

North Queensland Bulk Ports Corporation Mky

Southern and Northern Stations

Ambient Air Quality Monitoring

Validated Report

1st December – 31st December 2021

Report No.: DAT17927

Report issue date: 28th January 2022

Maintenance contract: MC950

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North Queensland Bulk Ports Corporation

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Revision	Report ID	Date	Analyst
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Executive Summary

North Queensland Bulk Ports Corporation has commissioned Ecotech P/L 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 during the month of December 2021.

Data capture for Northern station was 95.5% and Southern station was 92.8% for December 2021.

The PM₁₀ monthly average for Southern station was 10 µg/m³ with a standard deviation of 6 µg/m³.

The PM₁₀ monthly average for Northern station was 16 µg/m³ with a standard deviation of 12 µg/m³.

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1.0 Introduction

Ecotech Pty Ltd 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.

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

This report presents the data for the 1st – 31st December 2021

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 5.1.5) and stored at Ecotech'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 Ecotech 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. Ecotech 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 Ecotech 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 December 2021.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 Ecotech.

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.

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

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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Table 5: Southern and Northern Stations Maintenance Table December 2021

Station	Parameter	Date of Last Maintenance	Maintenance Type	Date of Last Calibration
Southern	PM ₁₀	01/12/2021	3-monthly	01/12/2021
Northern	PM ₁₀	01/12/2021	3-monthly	01/12/2021

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.

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Table 6 below displays data capture statistics for December 2021. **Bold** values in the table indicate data capture below 95%.

Table 6: Monthly Data Capture for Southern and Northern stations for December 2021

Station	Parameter	Data Capture (%)
Southern	PM ₁₀	92.8
Northern	PM ₁₀	95.5

3.2. Air Quality Summary

Table 7 below presents some statistical parameters for December 2021. The standard deviation is calculated based on the 5 minute averaged data.

Table 7: General statistics for December 2021

Station	Parameter	Time Period	Average ($\mu\text{g}/\text{m}^3$)	Standard Deviation ($\mu\text{g}/\text{m}^3$)
Southern	PM ₁₀	1 month	10	6
Northern	PM ₁₀	1 month	16	12

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3.2.1. Air Quality Index (AQI) Rating Assessment

The index value is the pollutant concentration expressed as a proportion of the pollutant goal concentration: dividing the pollutant concentration by the pollutant goal concentration and multiplying by 100. For Queensland, the 'pollutant goal concentration' used to calculate the index value is defined by the Air National Environment Protection Measure for Ambient Air Quality (Air NEPM) standard and it is equal to $50\mu\text{g}/\text{m}^3$ for PM_{10} . The air quality index comprises five colour-coded categories shown on the next table.³

Table 8: Colour-coded categories for Air Quality Index

Not available	Very good 0-33	Good 34-66	Fair 67-99	Poor 100-149	Very poor >150
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The PM_{10} 24 hour average values for the reporting month at the Northern and Southern stations were assessed against the Air Quality Index (AQI) Rating, and the pie chart on the next pages present the percentage of the days for which a specific air quality index category was identified.

³ <https://www.qld.gov.au/environment/pollution/monitoring/air-monitoring/air-quality-index/>

