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Adelaide Brighton Cement Ltd

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2022 Annual Report and TARP Review

Compliance date: 15/02/2023

EPA Licence 1126: Dust Management Plan (U-755)

Licensed site: **Adelaide Brighton Cement, Birkenhead Works**

62 Elder Road, Birkenhead, SA 5015

Date of Submission: **15 February 2022**

Version Number: **1**

Report Submitted by: Advisor Environment - C&L (SA/NSW/NT)

Glossary

Term	Definition
µg/m^3	micrograms per cubic metre
mg/m^3	milligrams per cubic metre
µm	micrometre
°C	degrees Celsius
m	metre
m^3	cubic metre
m^3/s	cubic metres per second
Nomenclature	**Definition**
PM_{10}	Particulate matter with a diameter less than 10 micrometres
$PM_{2.5}$	Particulate matter with a diameter less than 2.5 micrometres
24-hour average	Calendar day (midnight to midnight)
Abbreviations	**Definition**
ABC	Adelaide Brighton Cement
Air EPP	South Australian Environment Protection (Air Quality) Policy 2016
DMP	Dust Management Plan
EPA	Environment Protection Authority
GLPMRP	Ground Level Particulate Monitoring and Reporting Plan
SPMP	Stack Particulate Management Plan
TARP	Trigger Action Response Plan

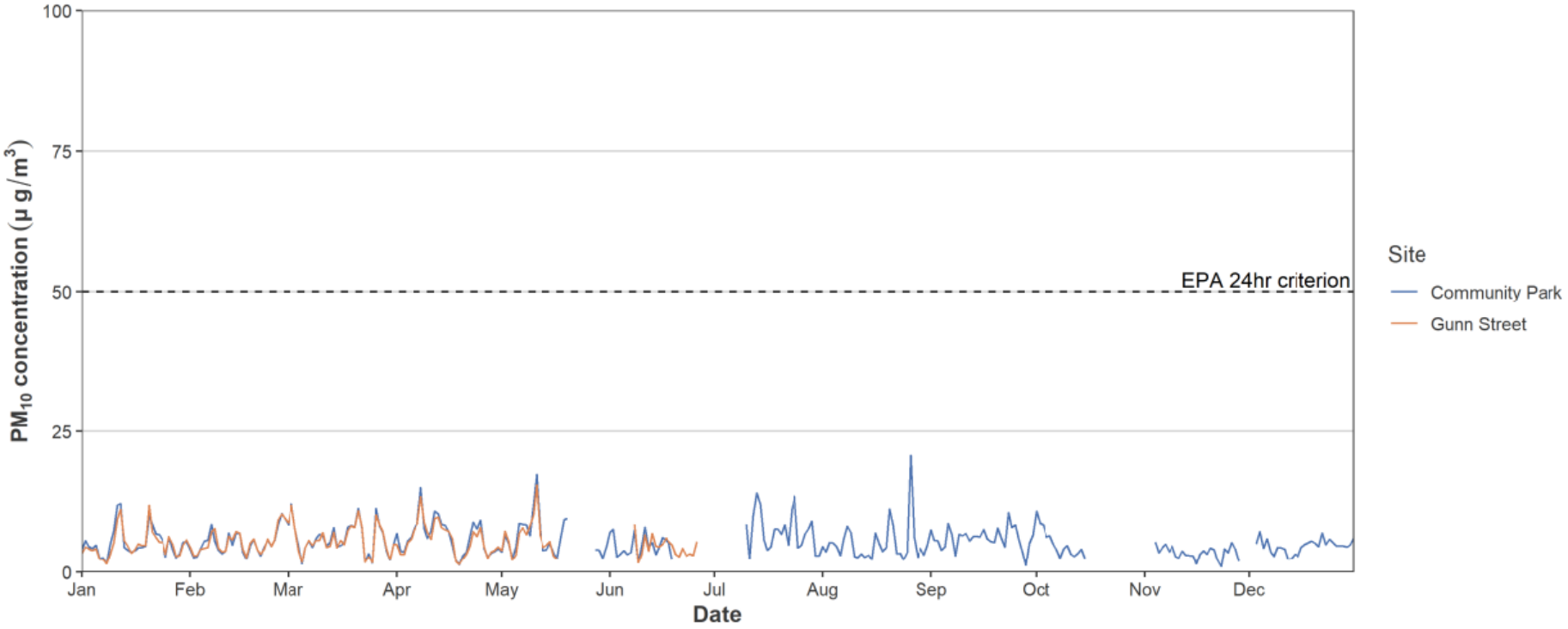
Purpose	The purpose of the Dust Management Plan (DMP) is to facilitate the ongoing implementation of dust control measures to minimise offsite dust from the Facility.
Dust Management Plan	This report has been prepared in compliance with the Dust Management Plan, approved 21 June 2018, by SA EPA. The plan is available on the ABC Birkenhead Community website: https:// http://www.birkenheadcommunity.com.au
Background Information	The DMP contains a Trigger Action Response Plan (TARP) to proactively manage fugitive dust emissions. The TARP uses three levels of trigger: • Low (watch and wait) – early warning to increase awareness of potential dust issues • Medium (investigate) – there may be a potential dust issue and investigate • High (escalate) – dust concentrations are higher than normal, and action may be required Triggers and responses have been defined for: • Ambient dust monitoring from on-site monitors • Meteorological parameters (forecasts and observations (e.g., extended dry period with less than 1 mm of rain over 20 days)) • Visual observations Trigger levels and responses are documented in the EPA Approved DMP. All monitoring data, triggers, associated responses and actions are captured in the Dust Management Dashboard and control system, for reporting and analysis. This annual review of the DMP is for the reporting period 1/1/2022 to 31/12/2022.

