



White Bay Cruise Terminal

Air Quality and Meteorological Monitoring
Report – April 2021

21 May 2021

Project No.: 0429140

Document details	The details entered below are automatically shown on the cover and the main page footer. PLEASE NOTE: This table must NOT be removed from this document.
Document title	White Bay Cruise Terminal
Document subtitle	Air Quality and Meteorological Monitoring Report – April 2021
Project No.	0429140
Date	21 May 2021
Version	1.0
Author	Angel Sanz
Client Name	NSW Port Authority

Document history

Version	Revision	Author	Reviewed by	ERM approval to issue		Comments
				Name	Date	
Draft	01	Angel Sanz	James Grieve	Peter Taylor Jane Barnett	20.05.2021	Draft Report
Final	01	Angel Sanz	James Grieve	Peter Taylor Jane Barnett	21.05.2021	Final Report

Signature Page

21 May 2021

White Bay Cruise Terminal

Air Quality and Meteorological Monitoring Report – April 2021



Peter Taylor
Project Manager



Jane Barnett
Partner

ERM Australia Pacific Pty Ltd
Level 15 309 Kent Street
Sydney NSW 2000

© Copyright 2021 by ERM Worldwide Group Ltd and / or its affiliates ("ERM").
All rights reserved. No part of this work June be reproduced or transmitted in any form,
or by any means, without the prior written permission of ERM.

DISCLAIMER

ERM acts in all professional matters as a faithful advisor to the Client and exercises all reasonable skill and care in the provision of its professional services. Reports are commissioned by and prepared for the exclusive use of the Client. They are subject to and issued in accordance with the agreement between the Client and ERM. ERM is not responsible for any liability and accepts no responsibility whatsoever arising from the misapplication or misinterpretation by third parties of the contents of its reports. Except where expressly stated, ERM does not attempt to verify the accuracy, validity or comprehensiveness of any information supplied to ERM for its reports.

Reports cannot be copied or reproduced in whole or part for any purpose without the prior written agreement of ERM. Where site inspections, testing or fieldwork have taken place, the report is based on the information made available by the client or their nominees during the visit, visual observations and any subsequent discussions with regulatory authorities. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to ERM is both complete and accurate. It is further assumed that normal activities were being undertaken at the site on the day of the site visit(s), unless explicitly stated otherwise.

CONTENTS

1.	INTRODUCTION	1
2.	AIR QUALITY DATA	2
2.1	Cruise Ship Days	2
2.2	10-minute Average Sulfur Dioxide Concentrations	2
2.3	1-hour Average Sulfur Dioxide Concentrations	3
2.4	24-hour Average Sulfur Dioxide Concentrations	3
2.5	24-hour Average PM _{2.5} Concentrations	5
2.6	Summary Statistics	8
3.	METEOROLOGICAL DATA	9
4.	DATA AVAILABILITY	10
5.	REFERENCES	11

List of Tables

Table 2-1: Summary statistics for SO ₂ and PM _{2.5} concentrations at WBCT (µg/m ³)	8
Table 4-1: Data availability and summary statistics for SO ₂ and PM _{2.5}	10

List of Figures

Figure 2-1: 10-minute average SO ₂ concentrations	2
Figure 2-2: 1-hour average SO ₂ concentrations	3
Figure 2-3: 24-hour average SO ₂ concentrations at WBCT and DPIE monitoring sites	4
Figure 2-4: 24-hour average PM _{2.5} concentration at WBCT and DPIE monitoring sites	6
Figure 3-1: Wind rose for the reporting period	9
Figure 4-1: Output summary and data distribution	10

1. INTRODUCTION

The Port Authority of New South Wales (NSW) has committed to undertaking air quality monitoring in the residential area adjacent to the White Bay Cruise Terminal (WBCT). This report presents a summary of monitoring data collected during April 2021.

For additional detail regarding the history of the monitoring program, the methodology, monitoring station equipment and technology, please refer to any of the monthly reports prior to February 2018.