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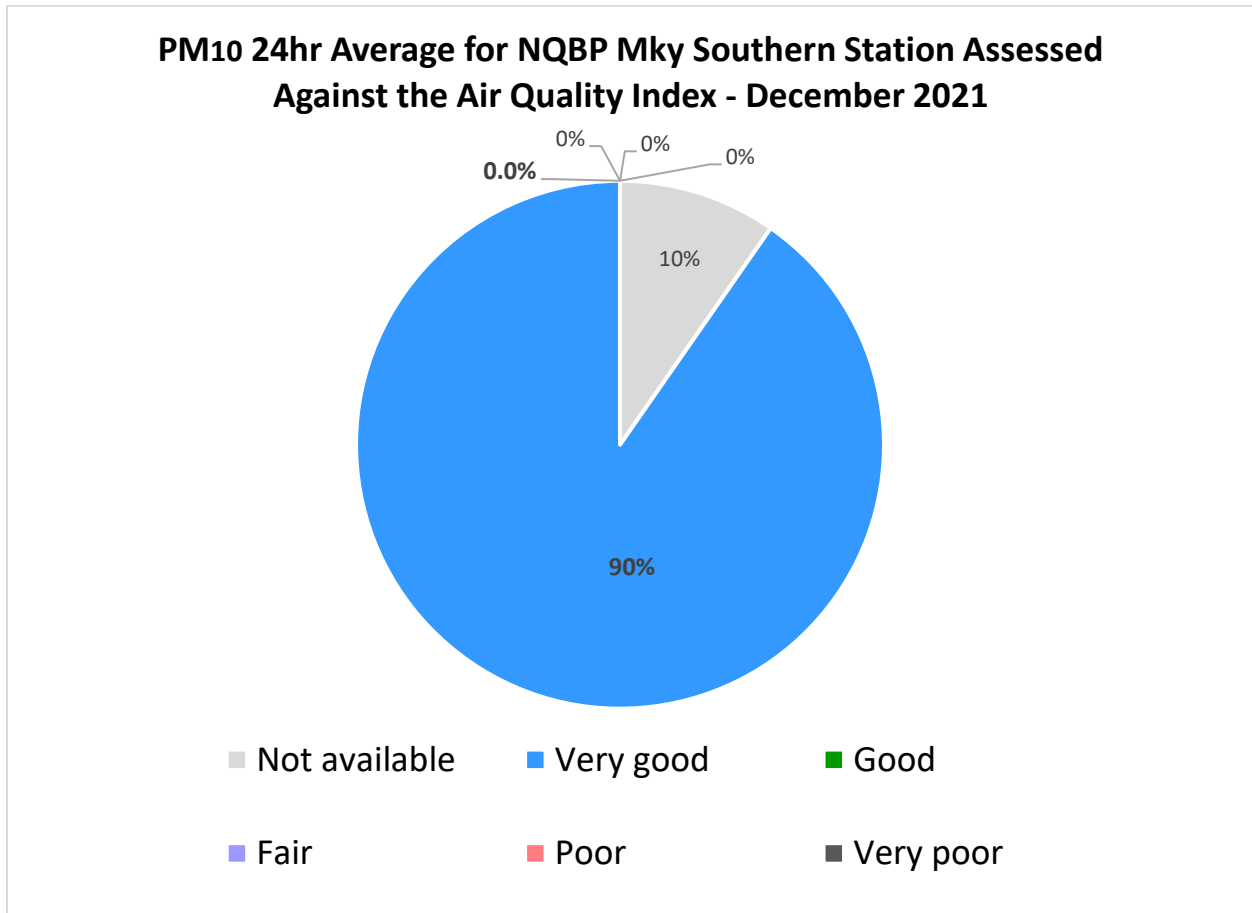


Figure 2: Daily PM₁₀ Averages for NQBP Mky Southern Station Assessed Against the Air Quality Index

90.0% of days during the reporting period presented by the Air Quality Index are classified as Very Good and 0.0% of days are classified as Good. 0.0% of days are classified as Fair, 0% of days are classified as Poor and Very Poor, 10.0% of days are classified as Not available.

