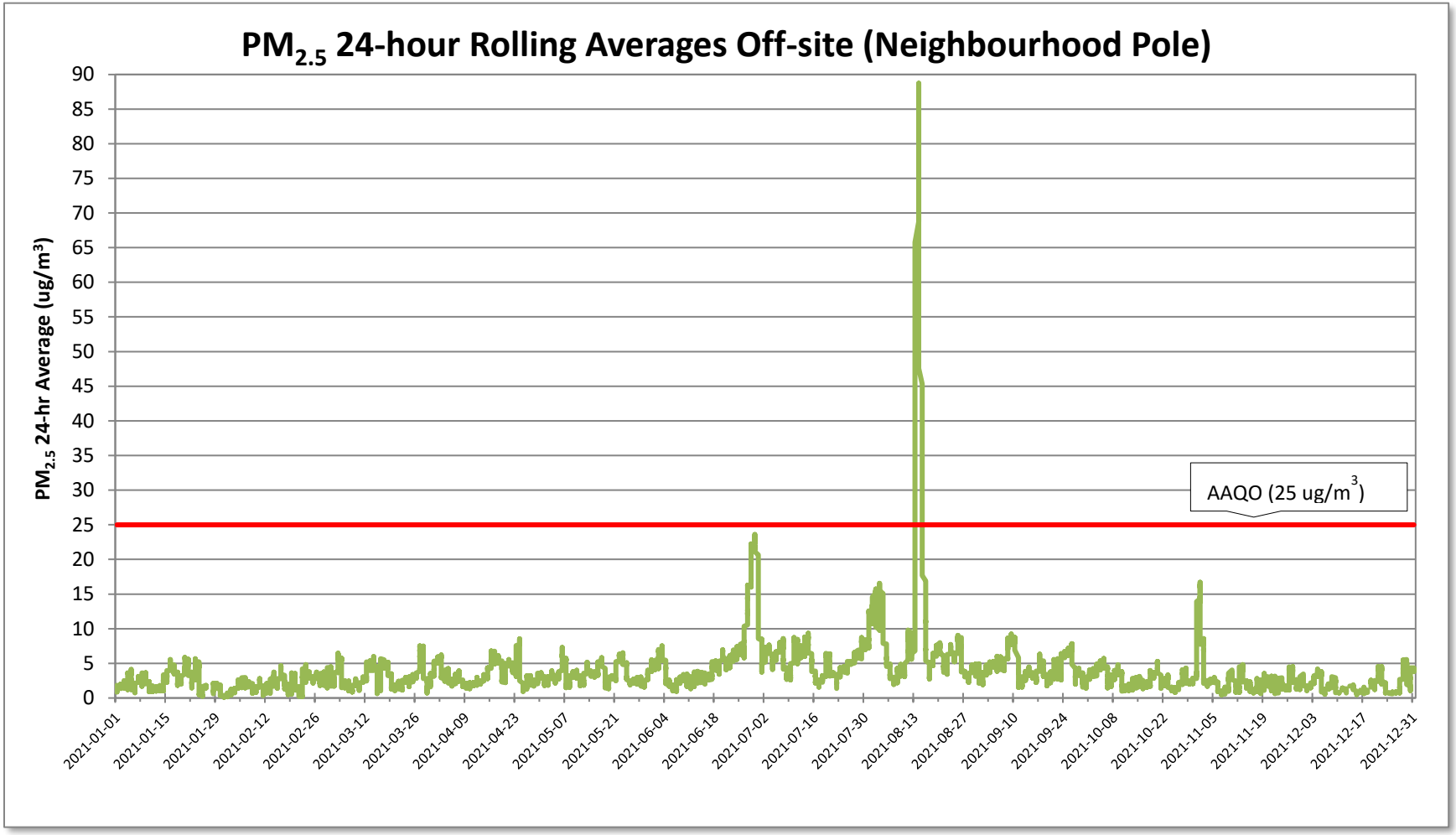


Figure 6: 24-hour rolling averages of $PM_{2.5}$ from off-site monitor at 618 2nd St. East for Jan 1st – Dec 31st, 2021