2. AIR QUALITY DATA

The monitoring results are presented below with comparison to the ambient air quality criteria for SO₂ and PM_{2.5} provided in *The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2017). The relevant averaging periods are 10 minutes, 1 hour and 24 hours for SO₂, and 24 hours for PM_{2.5}.

The 24-hour average SO₂ and PM_{2.5} concentrations are also compared with the data from several NSW Department of Planning, Industry and Environment (DPIE) monitoring sites, formerly known as Office of Environment and Heritage (OEH).

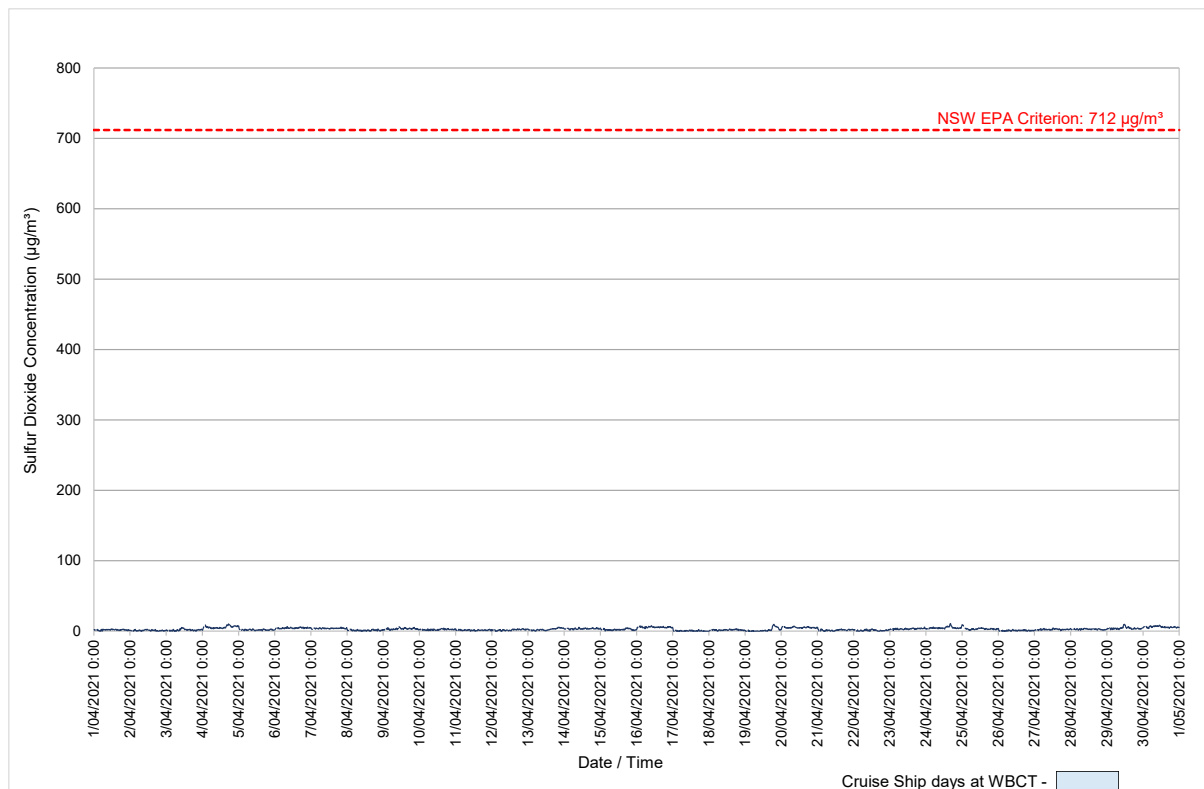
2.1 Cruise Ship Days

There were no cruise ships berthed during the month of April 2021 due to the COVID-19 restrictions.

2.2 10-minute Average Sulfur Dioxide Concentrations

A time-series plot of 10-minute average SO₂ concentrations for April is provided in Figure 2-1. No exceedances of the 10-minute average air quality criterion for SO₂ were recorded during the reporting period.

The highest 10-minute average SO₂ concentration (11 µg/m³) was recorded on 24 April at 4:20 pm. This concentration is approximately 2% of the NSW Environmental Protection Authority (EPA) criterion.