Reporting Objective	To review the effectiveness of the Trigger Action Response Plan (TARP) contained within the approved Dust Management Plan (DMP) and includes; • Review of all trigger values and frequency of occurrence • A review of the effectiveness of all action and response strategies • Correlation between triggers and measured onsite and offsite dust levels • A review and analysis of community complaints with the exceedance of trigger values and 24-hour exceedance of PM_{10} and $PM_{2.5}$ Air (EPP) criteria • A review and analysis of data collected from licence conditions U-729 and U-749 • A trend analysis of data collected • Opportunities for improvement in dust management • Revision of trigger level values as a result of improvements made in dust controls and practices
Particulate Monitor Locations	 Map showing sampling locations, major infrastructure, sensitive environmental receptors, and north arrow Sampling locations are indicated by colour-coded dots on the above map. **NB**: Four sampling points are located on the Birkenhead Works site; the other sampling points are in the community (corner of Gunn/Well streets and Community Park).

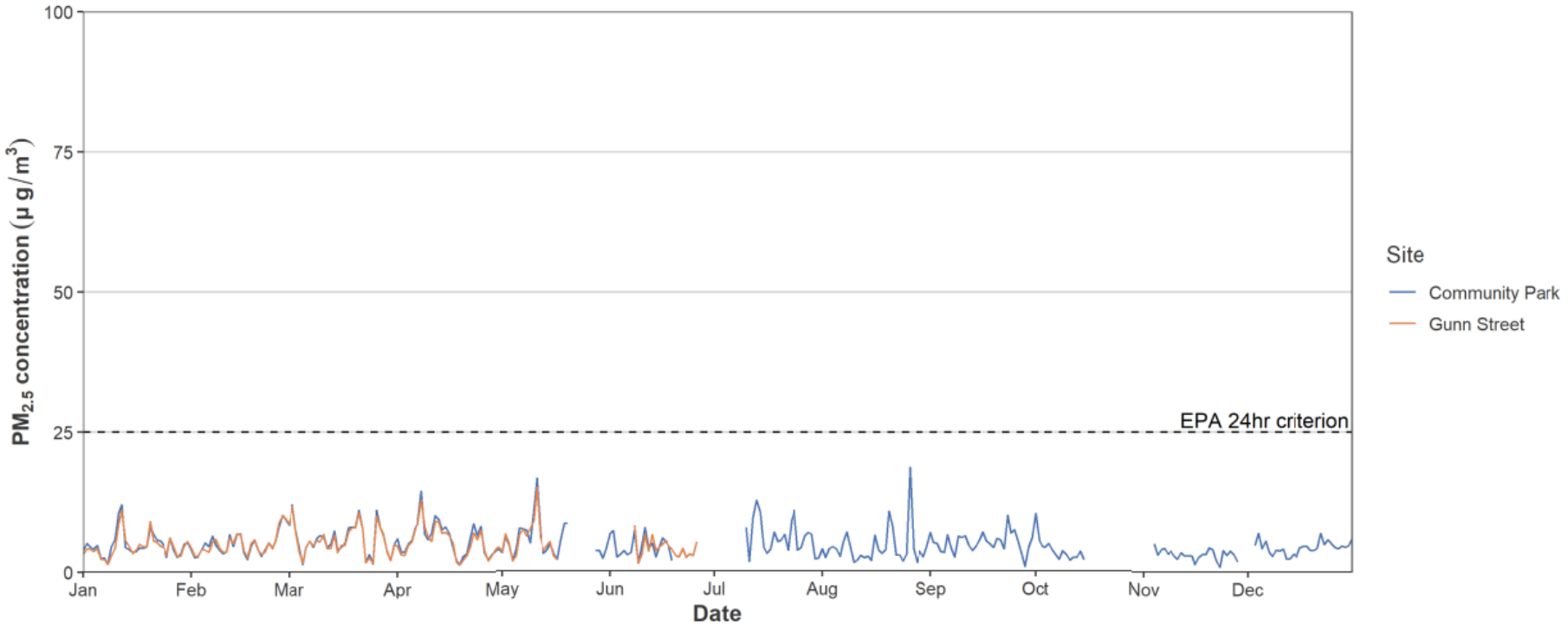
TARP – Review	A review of the Trigger Action Response Plan data, for the reporting period, 1 January 2022 – 31 December 2022, has been undertaken by Katestone Pty Ltd. (Katestone), in accordance with the requirements of the Dust Management Plan. Katestone's report is attached as an Appendix to this report.
Summary of findings from the TARP Review	**Review of trigger values and frequency of occurrence** The data analysis shows that there were 1,138 trigger alerts during the reporting period, comprising of: • 591 low trigger alerts • 287 medium trigger alerts • 77 high trigger alerts. The sites that generated the most triggers were Northern Grounds (219) and Eastern Grounds (152), followed by Meteorology – forecast (97), Southern Grounds (93) and Block 9 (30). In response to the 591 trigger alerts, ABC undertook 1662 actions, including 457 actions against low level triggers (27%), 738 actions against medium level triggers (44%) and 467 actions against high level triggers (28%). Sites that generated the most actions were Northern Grounds (634), Meteorology - forecast (398), and Eastern Grounds (297), followed by Southern Grounds (189) and Block 9 (144). **Review and analysis of data collected from licence conditions; Ground Level Particulate Monitoring and Reporting Plan (GLPMRP) - (U-729) and Stack Particulate Management Plan (SPMP) - (U-749)** GLPMRP showed that in the reporting period there were no occasions when particulate monitoring on the community located monitors exceeded the EPA, 24-hour average ambient air criteria for particulates for PM_{10} and /or $PM_{2.5}$. 24-hour average concentrations of PM_{10} at Le Fevre 1 exceeded the EPA criterion of 50 µg/m^3 once during the reporting period, on 20 January 2022. This exceedance was during the annual plant shutdown period (from 7/1/2022 to 6/2/2022), it is unlikely that emissions from the site contributed significantly to the exceedance. The property (not owned by ABC), on which the Gunn Street Monitor was located, was sold for redevelopment and was no longer available for use from the 30/6/2022. As a consequence the monitor was removed on 28 June 2022. A new monitoring location is currently being determined. There were intermittent problems with data transfer from the monitors to the Katestone FTP server during the reporting period. This issue appeared in April 2022 and was resolved after lengthy and complex investigative work in December 2022.

Despite the data transfer issues, all monitors except Gunn Street achieved greater than 75% data capture for the reporting period, and the Gunn Street monitor achieved greater than 80% data capture for the reporting period up to when it was removed. This level of data capture is considered sufficient to perform the annual TARP review as required.

The following graph shows the 24-hr average concentrations for PM_{10} on the community monitors 1/1/2022 – 31/12/2022