Note: *Blank spaces indicates no data available.*

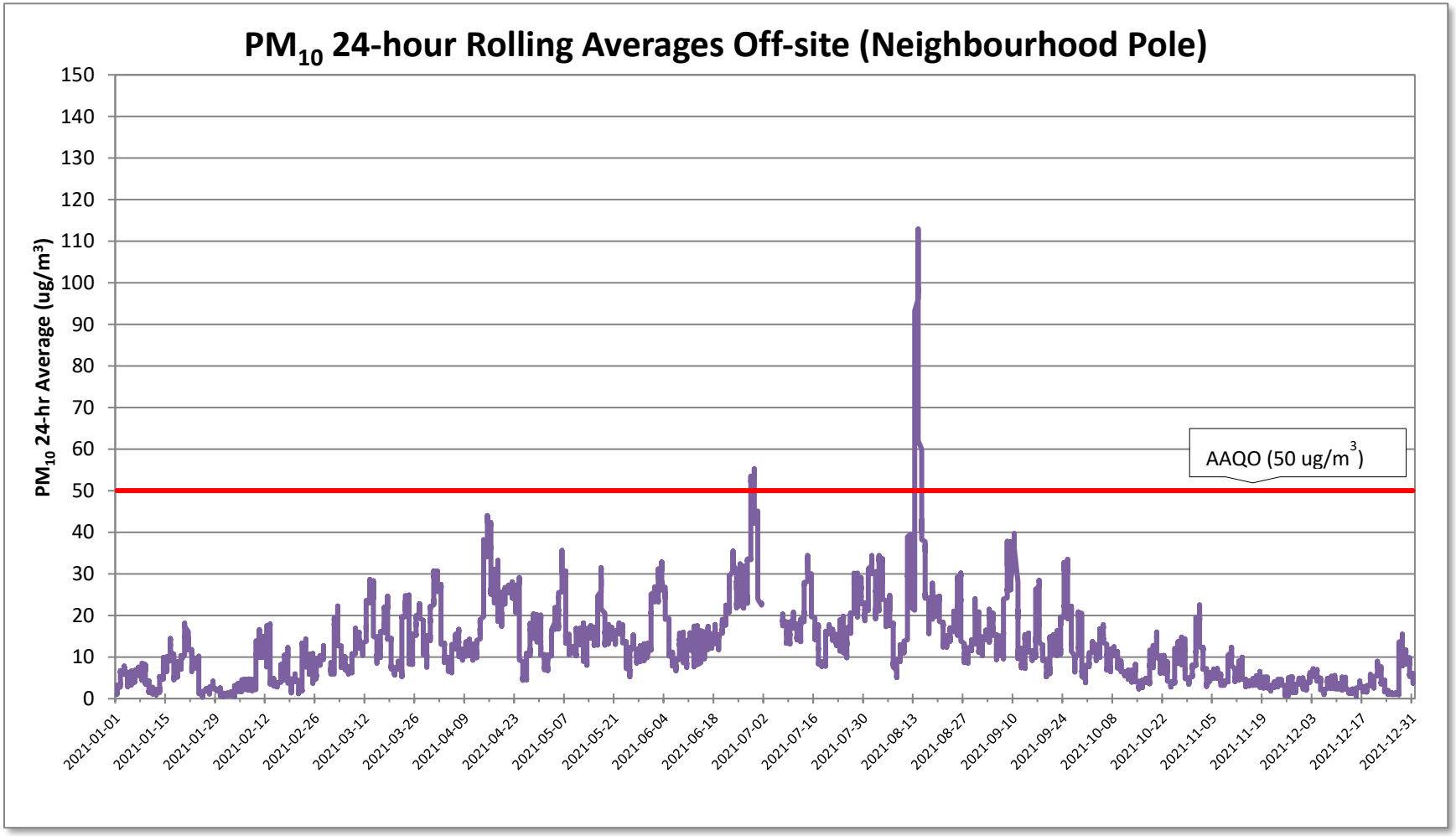


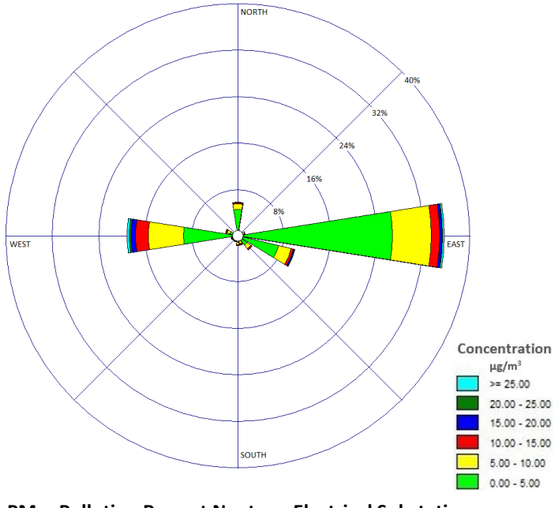
Figure 7: 24-hour rolling averages of PM_{10} from off-site monitor at 618 2nd St. East for Jan 1st – Dec 31st, 2021

Note: *Blank spaces indicates no data available.*

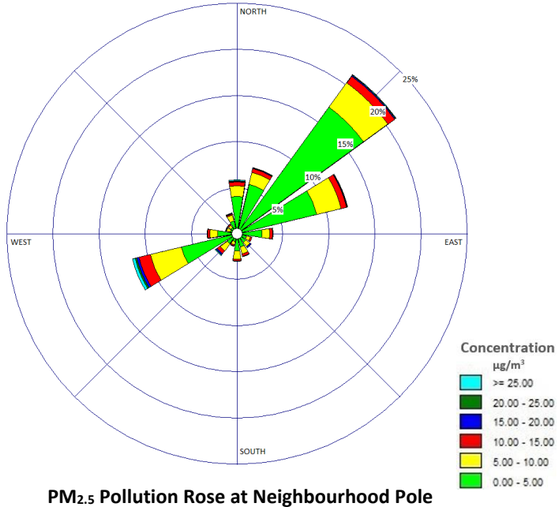
2.2.3 POLLUTION ROSES AND FREQUENCY DISTRIBUTION ANALYSES

