

North Queensland Bulk Ports Corporation Mky

Southern and Northern Stations

Ambient Air Quality Monitoring

Validated Report

1st October – 31st October 2023

Report No.: DAT20463

Report issue date: 28th November 2023

Maintenance contract: MC950

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**North Queensland Bulk Ports Mky
Southern and Northern Stations
Report No:DAT20463**

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| Revision History | | | |
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| Revision | Report ID | Date | Analyst |
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Executive Summary

North Queensland Bulk Ports Corporation has commissioned Acoem Australasia to conduct air quality monitoring for the Mackay Dust Monitoring Program. The monitoring stations at Southern and Northern sites are each equipped with an E-Sampler. Both E-samplers were equipped to measure TSP until 12th June 2020 when the E-Sampler heads at both stations were changed to measuring PM₁₀.

The air quality stations were commissioned in July 2016.

This report presents the data collected from the Southern and Northern stations.

Data capture for Southern station was 99.9% and Northern station was 99.9%.

The PM₁₀ monthly average for Southern station was 14 µg/m³ with a standard deviation of 9 µg/m³.

The PM₁₀ monthly average for Northern station was 18 µg/m³ with a standard deviation of 18 µg/m³.

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1.0 Introduction

Acoem Australasia was commissioned by North Queensland Bulk Ports Corporation to provide monitoring and data reporting for the Mackay Dust Monitoring Program at Southern and Northern monitoring stations, located in Mackay Harbour, QLD, Australia as detailed in Table 1.

Acoem Australasia commenced data collection from both stations on 20th July 2016.

The data presented in this report:

- Describes air quality measurements;
- Compares monitoring results;
- Has been quality assured.

2.0 Monitoring and Data Collection

2.1. Siting Details

Station locations and siting details are described below.

Table 1: Southern and Northern Stations Siting

| Site Name | Geographical Coordinates | Height Above Sea Level (m) |
|-----------|---------------------------------|----------------------------|
| Northern | 21° 06' 4.18" S 149°13'26.10" E | 5m |
| Southern | 21° 06' 22.3" S 149°13'28.4" E | 5m |

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Figure 1: Southern and Northern Monitoring Stations Location

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2.2. Monitored Parameters

Table 2 below details the parameters monitored and the instruments used at the Southern and Northern stations. Appendix 1 defines any abbreviated parameter names used throughout the report.

Table 2: Parameters Measured at the Southern and Northern Monitoring Stations

| Parameter Measured | Instrument and Measurement Technique |
|--------------------|---|
| PM ₁₀ | Met One E-Sampler – light scatter aerosol monitor |

2.3. Data Collection Methods

Table 3 shows the methods used for data collection.

Table 3: Methods

| Parameter Measured | Data Collection Methods Used | Description of Method |
|------------------------------|------------------------------------|------------------------------------|
| PM ₁₀ (E-Sampler) | Met One E-Sampler Operation Manual | Met One E-Sampler Operation Manual |

2.3.1. Data Acquisition

Data is logged by the E-sampler at each monitoring site. Each E-sampler is equipped with a 4G modem for remote data collection. The recorded data is remotely collected from the E-samplers on a daily basis (using Airodis™ version 5.2.1) and stored at Acoem Australasia's Environmental Reporting Services (ERS) department in Melbourne, Australia. Data samples are logged in 5-minute intervals.

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2.4. Data Validation and Reporting

2.4.1. Validation

The Acoem Australasia ERS department performs daily data checks to ensure maximum data capture rates are maintained. Any equipment failures are communicated to the responsible field engineers for urgent rectification. Acoem Australasia ERS maintains two distinct databases containing non-validated and validated data respectively.

The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations and other maintenance activities. The data validation software requires the analyst to supply a valid reason (e.g., backed by maintenance notes, calibration sheets etc) in the database for flagging any data as invalid.

Validation is performed by the Acoem Australasia ERS operator, and the validation is reviewed. All data is checked and graphs and reports are generated based on the verified five-minute data.

2.4.2. Reporting

The reported data is in a Microsoft Excel format file named *"NQBP Mky Southern and Northern Stations Data Report October 2023.xlsx"*.