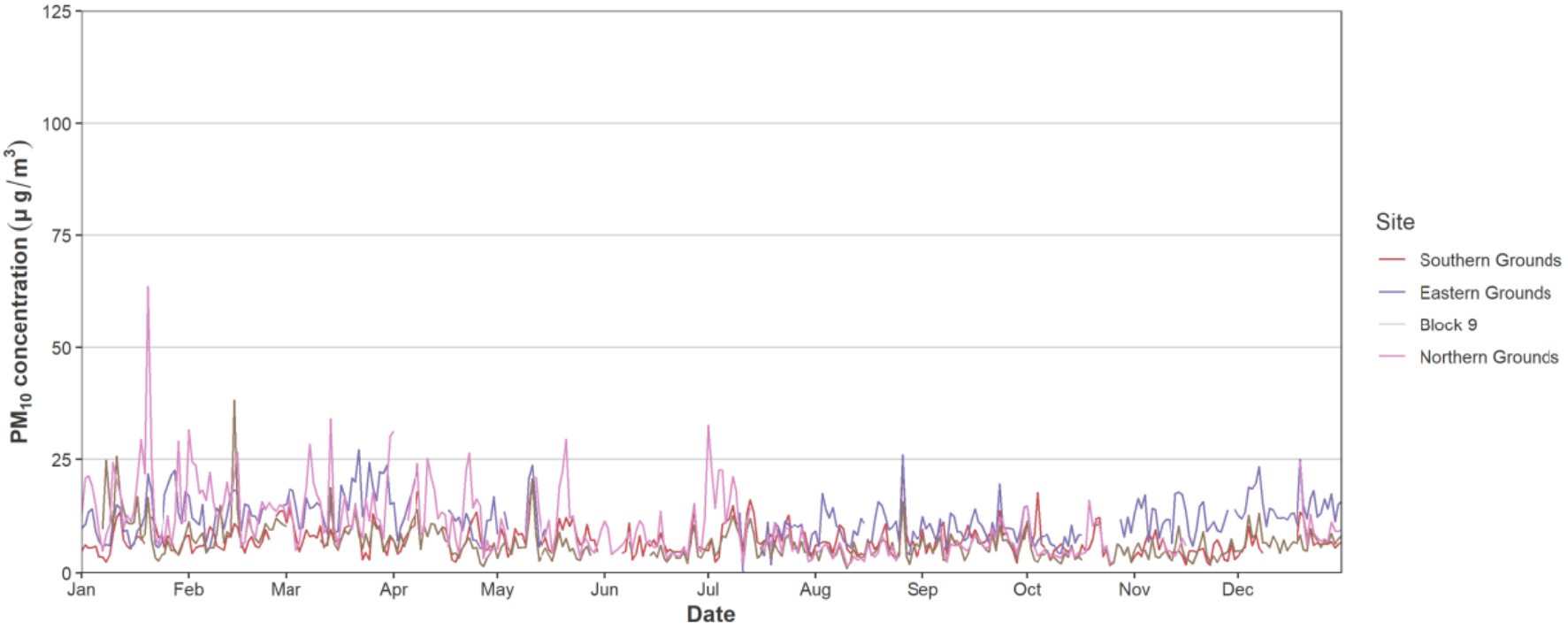


The following graph shows the 24-hr average concentrations for $PM_{2.5}$ on the community monitors 1/1/2022 – 31/12/2022