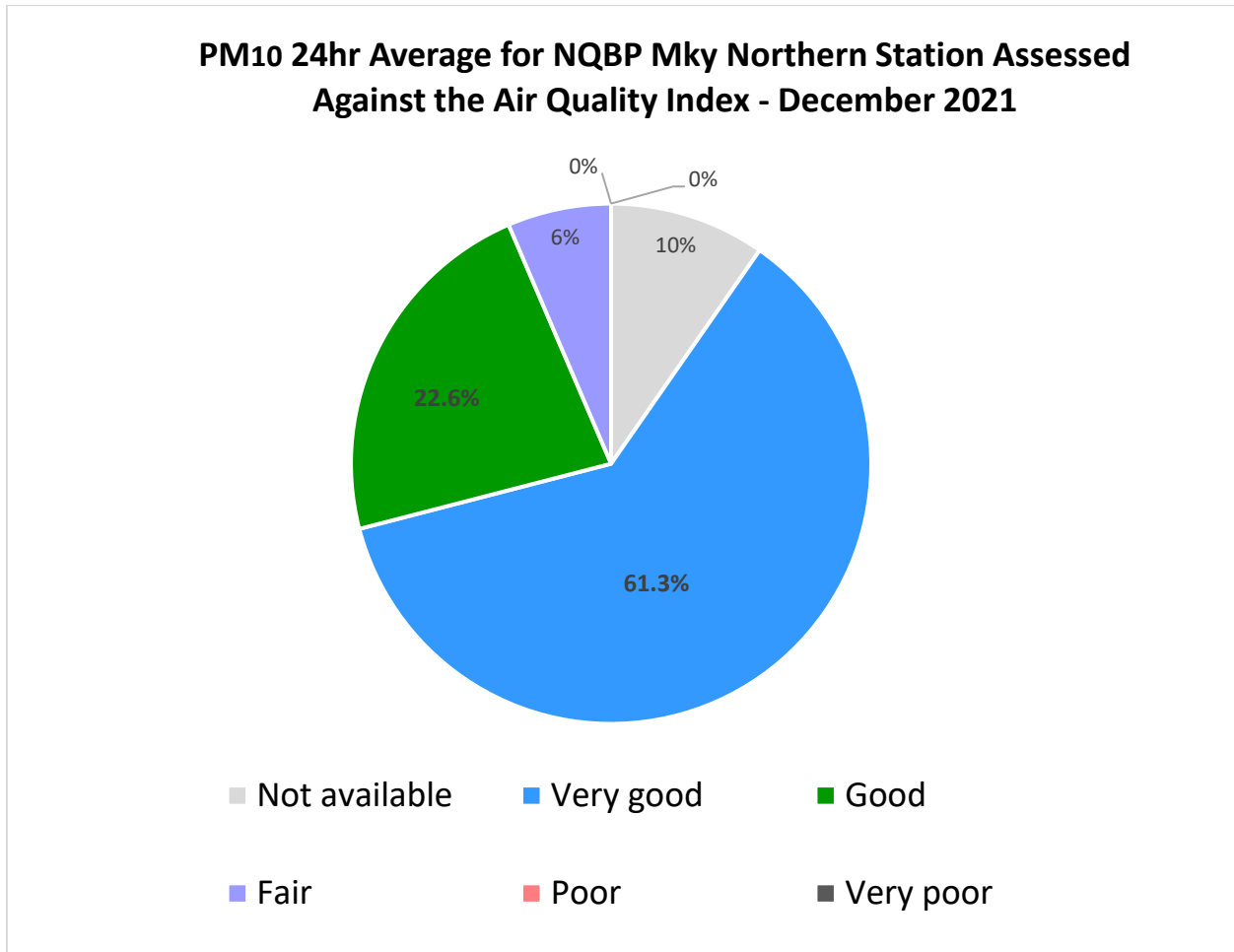


Figure 3: Daily PM₁₀ averages for NQBP Mky Northern Station Assessed Against the Air Quality Index

61.3% of days during the reporting period presented by the Air Quality Index are classified as Very Good and 22.6% of days are classified as Good. 6.0% of days are classified as Fair, 0% of days are classified as Poor and Very Poor, 10.0% of days 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 stations during December 2021.