The Excel file consists of six worksheets:

1. Cover
2. 5 Minute Data Averages
3. 15 Minute Data Averages
4. 1 Hour Data Averages
5. 24 Hour Data Averages
6. Valid Data Exception Tables

The data contained in these reports is based on Australian Eastern Standard Time. Data is for all parameters measured continuously.

All averages are calculated from the five-minute data. Averages are based on a minimum of 75% valid readings within the averaging period. Averaging periods of eight hours or less are reported for the end of the period, i.e., the hourly average 02:00am is for the data collected from 1:00am to 2:00am. One-hour averages are calculated based on a clock hour. One day and one-year averages are calculated based on calendar days.

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2.5. Calibrations and Maintenance

2.5.1. Units and Uncertainties

The uncertainties for each parameter have been determined by the manufacturer's tolerance limits of the equipment's parameters, and by the data collection standard method.

The reported uncertainties are expanded uncertainties, calculated using coverage factors which give a level of confidence of approximately 95%.

Table 4: Units and Uncertainties

| Parameter | Units | Resolution | Uncertainty ¹ | Measurement Range |
|---------------------------------|-------------------|---------------------|--|---------------------------|
| PM ₁₀ (E-Sampler) | µg/m ³ | 1 µg/m ³ | ± 10% to gravimetric method ² | 0 to 65 mg/m ³ |

2.5.2. Maintenance

Scheduled maintenance is completed every 2 months by Acoem Australasia.

2.5.2.1. Calibration & Maintenance Summary Tables

The last calibrations for the following parameters were performed on the indicated dates. Data supplied after this time is subject to verification, to be performed at the next calibration cycle.

Note: Maintenance and calibration dates may differ, as calibrations may be less frequent than scheduled maintenance visits.

¹ Uncertainties are calculated based on the full measurement range unless stated otherwise

² Manufacturer's stated accuracy for nephelometer when calibrated for local particulate type.

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2.5.3. Maintenance Notes

2.5.3.1. NQBP Mky Northern

- Scheduled 2 monthly maintenance was performed on 06/10/2023. Checks were performed on E-Sampler.

2.5.3.2. NQBP Mky Southern

- Scheduled yearly maintenance was performed on 06/10/2023. Checks were performed on E-Sampler.

Table 5 indicates when the particulate equipment was last maintained/calibrated.

Table 5: Southern and Northern Stations Maintenance Table

| Station | Parameter | Date of Last Maintenance | Maintenance Type | Date of Last Calibration |
|----------|------------------|--------------------------|------------------|--------------------------|
| Southern | PM ₁₀ | 06/10/2023 | 2 Monthly | 06/10/2023 |
| Northern | PM ₁₀ | 06/10/2023 | 2 Monthly | 06/10/2023 |

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3.0 Results

3.1. Data Capture

Data capture is calculated from 5-minute data, and refers to the amount of available data collected during the report period.

The percentage of data captured is calculated using the following equation:

$$\text{Data capture} = (\text{Reported air quality data} / \text{Total data}) \times 100\%$$

Where:

- Reported air quality data = Number of instrument readings which have been verified through a quality assured process and excludes all data errors, zero data collection due to calibration, failures and planned and unplanned maintenance.
- Total data = Total number of samples (instrument readings) expected for the sampling period. Total data is calculated based on the same averaging period as “reported air quality data” and the duration of the corresponding report period. e.g., for 5-minute data collected over a month of 31 days, the total data would be equal to 12 (5-minute samples in an hour) x 24 (hours in a day) x 31 (days in a month) = 8928 samples.

Table 6 below displays data capture statistics for October 2023. **Bold** values in the table indicate data capture below 95%.

Table 6: Monthly Data Capture for Southern and Northern stations

| Station | Parameter | Data Capture (%) |
|----------|------------------|------------------|
| Southern | PM ₁₀ | 99.9 |
| Northern | PM ₁₀ | 99.9 |

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3.2. Air Quality Summary

Table 7 below presents some statistical parameters for Southern and Northern stations. The standard deviation is calculated based on the 5-minute averaged data.