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.) and roof of Carlton Tower (1327 Keith Road East), and pole mounted at 618 2nd St. East) for 2021.

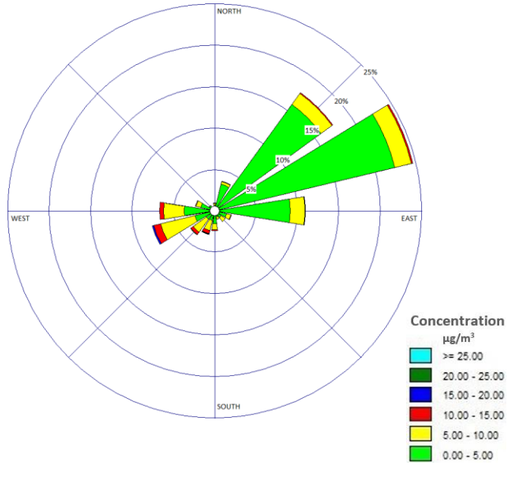
It should be noted that there was heavy construction around the neighbourhood pole monitor (618 2nd St. East) during 2021.



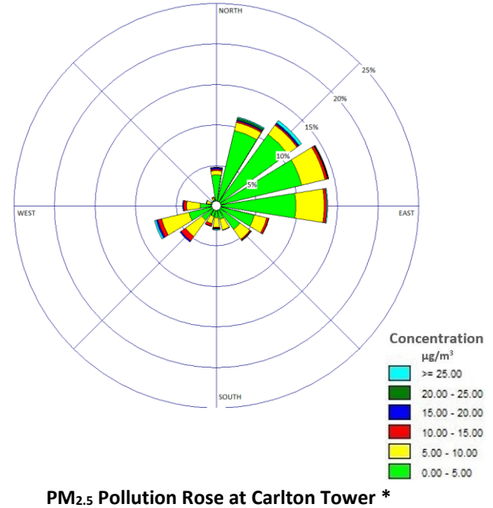
$PM_{2.5}$ Pollution Rose at Neptune Electrical Substation