Table 9: Southern and Northern Stations Data Table December 2021

Date	Southern (µg/m ³)	Northern (µg/m ³)
1/12/2021	10	14
2/12/2021	7	11
3/12/2021	7	9
4/12/2021	8	13
5/12/2021	10	13
6/12/2021	9	13
7/12/2021	10	13
8/12/2021	11	13
9/12/2021	10	10
10/12/2021	7	11
11/12/2021	9	
12/12/2021	13	21
13/12/2021	16	32
14/12/2021	13	
15/12/2021	11	18
16/12/2021	10	15
17/12/2021	11	
18/12/2021	12	18
19/12/2021	12	18
20/12/2021	12	18
21/12/2021	12	16
22/12/2021	7	10
23/12/2021	11	14
24/12/2021	9	9
25/12/2021	5	7
26/12/2021	6	7
27/12/2021	4	4
28/12/2021	6	7
29/12/2021		38
30/12/2021		44
31/12/2021		21

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3.4. Graphic Representations

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

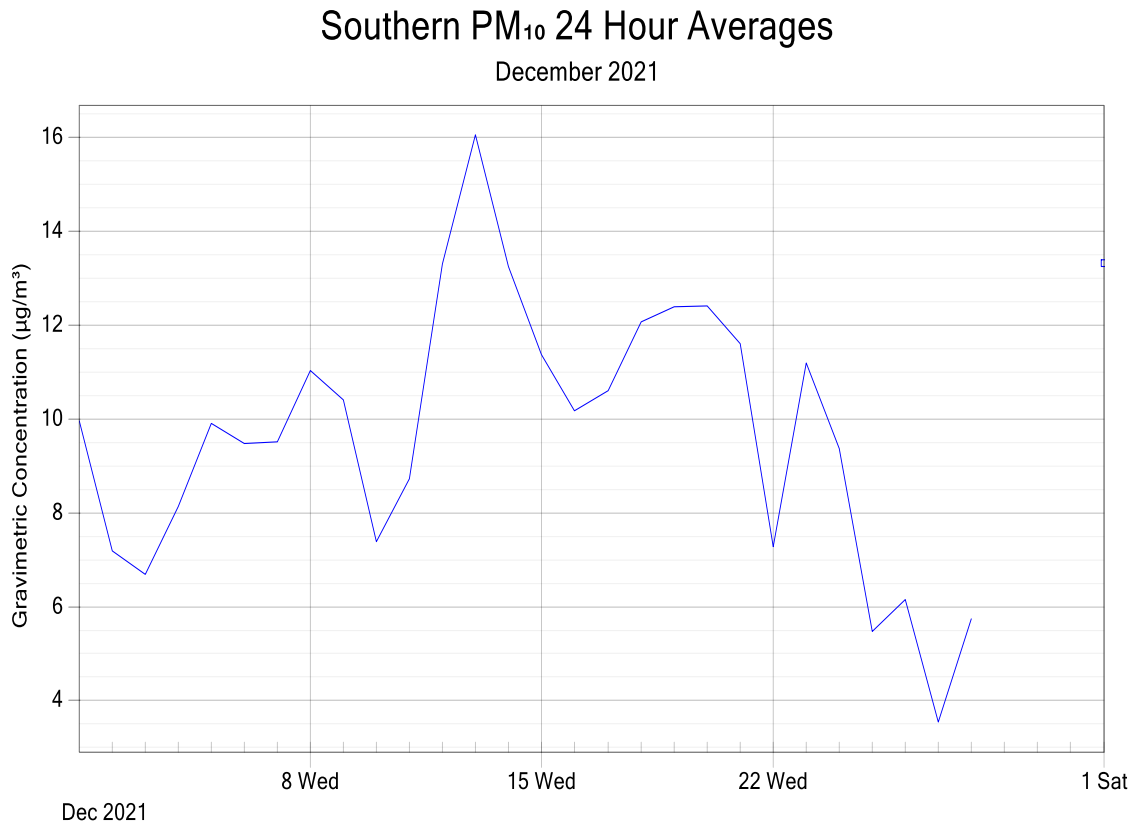


Figure 4: Southern station PM₁₀ 24 Hour Averages December 2021

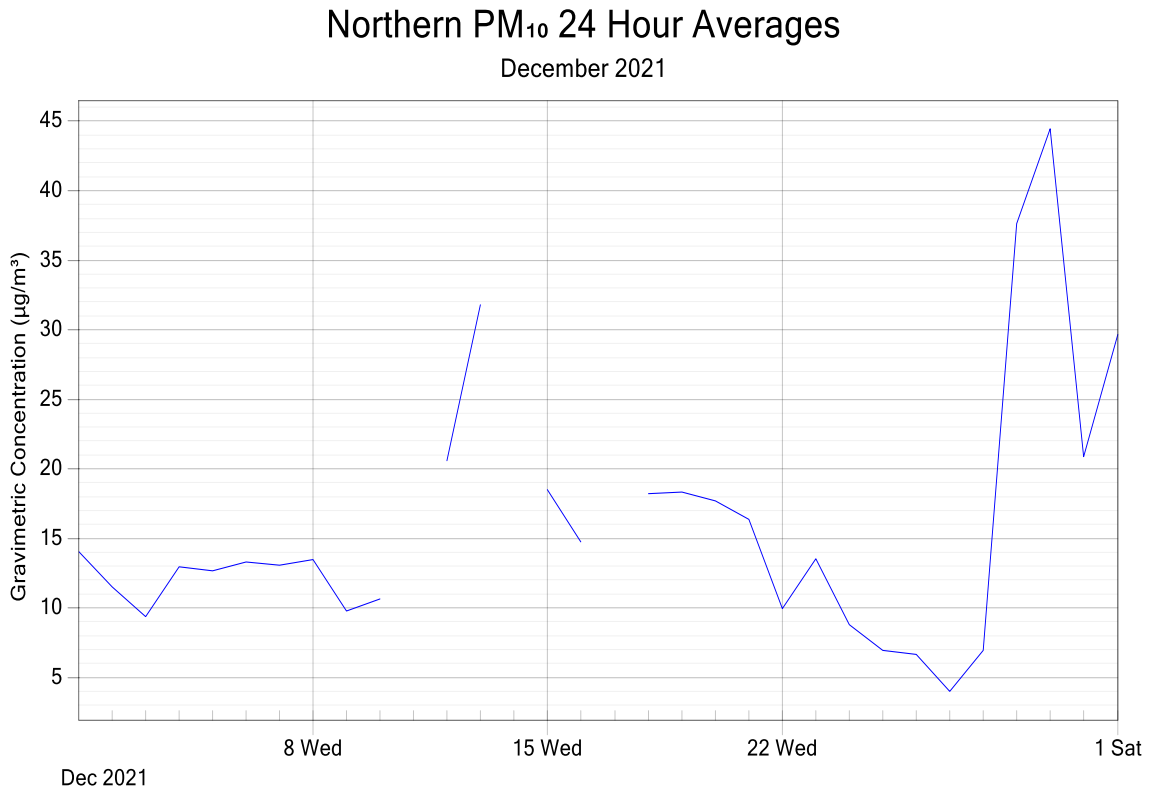


Figure 5: Northern station PM₁₀ 24 Hour Averages December 2021

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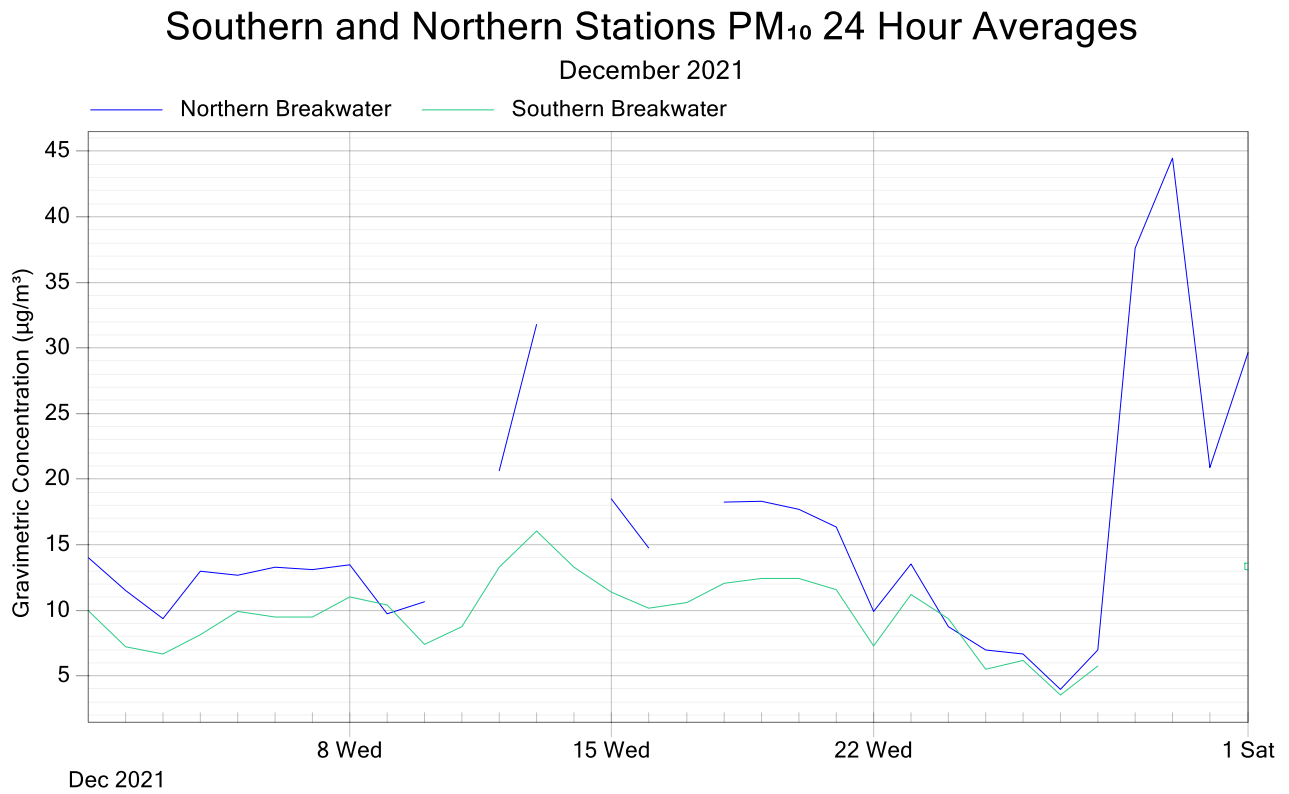


Figure 6: Southern and Northern Stations PM₁₀ 24 Hour Averages Comparison December 2021

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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
01-12-21 07:40	01-12-21 07:55	Scheduled 3-monthly maintenance	PM ₁₀	AS	18-01-22
29-12-21 03:55	31-12-21 08:50	Power interruption and instrument stabilisation due to overcast condition	PM ₁₀	AS	18-01-22

Table 11: Northern Station PM₁₀ Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
01-12-21 07:00	01-12-21 07:25	Scheduled 3-monthly maintenance	PM ₁₀	AS	18-01-22
11-12-21 01:45	17-12-21 11:25	Intermittent power interruption and instrument stabilisation due to low battery voltage	PM ₁₀	AS	18-01-22

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5.0 Report Summary

- Data capture for Northern station was 95.5% and Southern station was 92.8% for December 2021.
- The PM₁₀ monthly average for Southern station was 10 µg/m³ with a standard deviation of 6 µg/m³.
- The PM₁₀ monthly average for Northern station was 16 µg/m³ with a standard deviation of 12 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 startup period of an instrument after power has been restored.