Table 7: General statistics

| Station | Parameter | Time Period | Average ($\mu\text{g}/\text{m}^3$) | Standard Deviation ($\mu\text{g}/\text{m}^3$) |
|----------|------------------|-------------|---|--|
| Southern | PM ₁₀ | 1 month | 14 | 9 |
| Northern | PM ₁₀ | 1 month | 18 | 18 |

3.2.1. Air Quality Categories

Air quality categories rather than an air quality index have been adopted to align with a Nationally consistent method of reporting of air quality data.

Each air quality measurement from a monitoring station is assigned an air quality category rating based on comparison of the measurement value against the relevant air quality guideline. Five colour-coded air quality categories are used, being 'Good' (green), 'Fair' (yellow), 'Poor' (orange), 'Very Poor' (red) or 'Extremely Poor' (dark red). Values greater than the air quality guideline will be appear as 'Poor', 'Very Poor' or 'Extremely Poor'.⁴

The Air Quality Categories rating is based on 1-hour averages values.

Table 8: Colour-coded Categories for Air Quality Categories

| | | | | | |
|---------------|-------------|----------------|-------------------|------------------------|------------------------|
| Not available | Good <50 | Fair 50-100 | Poor 100.1-200 | Very poor 200.1-600 | Extremely poor >600 |
|---------------|-------------|----------------|-------------------|------------------------|------------------------|

The PM₁₀ 1-hour average values for the reporting month at the Northern and Southern stations were assessed against the air quality category rating, and the pie chart on the next pages presents the percentage of the time for which a specific air quality category was identified.

⁴ <https://www.qld.gov.au/environment/pollution/monitoring/air-monitoring/air-quality-index/>

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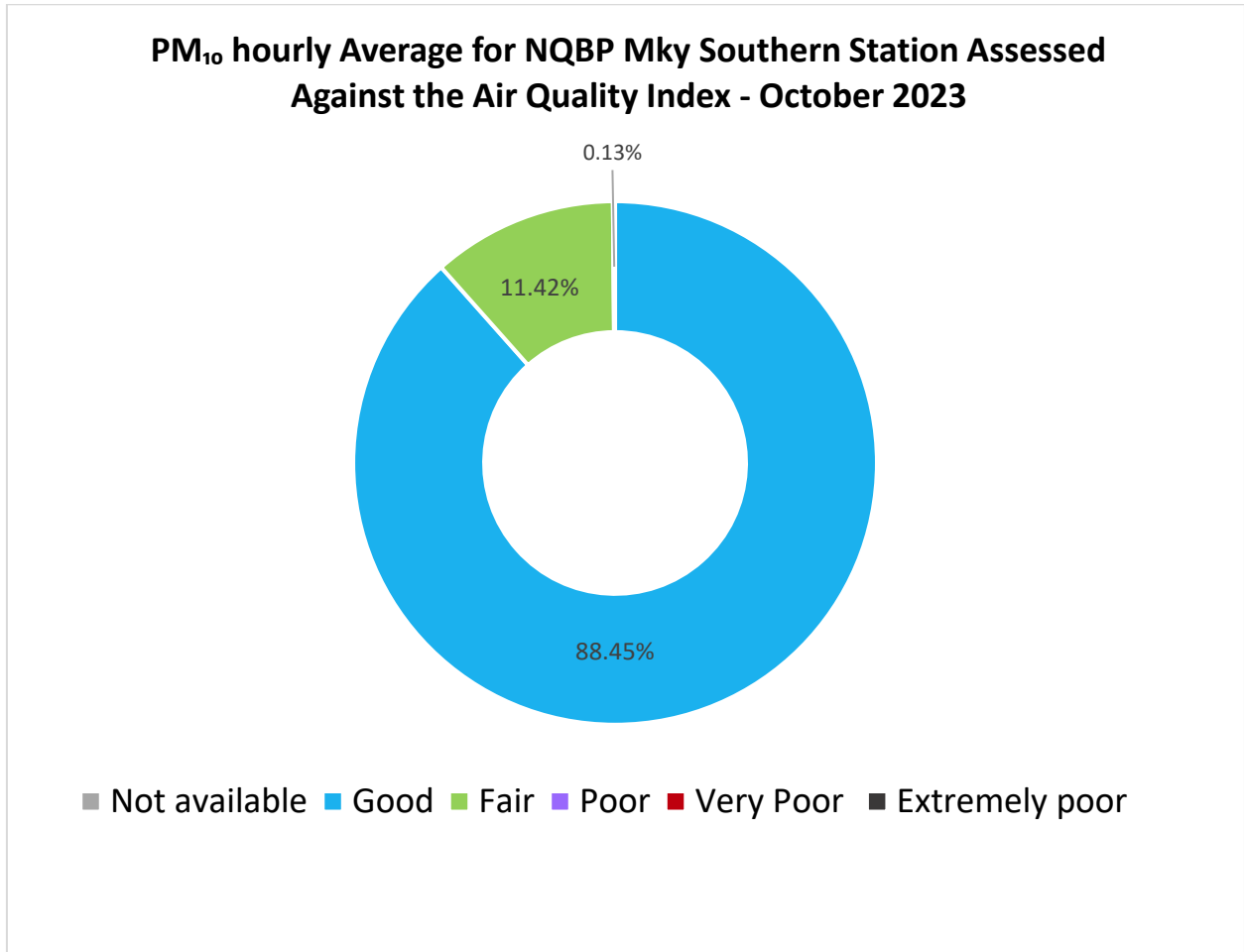