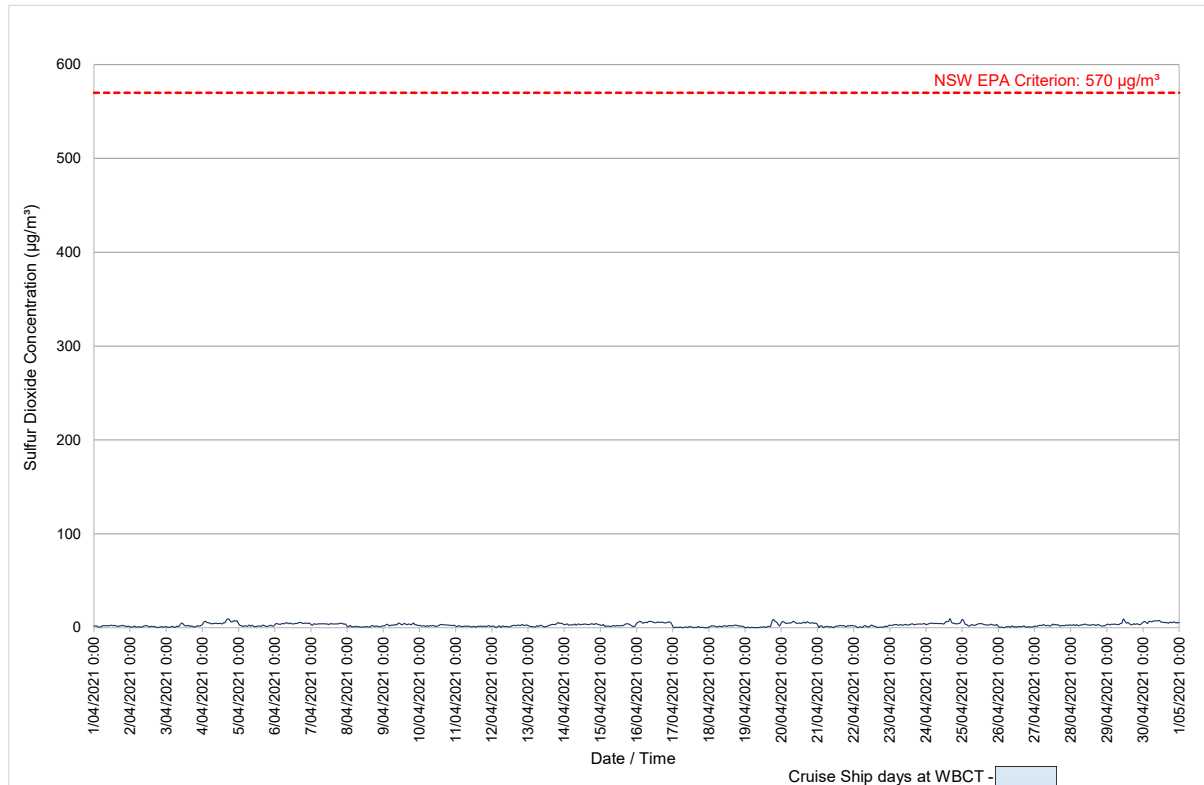


Note: Blue shading indicates cruise ship days, not arrival and departure times. Arrival and departure times are provided in Table 2.1.

Figure 2-1: 10-minute average SO₂ concentrations

2.3 1-hour Average Sulfur Dioxide Concentrations

A time series plot of the 1-hour average SO₂ concentration for April is shown in Figure 2-2. No exceedances of the 1-hour SO₂ criterion were recorded during the reporting period. The highest 1-hour average SO₂ concentration (9 µg/m³) was recorded on 24 April at 4 pm. This concentration is approximately 2% of the NSW EPA criterion.



Note: Blue shading indicates cruise ship days, not arrival and departure times. Arrival and departure times are provided in Table 2.1.