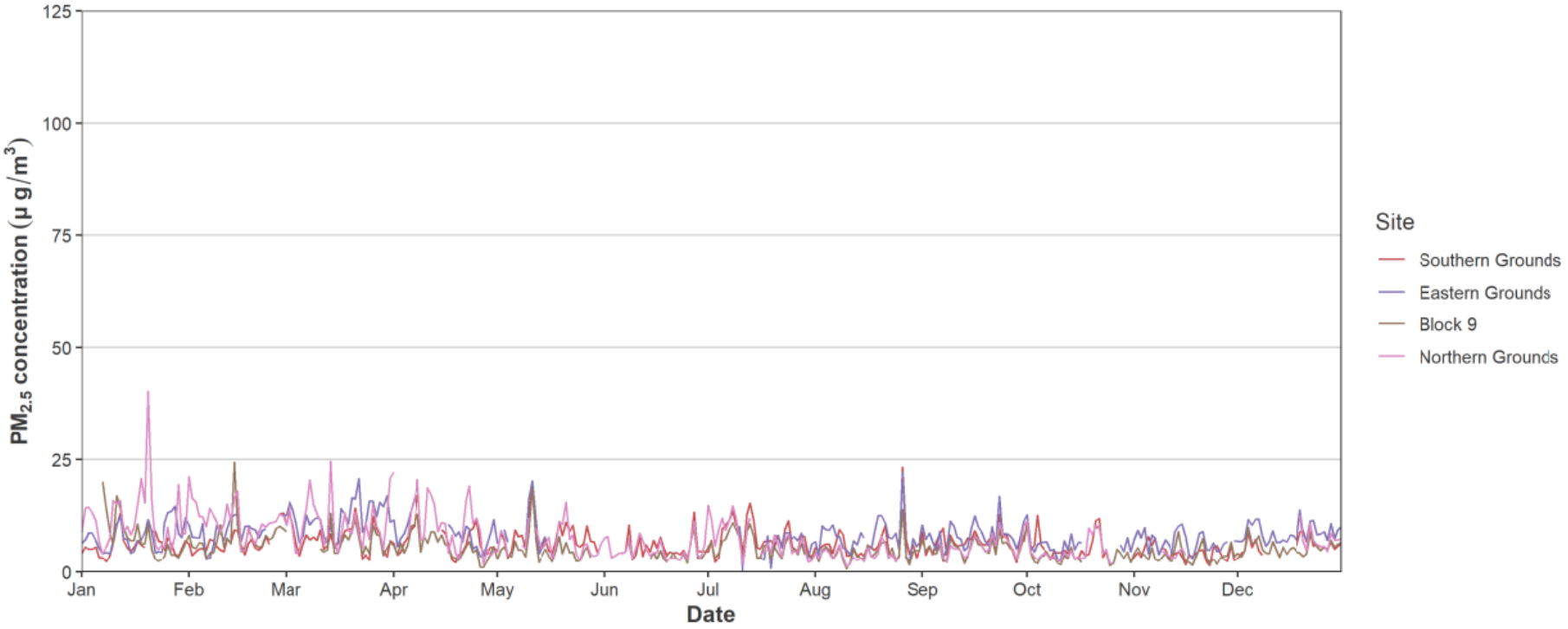


The property (not owned by ABC), on which the Gunn Street Monitor was located, was sold for redevelopment and was no longer available for use from the 30/6/2022. As a consequence the monitor was removed on 28 June 2022. A new monitoring location is currently being determined.

The following graph shows the 24-hr average concentrations for PM_{10} from the on-site monitors 1/1/2022 – 31/12/2022



The following graph shows the 24-hr average concentrations for $PM_{2.5}$ from the on-site monitors 1/1/2022 – 31/12/2022