Figure 2: Hourly PM₁₀ Averages for NQBP Mky Southern Station Assessed Against the Air Quality Category

88.45% of time during the reporting period presented by the Air Quality Category are classified as Good, 11.42% time are classified as Fair, 0.13% of time are classified as Poor, 0.28% of time are classified as Very Poor, 0.00% of time are classified as Extremely Poor and 0.0% of time are classified as Not Available.

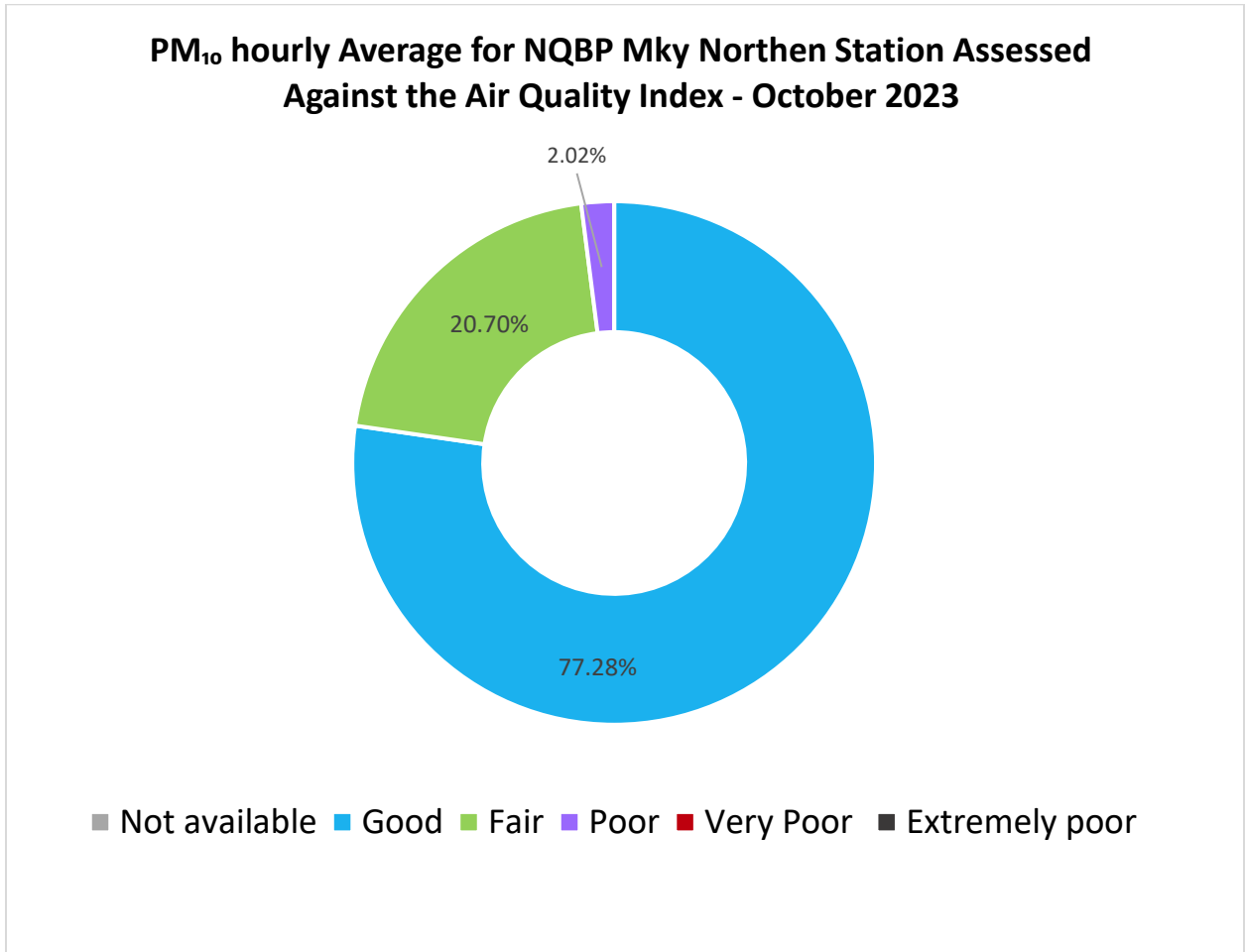


Figure 3: Hourly PM₁₀ averages for NQBP Mky Northern Station Assessed Against the Air Quality Category

77.28% of time during the reporting period presented by the Air Quality Category are classified as Good, 20.70% of time are classified as Fair, 2.02% of time are classified as Poor. 0.00% of time are classified as Very Poor, 0.00% of time are classified as Extremely Poor and 0.00% of time are classified as Not Available.

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3.3. Tabulated Data

Table 9 details the daily averages for PM₁₀ measured at Southern and Northern.