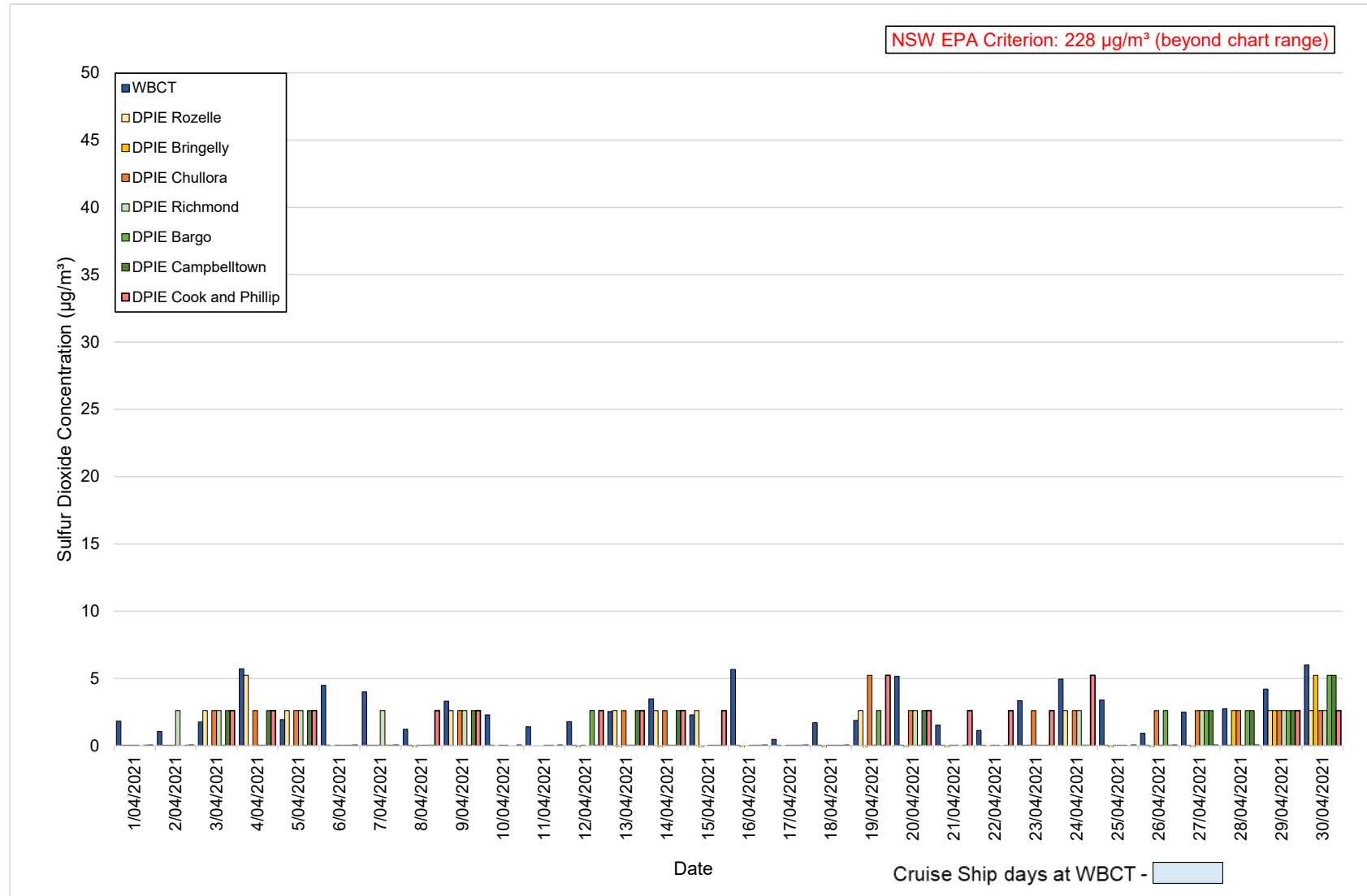
Figure 2-2: 1-hour average SO₂ concentrations

2.4 24-hour Average Sulfur Dioxide Concentrations

Time-series plots of 24-hour average SO₂ concentrations at WBCT and selected NSW DPIE urban background sites in Sydney are shown in Figure 2-3.