Review and analysis of community complaints, trigger values, 24-hour PM_{10} and $PM_{2.5}$ ambient air exceedance criteria and stack reporting events

The table below captures community complaints by type, 1-hr stack reporting events and 24-hr ambient PM_{10} and $PM_{2.5}$ exceedance events for reporting period.

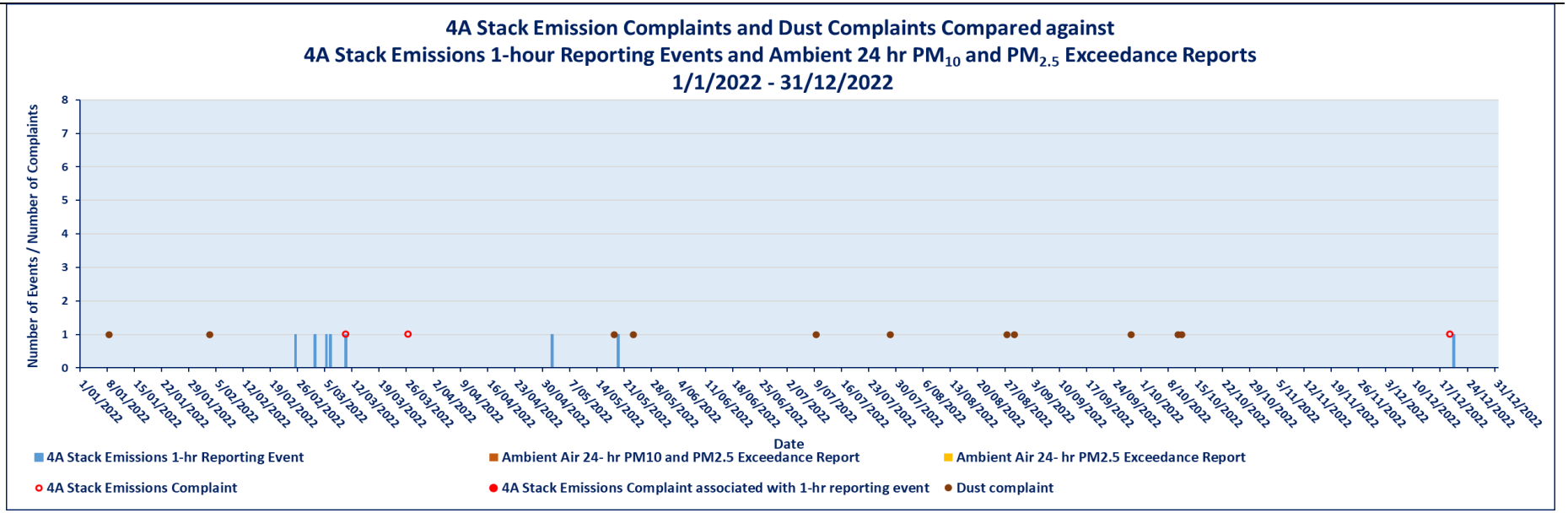
Legend
4A Stack 1-hr reporting event
4B Stack 1-hr reporting event
4A Stack Emissions complaint
4B Stack Emissions complaint
Ambient Air 24-hr $PM_{2.5}$ exceedance
Ambient Air 24-hr PM_{10} & $PM_{2.5}$ exceedance
Dust complaint