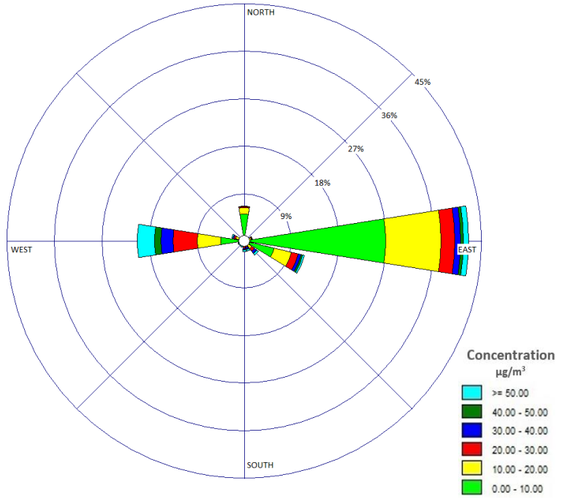
$PM_{2.5}$ Pollution Rose at Neighbourhood Pole (618 2nd St. East)



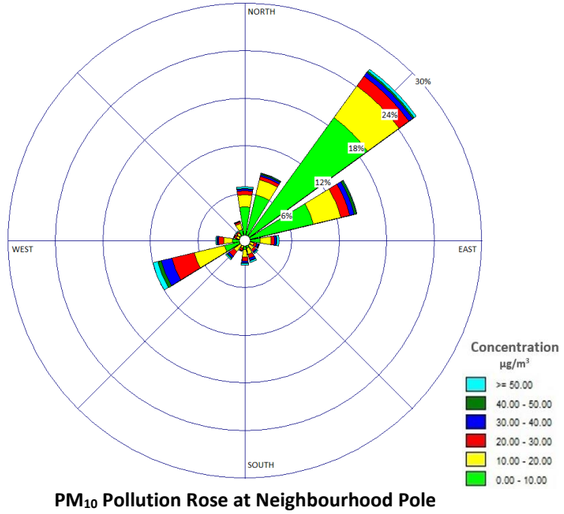
$PM_{2.5}$ Pollution Rose at Neptune Office Building * (340 Brooksbank Ave.) from Jan 1st to Jun 25th



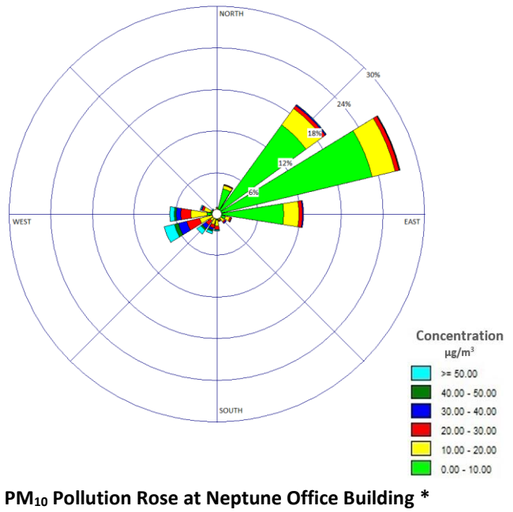
$PM_{2.5}$ Pollution Rose at Carlton Tower * (1370 Keith Road East) from June 25th to Dec 31st



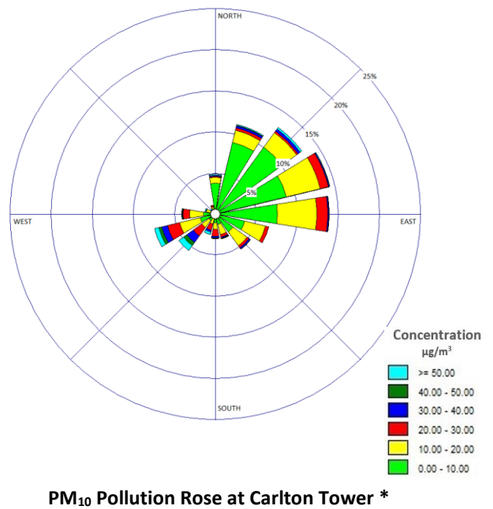
PM_{10} Pollution Rose at Neptune Electrical Substation