The selected DPIE monitoring sites that measure SO₂ include Rozelle, Bringelly, Chullora, Richmond, Bargo, Campbelltown and Cook and Phillip Park (Sydney CBD). 24-hour average SO₂ concentrations measured at White Bay are within the EPA criterion and are shown against those measured by DPIE stations in the region.

The highest 24-hour average SO₂ concentration (6 µg/m³) was recorded on 30 April.



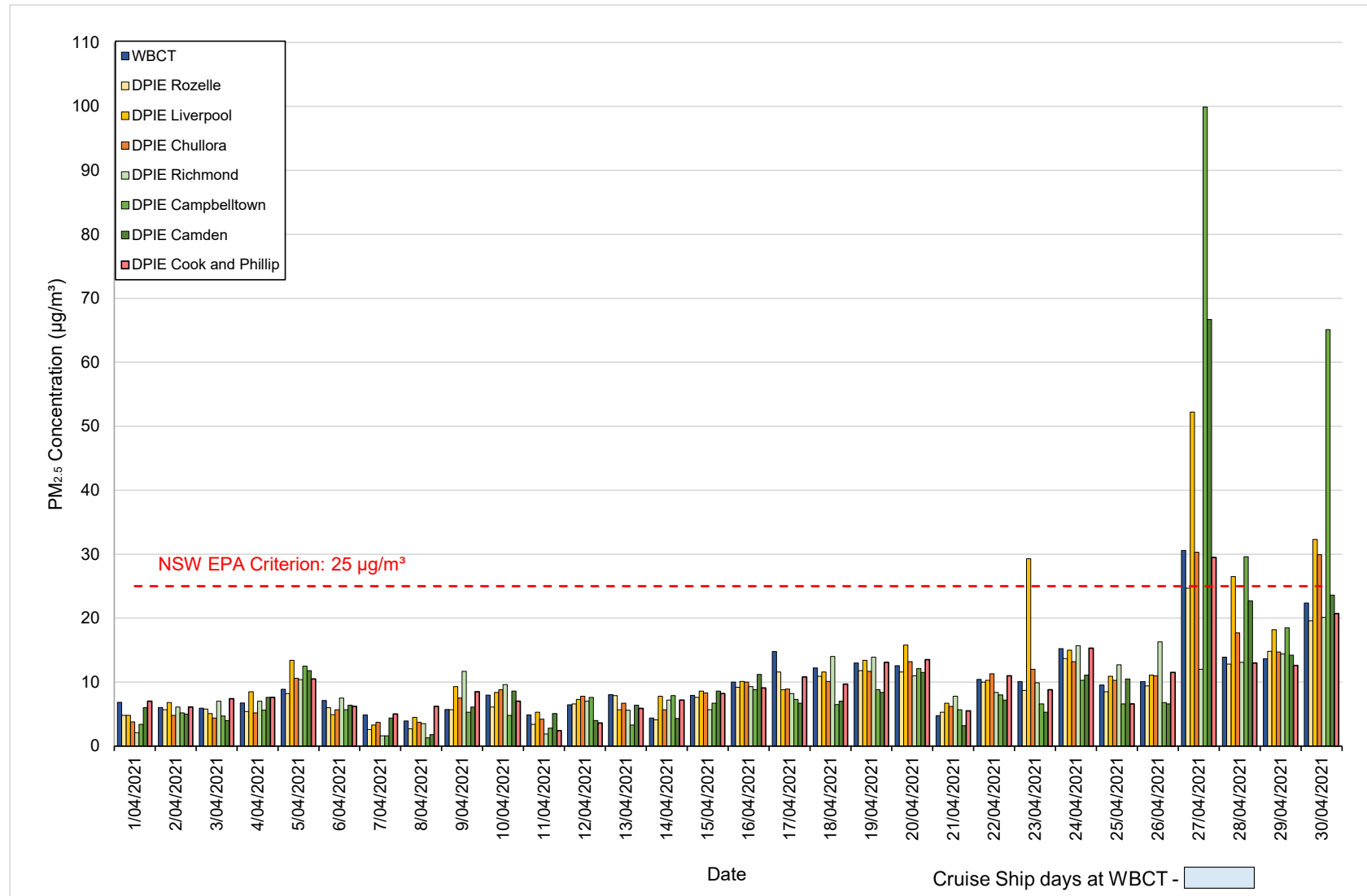
Note: Blue shading indicates cruise ship days, not arrival and departure times. Arrival and departure times are provided in Table 2.1. Zero data are graphed with a minor accentuation for visual purposes.