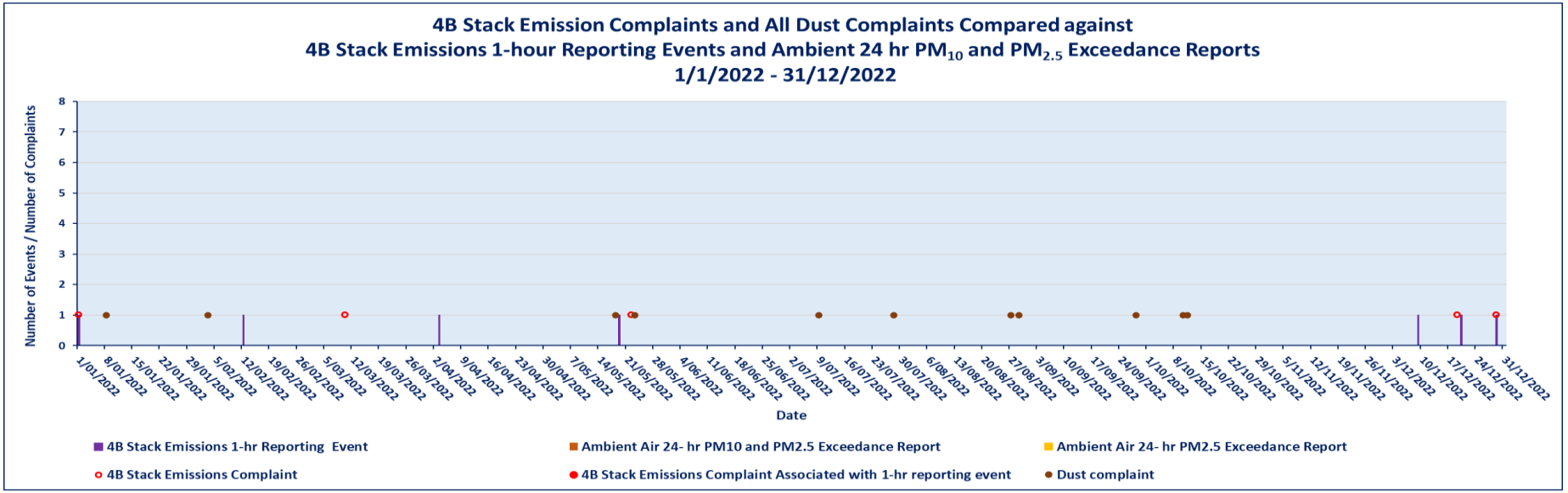
Date	Finish Time	4A Stack Emissions 1-hr Reporting Event	4B Stack Emissions 1-hr Reporting Event	4A Stack Emissions Complaint	4B Stack Emissions Complaint	4A Stack Emissions Complaint associated with 1-hr reporting event	4B Stack Emissions Complaint Associated with 1-hr reporting event	Dust complaint	Ambient Air 24- hr PM_{10} and $PM_{2.5}$ Exceedance Report	Ambient Air 24- hr $PM_{2.5}$ Exceedance Report
1/01/2022	08:05				**1**					
01/01/2022	10:25		1							
01/01/2022	11:58		1							
8/01/2022	15:18							1		
3/02/2022	18:00							1		
12/02/2022	11:49		1							
25/02/2022	13:04	1								
02/03/2022	23:36	1								
05/03/2022	22:49	1								

Date	Finish Time	4A Stack Emissions 1-hr Reporting Event	4B Stack Emissions 1-hr Reporting Event	4A Stack Emissions Complaint	4B Stack Emissions Complaint	4A Stack Emissions Complaint associated with 1-hr reporting event	4B Stack Emissions Complaint Associated with 1-hr reporting event	Dust complaint	Ambient Air 24- hr PM_{10} and $PM_{2.5}$ Exceedance Report	Ambient Air 24- hr $PM_{2.5}$ Exceedance Report
06/03/2022	8:19	1								
10/03/2022	09:30			1						
10/03/2022	09:30				1					
10/03/2022	9:59	1								
23/03/2022	15:58									
26/03/2022	10:10			1						
03/04/2022	4:33		1							
02/05/2022	19:38	1								
18/05/2022	16:15							1		
19/05/2022	11:46	1								
19/05/2022	17:23		1							
22/05/2022	01:43				1					
23/05/2022	15:45							1		
9/07/2022	12:43							1		
28/07/2022	09:00							1		
27/08/2022	17:24							1		
29/08/2022	13:36							1		
19/09/2022	20:37									
28/09/2022	16:27							1		
10/10/2022	15:36							1		
11/10/2022	12:09							1		
8/11/2022	22:32									
09/12/2022	12:30		1							
09/12/2022	14:20		1							