Table 9: Southern and Northern Stations Data Table

| Date | Southern ($\mu\text{g}/\text{m}^3$) | Northern ($\mu\text{g}/\text{m}^3$) |
|------------|--|--|
| 1/09/2023 | 9 | 12 |
| 2/09/2023 | 9 | 17 |
| 3/09/2023 | 8 | 13 |
| 4/09/2023 | 12 | 18 |
| 5/09/2023 | 13 | 19 |
| 6/09/2023 | 12 | 20 |
| 7/09/2023 | 24 | 38 |
| 8/09/2023 | 13 | 25 |
| 9/09/2023 | 13 | 17 |
| 10/09/2023 | 25 | 34 |
| 11/09/2023 | 29 | 45 |
| 12/09/2023 | 22 | 34 |
| 13/09/2023 | 15 | 24 |
| 14/09/2023 | 11 | 18 |
| 15/09/2023 | 15 | 22 |
| 16/09/2023 | 20 | 30 |
| 17/09/2023 | 20 | 33 |
| 18/09/2023 | 16 | 30 |
| 19/09/2023 | 17 | 28 |
| 20/09/2023 | 13 | 21 |
| 21/09/2023 | 10 | 16 |
| 22/09/2023 | 36 | 47 |
| 23/09/2023 | 30 | 42 |
| 24/09/2023 | 18 | 26 |
| 25/09/2023 | 15 | 22 |
| 26/09/2023 | 10 | 15 |
| 27/09/2023 | 7 | 12 |
| 28/09/2023 | 10 | 14 |
| 29/09/2023 | 11 | 17 |
| 30/09/2023 | 12 | 18 |

3.4. Graphic Representations

Validated PM₁₀ data was used to construct the following monthly graphic representations.