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



PM_{10} Pollution Rose at Neptune Office Building * (340 Brooksbank Ave.) from Jan 1st to Jun 25th

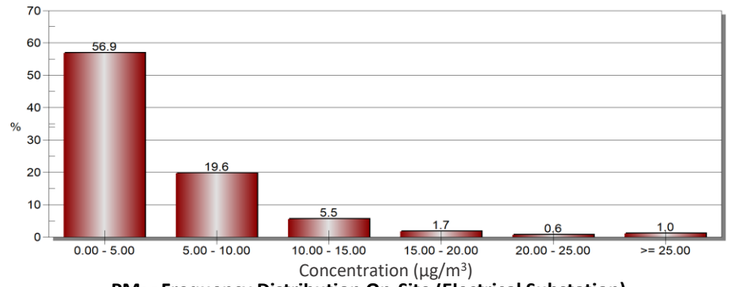


PM_{10} Pollution Rose at Carlton Tower * (1370 Keith Road East) from Jul 9th to Dec 31st

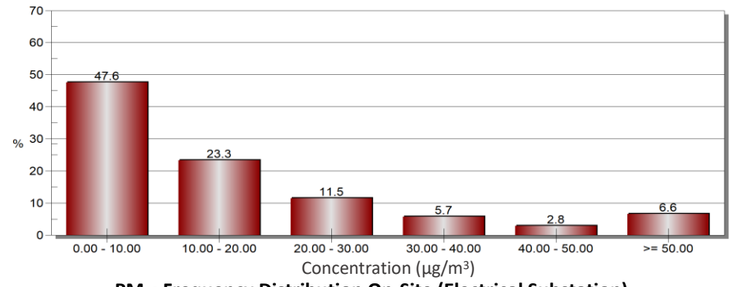
Figure 8: Pollution roses (direction wind blowing from) at on-site and off-site monitoring stations for Jan 1st – Dec 31st, 2021

Note: Scales are not consistent between wind roses.

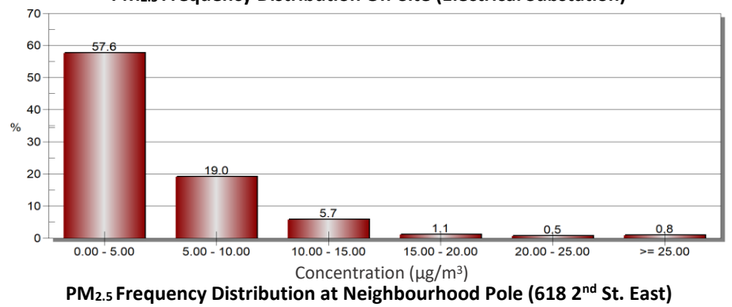
** Due to roof maintenance/repairs at the Neptune Office Building (340 Brooksbank Ave.), the wind sensor and particulate monitor normally operated on the roof of the Neptune Office Building was temporarily relocated to the nearby roof of 1327 Keith Road East (Carlton Tower) from July 9th.*



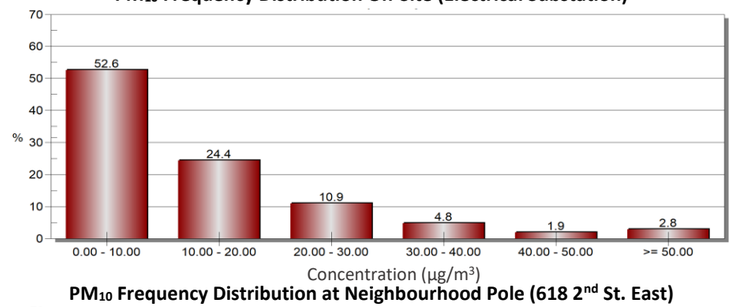
$PM_{2.5}$ Frequency Distribution On-Site (Electrical Substation)