Figure 2-3: 24-hour average SO₂ concentrations at WBCT and DPIP monitoring sites

2.5 24-hour Average PM_{2.5} Concentrations

Time-series plots of 24-hour average PM_{2.5} concentrations at WBCT and selected DPIE monitoring sites are shown in Figure 2-4.

Of the DPIE sites in Sydney, PM_{2.5} is measured at a range of locations, including Rozelle, Liverpool, Chullora, Richmond, Campbelltown, Camden and Cook and Phillip.



Note: Blue shading indicates cruise ship days, not arrival and departure times. Arrival and departure times are provided in Table 2.1.

Figure 2-4: 24-hour average PM_{2.5} concentration at WBCT and DPIP monitoring sites

There was an exceedance of the NSW EPA 24-hour PM_{2.5} criterion (25 µg/m³) at WBCT on 27 April (30.6 µg/m³) due to hazard reduction burns within the region.

As shown in the Figure 2-4, measurements were generally consistent with DPIE stations elsewhere within the region over this period. A review of satellite imagery shows the presence of bushfire smoke on that date¹.

¹ [https://worldview.earthdata.nasa.gov/?v=150.45619875109455_-34.71604704318642,151.7523494134539_-34.061896005776944&l=MODIS_Aqua_Thermal_Anomalies_All,MODIS_Aqua_Thermal_Anomalies_Night,MODIS_Aqua_Thermal_Anomalies_Day,Reference_Labels_15m\(hidden\),Reference_Features_15m\(hidden\),Coastlines_15m,VIIIRS_SNPP_CorrectedReflectance_TrueColor\(hidden\),MODIS_Aqua_CorrectedReflectance_TrueColor\(hidden\),MODIS_Terra_CorrectedReflectance_TrueColor&lg=false&t=2021-04-27-T02%3A40%3A51Z](https://worldview.earthdata.nasa.gov/?v=150.45619875109455_-34.71604704318642,151.7523494134539_-34.061896005776944&l=MODIS_Aqua_Thermal_Anomalies_All,MODIS_Aqua_Thermal_Anomalies_Night,MODIS_Aqua_Thermal_Anomalies_Day,Reference_Labels_15m(hidden),Reference_Features_15m(hidden),Coastlines_15m,VIIIRS_SNPP_CorrectedReflectance_TrueColor(hidden),MODIS_Aqua_CorrectedReflectance_TrueColor(hidden),MODIS_Terra_CorrectedReflectance_TrueColor&lg=false&t=2021-04-27-T02%3A40%3A51Z)

2.6 Summary Statistics

Summary statistics for the SO₂ and PM_{2.5} concentrations at WBCT are shown in Table 2-1.

Table 2-1: Summary statistics for SO₂ and PM_{2.5} concentrations at WBCT (µg/m³)

Pollutant:	SO ₂			PM _{2.5}
Averaging period:	10 minute	1 hour	24 hour	24 hour
Criterion:	712	570	228	25
Mean	3	3	3	10
Median	2	2	2	8
Standard deviation	2	2	2	6
Sample variance	4	3	2	31
Range	11	9	6	27
Minimum	0	0	0	4
Maximum	11	9	6	31
Maximum (cruise ship day)	N/A	N/A	N/A	N/A

Note: N/A – Not Applicable due to the absence of cruise ships during the month of April.

3. METEOROLOGICAL DATA

A wind rose showing the frequency of counts by wind direction for the reporting period is shown in Figure 3-1. Guidance on the interpretation of wind roses is provided in the monthly reports prior to March 2018.