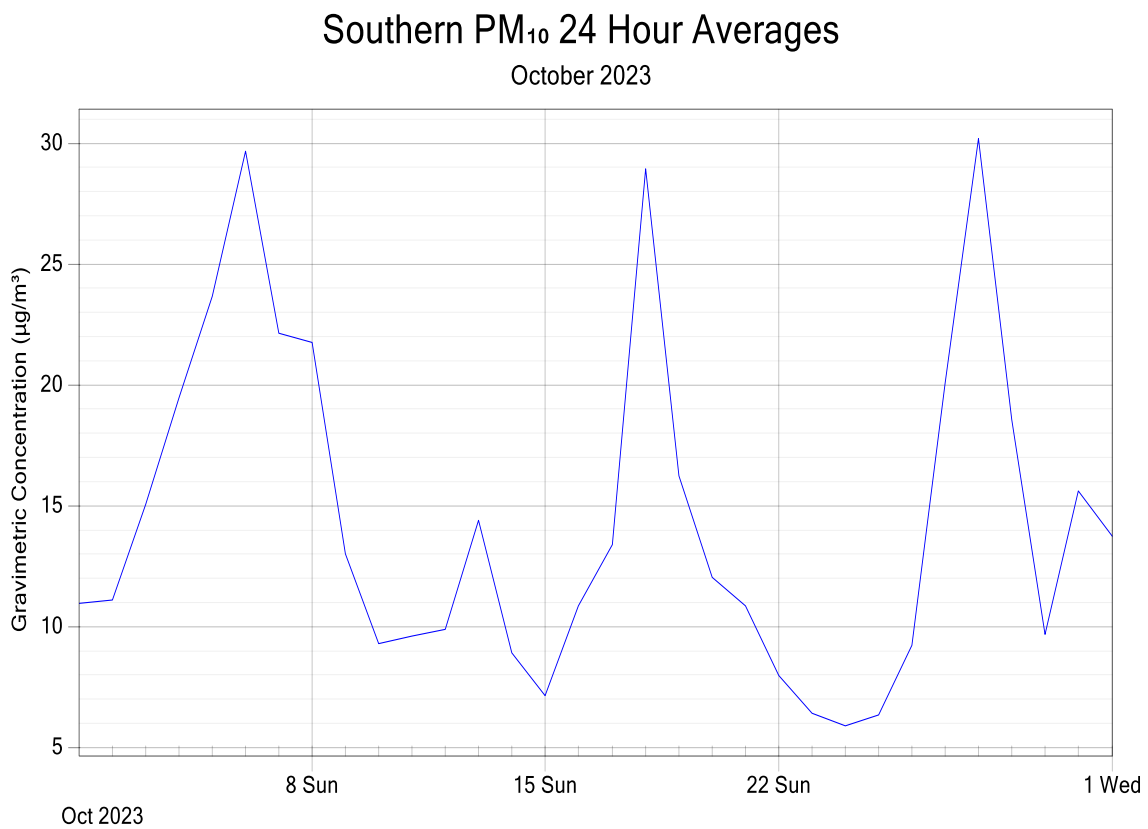


Figure 4: Southern station PM₁₀ 24 Hour Averages

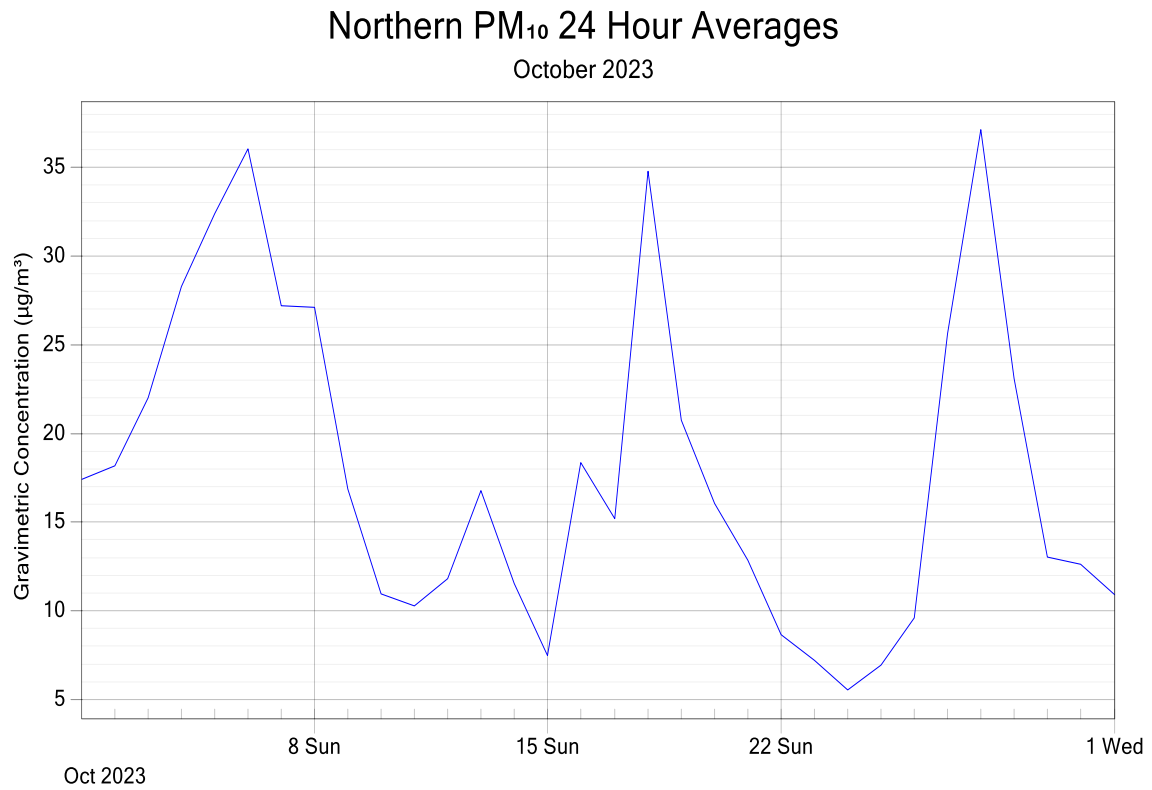


