

North Queensland Bulk Ports Corporation Mky

Southern and Northern Stations

Ambient Air Quality Monitoring

Validated Report

1st December – 31st December 2023

Report No.: DAT20690- Revision 2

Report issue date: 8th February 2024

Maintenance contract: MC950

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North Queensland Bulk Ports Corporation

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Revision History			
Revision	Report ID	Date	Analyst
0	DAT20690	25/01/2024	Amin Nikpay
1	DAT20690	05/02/2024	Amin Nikpay
2	DAT20690	08/02/2024	Amin Nikpay

*Note: Please see Appendix 3 for details of amendments.

Report by: Amin Nikpay



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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 88.2% and Northern station was 99.9%.

The PM₁₀ monthly average for Southern station was 18 µg/m³ with a standard deviation of 13 µg/m³.

The PM₁₀ monthly average for Northern station was 21 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 5.2.4) 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 December 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 Uncertainties¹

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.²

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 08/12/2023. Checks were performed on E-Sampler.

2.5.3.2. NQBP Mky Southern

- Scheduled yearly maintenance was performed on 08/12/2023. 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	08/12/2023	Yearly	08/12/2023
Northern	PM ₁₀	08/12/2023	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 December 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	88.2
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	18	13
Northern	PM ₁₀	1 month	21	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' (Blue), 'Fair' (Green), 'Poor' (Purple), 'Very Poor' (Red) or 'Extremely Poor' (Black). Values greater than the air quality guideline will be appear as 'Poor', 'Very Poor' or 'Extremely Poor'.

The Air Quality Categories rating is based on 1-hour averages values.³

Table 8: Colour-coded Categories for Air Quality Categories⁴

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

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

⁴ Colour scheme and pie chart type has been changed to reflect the website of North Queensland Bulk Ports Corporation.

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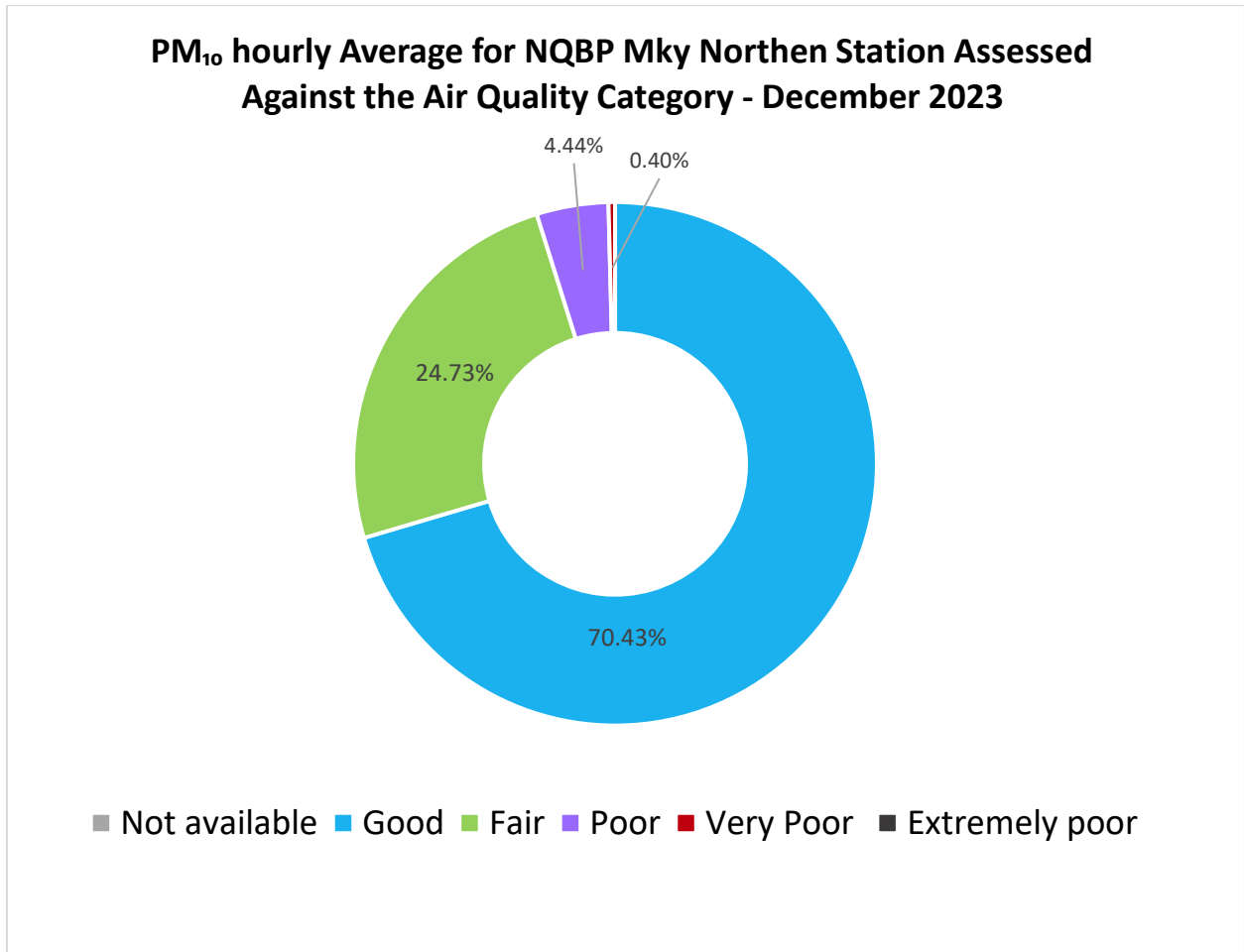