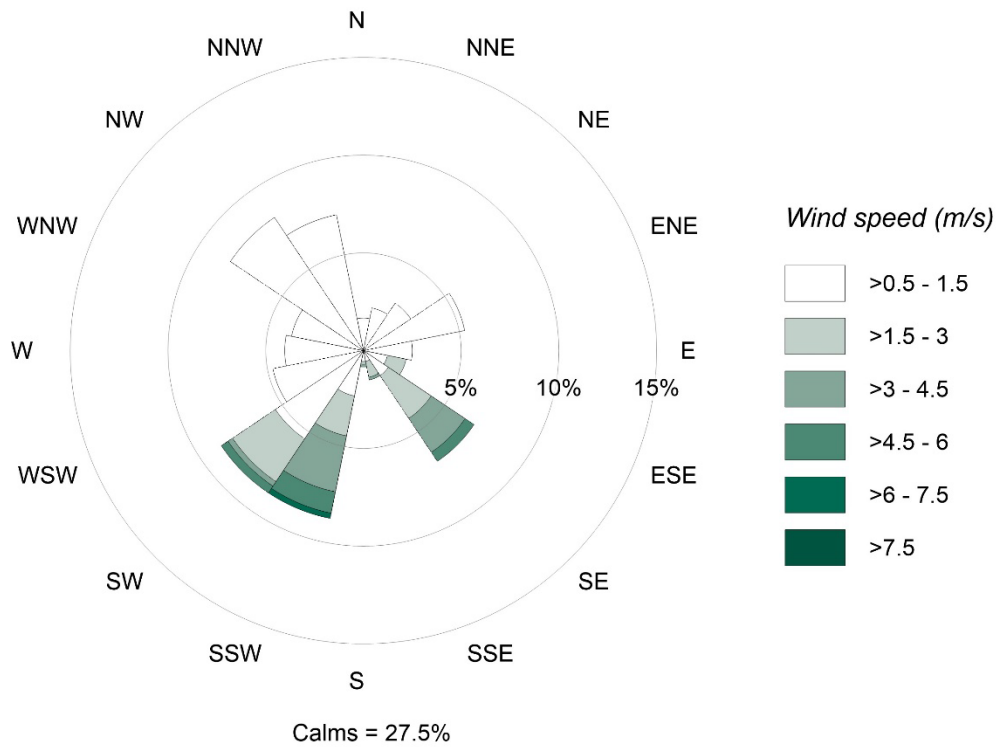


Figure 3-1: Wind rose for the reporting period

4. DATA AVAILABILITY

Data availability for SO₂ and PM_{2.5} during the reporting period, based on the 5-minute average values, is shown in Table 4-1. An output summary and data distribution for 5-minute values of wind speed (m/s), wind direction, SO₂ (µg/m³) and PM_{2.5} (µg/m³) concentrations are shown in Figure 4-1. Blue bars below each parameter represent captured data and the red bars represent missing data.

Table 4-1: Data availability and summary statistics for SO₂ and PM_{2.5}

Statistic	SO ₂ (5-minute)	PM _{2.5} (1-hour)
Possible values	8,280	720
Missing values	394	25
Availability (%)	95	100
95 th percentile (µg/m ³)	6	22