Figure 5: Northern station PM₁₀ 24 Hour Averages

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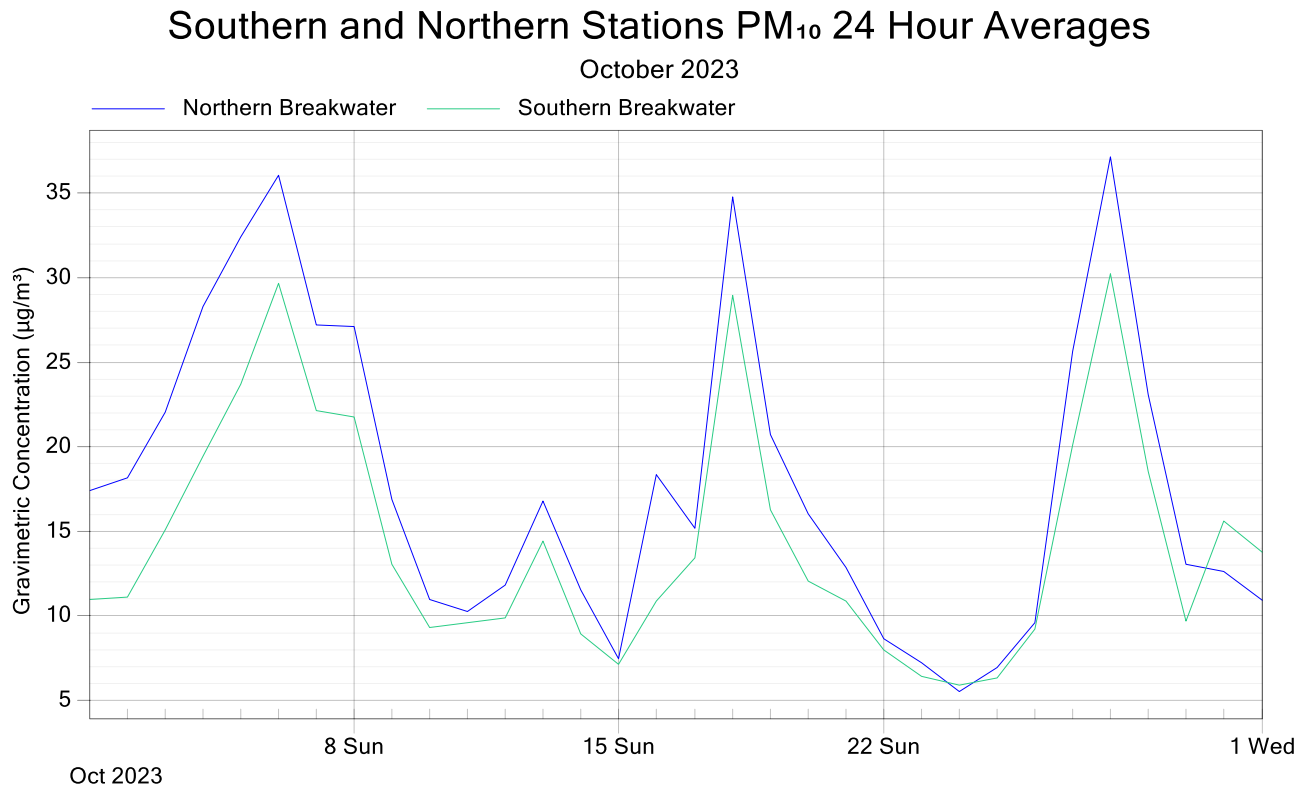