Figure 2: Hourly PM₁₀ Averages for NQBP Mky Northern Station Assessed Against the Air Quality Category

70.43% of time during the reporting period presented by the Air Quality Category are classified as Good, 24.73% time are classified as Fair, 4.44% of time are classified as Poor, 0.40% 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.

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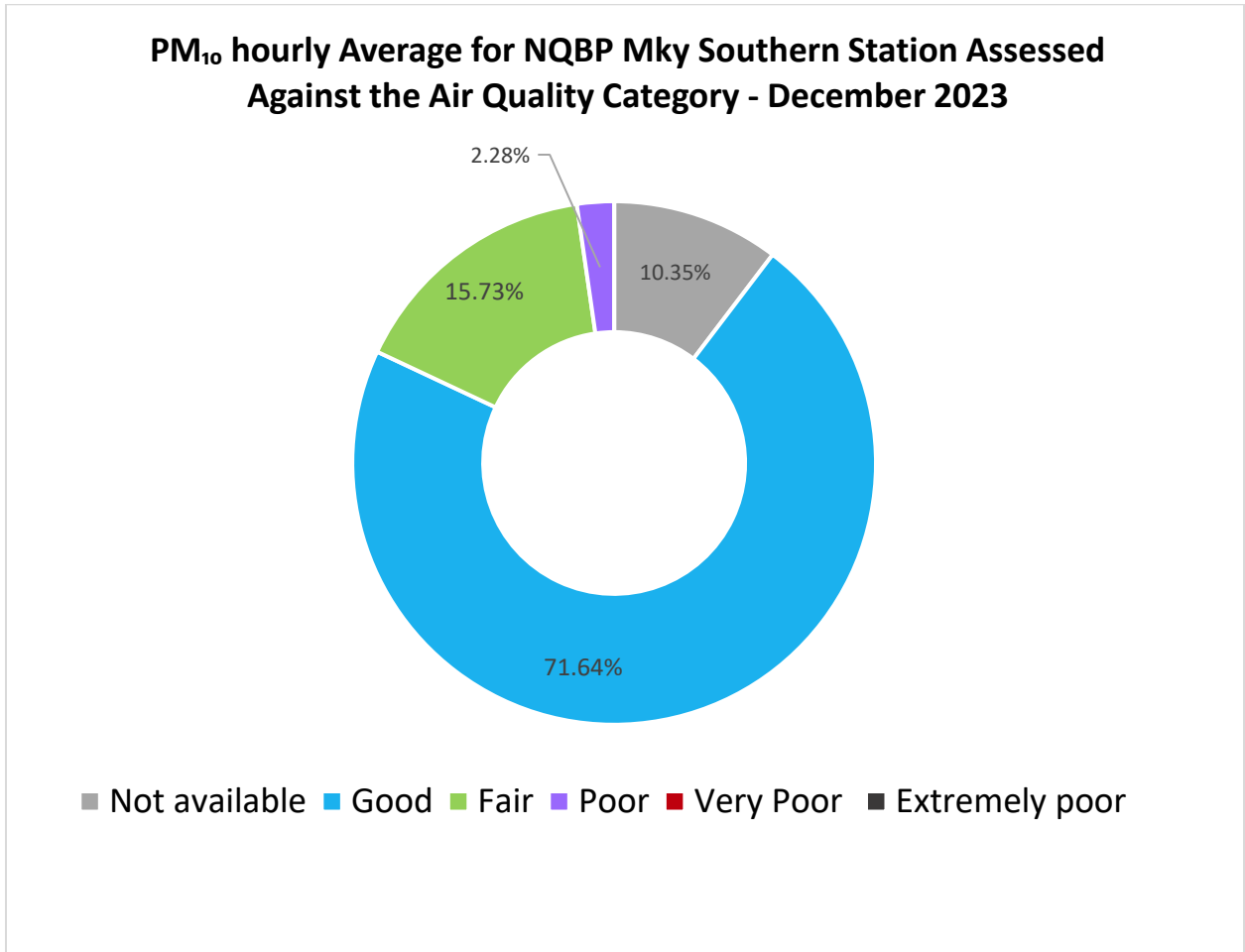