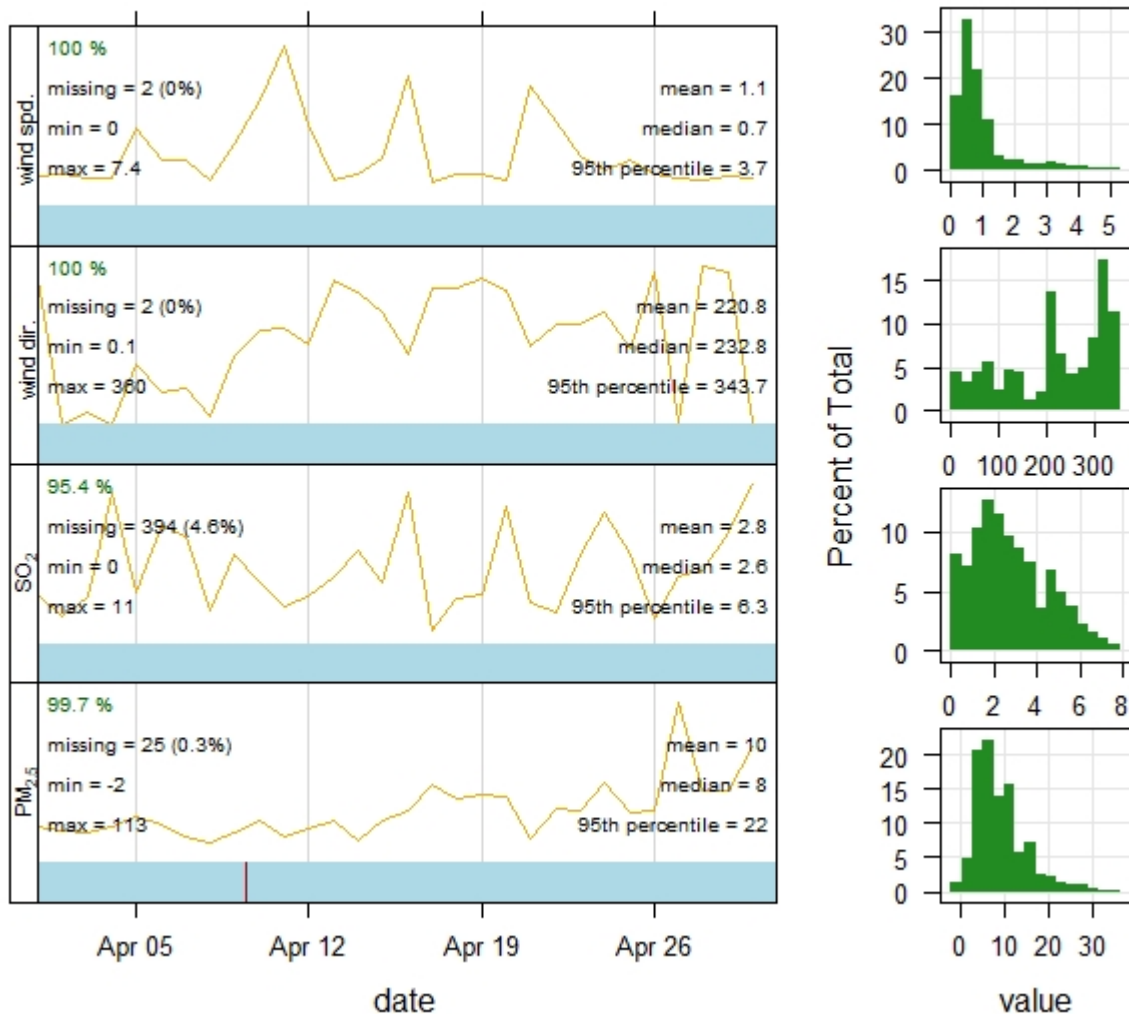


Figure 4-1: Output summary and data distribution

5. REFERENCES

NSW Environmental Protection Authority (EPA). 2017. *The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, New South Wales Environment Protection Authority, January 2017.

ERM has over 160 offices across the following countries and territories worldwide

Argentina	The Netherlands
Australia	New Zealand
Belgium	Norway
Brazil	Panama
Canada	Peru
Chile	Poland
China	Portugal
Colombia	Puerto Rico
France	Romania
Germany	Russia
Ghana	Senegal
Guyana	Singapore
Hong Kong	South Africa
India	South Korea
Indonesia	Spain
Ireland	Sweden
Italy	Switzerland
Japan	Taiwan
Kazakhstan	Tanzania
Kenya	Thailand
Malaysia	UAE
Mexico	UK
Mozambique	US
Myanmar	Vietnam

ERM's Sydney Office

Level 15
309 Kent Street
Sydney NSW 2000

T: +61 2 8584 8888

F: Add fax number

www.erm.com