Figure 6: Southern and Northern Stations PM₁₀ 24 Hour Averages Comparison

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4.0 Valid Data Exception Tables

The tables below detail all changes made to the raw data set during the validation process. An explanation of reasons given in the table can be found in Appendix 2.

Table 10: Southern Station PM₁₀ Valid Data Exception Table

| Start Date | End Date | Reason | Change Details | User Name | Change Date |
|----------------|----------------|---------------------------------|------------------|-----------|-------------|
| 06/10/23 11:25 | 06/10/23 11:50 | Scheduled 2 monthly maintenance | PM ₁₀ | EQ | 28/11/23 |

Table 11: Northern Station PM₁₀ Valid Data Exception Table

| Start Date | End Date | Reason | Change Details | User Name | Change Date |
|----------------|----------------|---------------------------------|------------------|-----------|-------------|
| 06/10/23 10:50 | 06/10/23 11:10 | Scheduled 2 monthly maintenance | PM ₁₀ | EQ | 28/11/23 |

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5.0 Report Summary

- Data capture for Southern station was 99.9% and Northern station was 99.9%.
- The PM₁₀ monthly average for Southern station was 14 µg/m³ with a standard deviation of 9 µg/m³.
- The PM₁₀ monthly average for Northern station was 18 µg/m³ with a standard deviation of 18 µg/m³.

-----END OF REPORT-----

Appendix 1 - Definitions & Abbreviations

| | |
|--------------------------|---|
| $\mu\text{g}/\text{m}^3$ | Micrograms per cubic metre at standard temperature and pressure (0°C and 101.3 kPa) |
| PM ₁₀ | Particulates less than 10 microns equivalent in aerodynamic diameter |

Appendix 2 - Explanation of Exception Table

Commissioning refers to the initial setup and calibration of the instrument when it is first installed. For some instruments there may be a stabilisation period before normal operation commences.

Data transmission error refers to a period of time when the instrument could not transmit data. This may be due to interference, or a problem with the phone line or modem.

Equipment malfunction/instrument fault refers to a period of time when the instrument was not in the normal operating mode and did not measure a representative value of the existing conditions.

Gap in data/data not available refers to a period of time when either data has been lost or could not be collected.

Instrument Alarm refers to an alarm produced by the instrument. A range of alarms can be produced depending on how operation of the instrument is being affected.

Instrument out of service refers to a lack of data due to an instrument being shut down for repair, maintenance, or factory calibration.

Linear offset or multiplier refers to when an offset or multiplier has been applied between two points where the values of the offset or multiplier are different and the correction is interpolated between the two points.

Logger error refers to when an error occurs and instrument readings are not correctly recorded by the logger.

Maintenance refers to a period of time when the logger/instrument was switched off due to maintenance.

Power Interruption refers to no power to the station therefore no data was collected at this time.

Stabilisation following power interruption refers to the start-up period of an instrument after power has been restored.