Figure 3: Hourly PM₁₀ averages for NQBP Mky Southern Station Assessed Against the Air Quality Category

71.64% of time during the reporting period presented by the Air Quality Category are classified as Good, 15.73% of time are classified as Fair, 2.28% 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 10.35% 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 (µg/m ³)	Northern (µg/m ³)
1/12/2023	14	20
2/12/2023	12	14
3/12/2023	9	11
4/12/2023	14	23
5/12/2023	17	28
6/12/2023	13	22
7/12/2023	12	25
8/12/2023	15	28
9/12/2023	21	28
10/12/2023	37	37
11/12/2023	39	45
12/12/2023	45	53
13/12/2023	31	44
14/12/2023	34	32
15/12/2023	34	28
16/12/2023	17	19
17/12/2023		16
18/12/2023	9	11
19/12/2023		12
20/12/2023	11	15
21/12/2023	10	14
22/12/2023	11	11
23/12/2023		12
24/12/2023	9	10
25/12/2023		20
26/12/2023		11
27/12/2023	10	10
28/12/2023	12	12
29/12/2023	8	8
30/12/2023	14	13
31/12/2023	20	27

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3.4. Graphic Representations

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

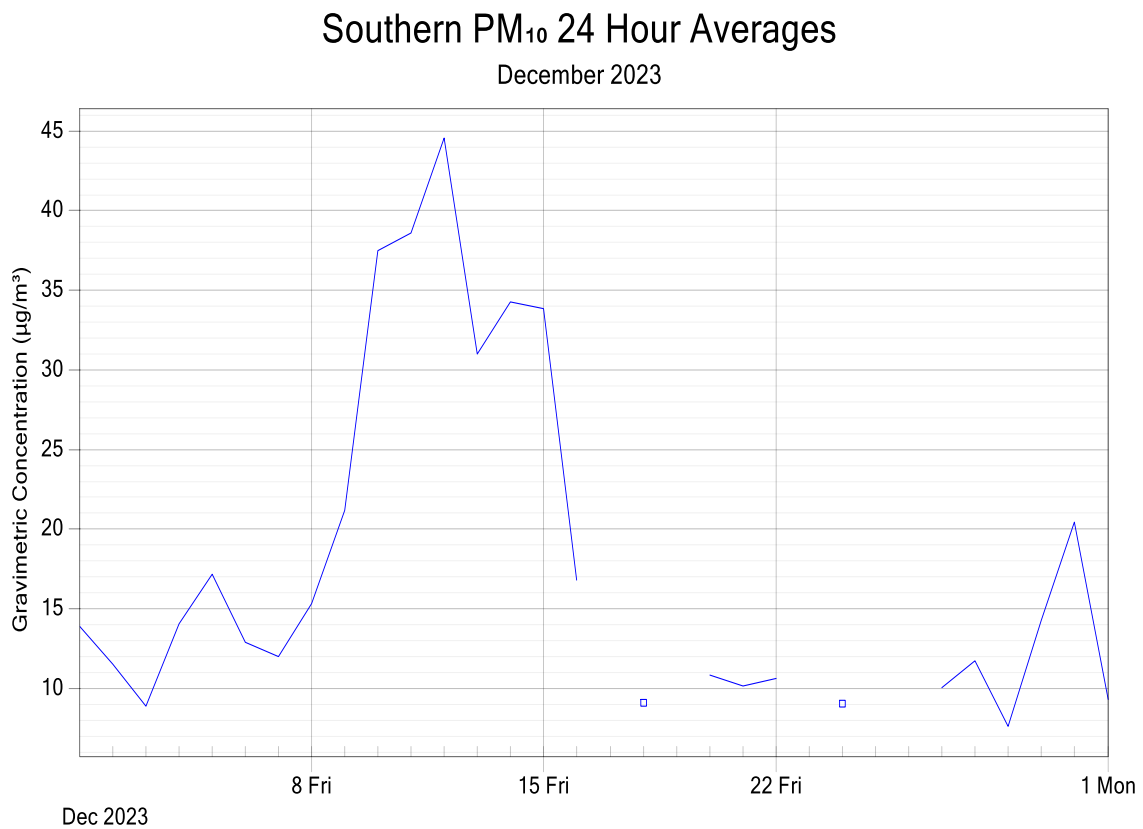


Figure 4: Southern station PM₁₀ 24 Hour Averages

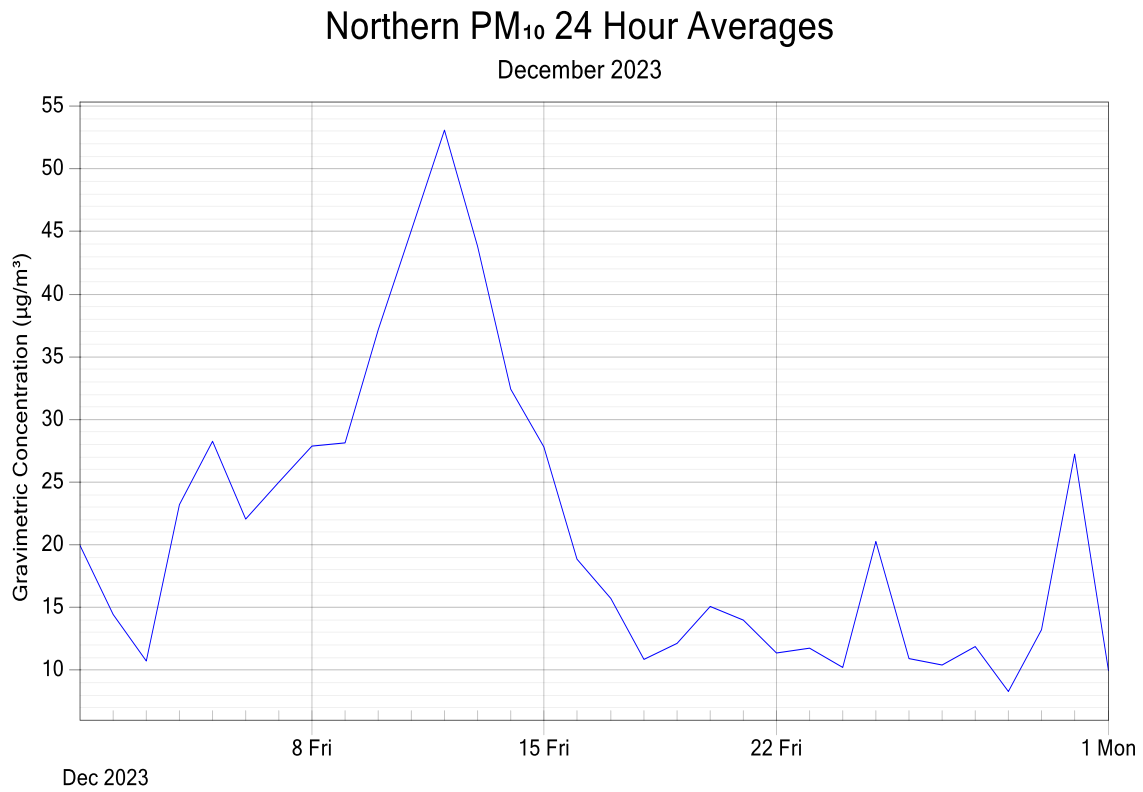


Figure 5: Northern station PM₁₀ 24 Hour Averages

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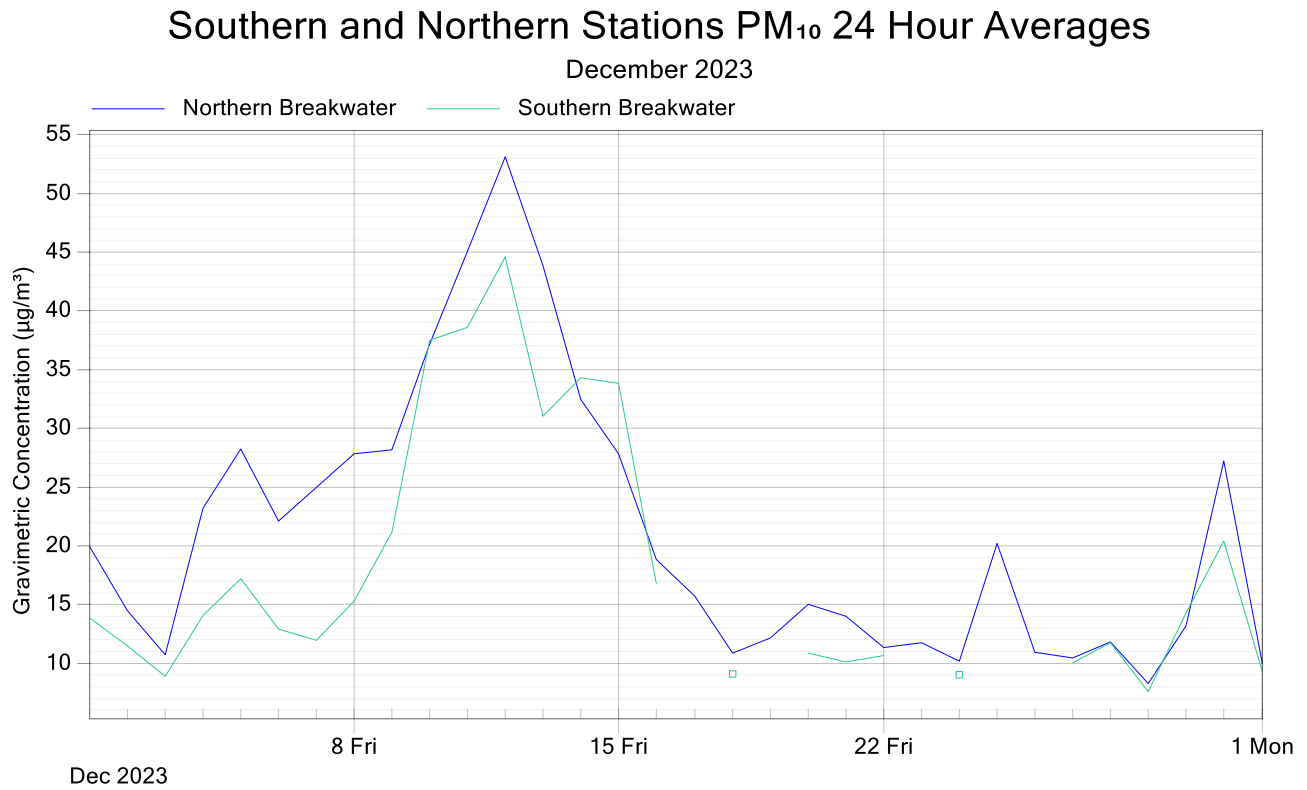


Figure 6: Southern and Northern Stations PM₁₀ 24 Hour Averages Comparison

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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
08/12/23 09:25	08/12/23 10:20	Yearly maintenance (New pump and filter installation, Leak check, Ambient temperature, and Pressure calibration)	PM ₁₀	AN	25/01/24
16/12/23 22:55	31/12/23 08:35	Intermittent power interruptions followed by instrument stabilisation	PM ₁₀	AN	25/01/24

Table 11: Northern Station PM₁₀ Valid Data Exception Table

Start Date	End Date	Reason	Change Details	User Name	Change Date
08/12/23 08:50	08/12/23 09:10	2 monthly maintenances (Leak check, flow, Ambient temperature, and Pressure audit)	PM ₁₀	AN	25/01/24

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5.0 Report Summary

- Data capture for Southern station was 88.2% and Northern station was 99.9%.
- The PM₁₀ monthly average for Southern station was 18 µg/m³ with a standard deviation of 13 µg/m³.
- The PM₁₀ monthly average for Northern station was 21 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

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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.

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Appendix 3 – Amendment

This report supersedes DAT20690 Revision 1 issued on 5th February 2024. The following changes have been made:

- The description of the colour scheme representing air quality categories in section 3.2.1 has been updated to align with the North Queensland Bulk Ports Corporation website.