Date	Finish Time	4A Stack Emissions 1-hr Reporting Event	4B Stack Emissions 1-hr Reporting Event	4A Stack Emissions Complaint	4B Stack Emissions Complaint	4A Stack Emissions Complaint associated with 1-hr reporting event	4B Stack Emissions Complaint Associated with 1-hr reporting event	Dust complaint	Ambient Air 24- hr PM_{10} and $PM_{2.5}$ Exceedance Report	Ambient Air 24- hr $PM_{2.5}$ Exceedance Report
09/12/2022	15:02		1							
19/12/2022	21:45			1						
19/12/2022	21:45				1					
20/12/2022	20:47	1								
20/12/2022	21:16		1							
29/12/2022	22:32				1					
29/12/2022	23:31		1							

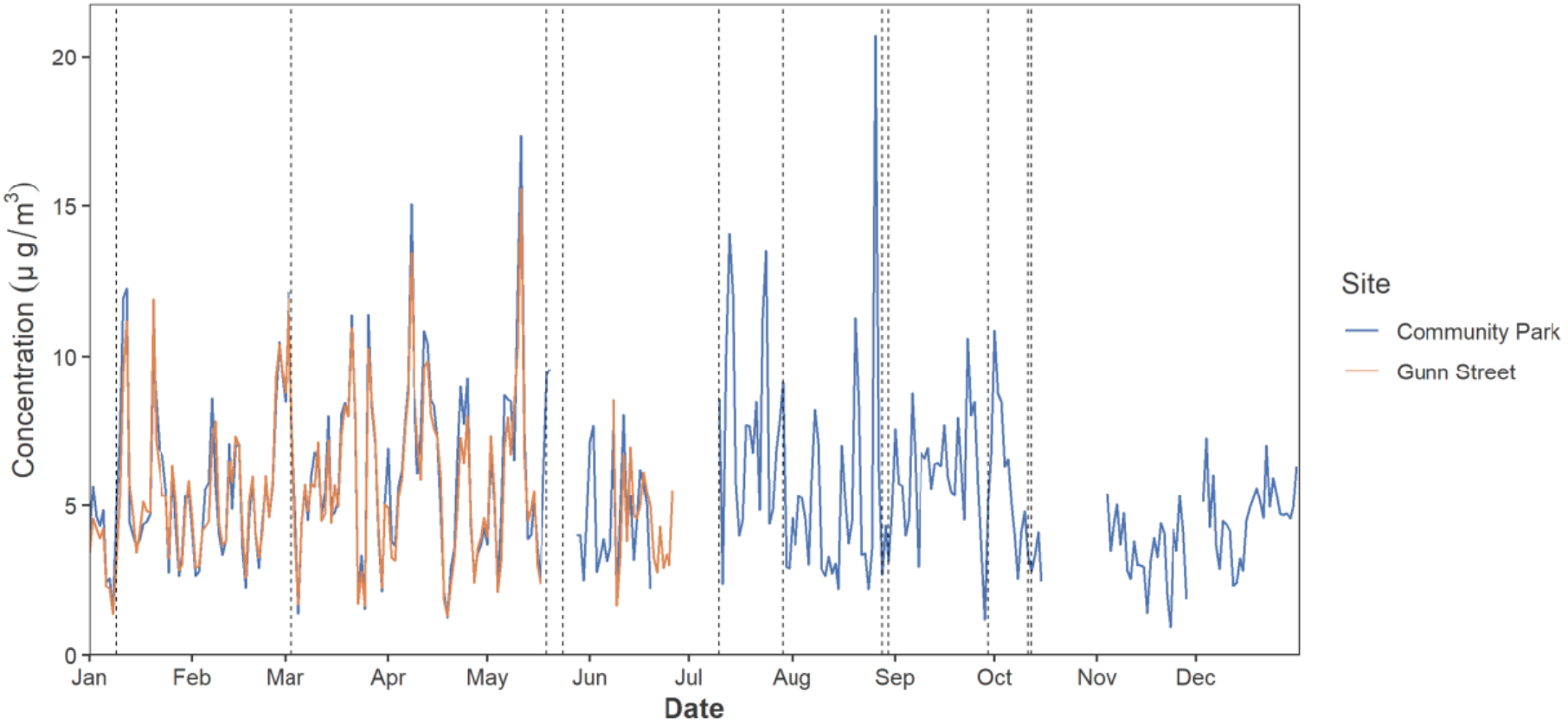
The above data is plotted on the following time series graphs for each stack