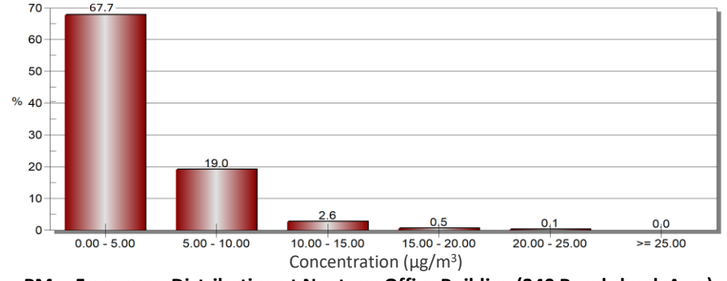
PM_{10} Frequency Distribution On-Site (Electrical Substation)



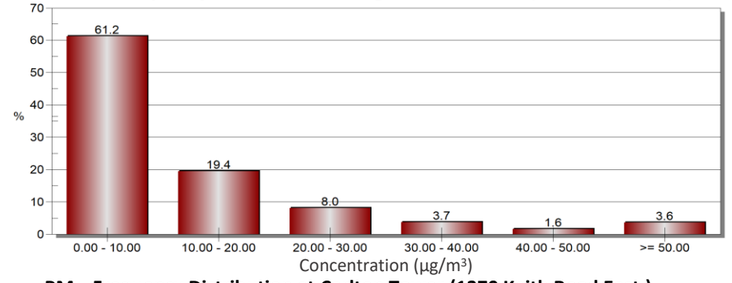
$PM_{2.5}$ Frequency Distribution at Neighbourhood Pole (618 2nd St. East)



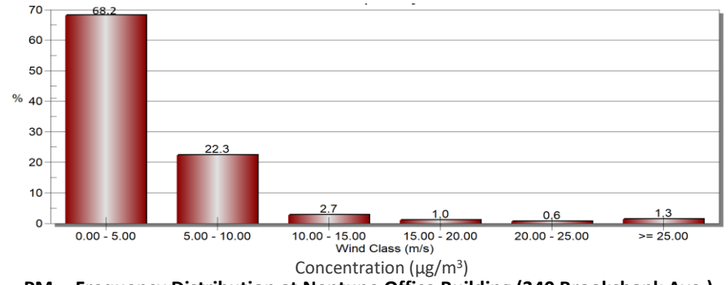
PM_{10} Frequency Distribution at Neighbourhood Pole (618 2nd St. East)



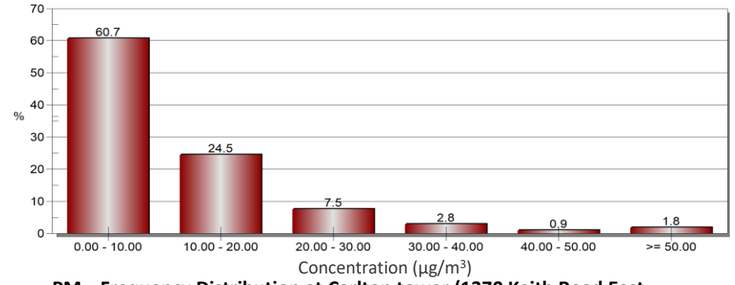
$PM_{2.5}$ Frequency Distribution at Neptune Office Building (340 Brooksbank Ave.) from Jan 1st to Jun 25th



PM_{10} Frequency Distribution at Carlton Tower (1370 Keith Road East.) from Jan 1st to Jun 25th



$PM_{2.5}$ Frequency Distribution at Neptune Office Building (340 Brooksbank Ave.) from June 25th to Dec 31st



PM_{10} Frequency Distribution at Carlton tower (1370 Keith Road East from Jul 9th to Dec 31st

Figure 9: Frequency distributions at on-site and off-site monitoring stations for Jan 1st – Dec 31st, 2021