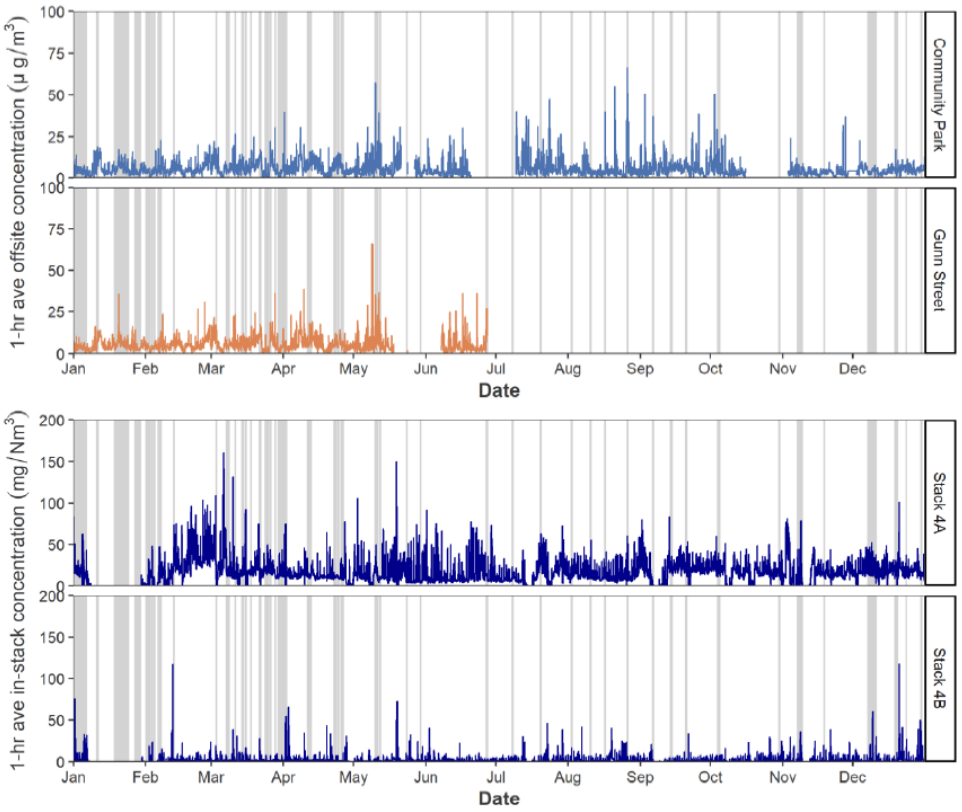
The data shows there is no relationship between 1-hour stack emission reporting events and 24-hour ambient particulate PM_{10} and $PM_{2.5}$ exceedance reports, dust complaints and stack emission complaints.

The following graph shows a time series of the 24-hr average concentrations of PM_{10} at the offsite monitors during the reporting period with dust complaint reporting dates marked as vertical dashed lines.



The graph shows that the highest measured concentrations did not tend to correlate with complaints being generated. It is relevant to note that complaints may not reflect specific elevated dust events, instead reflecting extended periods of low levels of dust accumulating over time. This possibility may indicate a cumulative combination of broader dust sources, as measured by the EPA monitoring network in combination with on-site operations.

The following graph shows the 1-hr average concentration of PM_{10} at the Community Park and Gunn Street monitoring locations during the reporting period and rolling 1-hr average in stack particulates (mg/m^3) from stacks 4A and 4B with periods of high trigger alerts identified with a grey vertical marker.



This graph shows the following:

- The majority of actual elevated PM_{10} events were also covered by a high trigger alert.
- The highest PM_{10} levels recorded at both Community Park and Gunn Street did not coincide with high in-stack concentrations.
- The highest in-stack PM10 level recorded in June 2021 at Stack 4A does not coincide with high off-site concentrations at Community Park or Gunn Street.
- The lack of a positive relationship between stack particulate emissions concentrations and ambient concentrations suggests that the stack emissions have little influence on local particulate concentrations.

TARP Effectiveness	Independent air quality specialists Katestone have undertaken a detailed analysis of the Trigger Action Response Plan (TARP) (attached in the Appendix). Analysis of concentrations at community monitors in the hours before and after trigger alerts have been generated suggest that effective response actions are being taken to prevent unacceptable fugitive dust emissions from the site. The analysis carried out has demonstrated that the TARP is working effectively to reduce off-site particulate concentrations and prevent exceedances, despite dust complaints continuing to be generated in the nearby community. Compared to the number of dust-related complaints and number of off-site exceedances recorded for the previous three reporting periods, there was a significant decrease in 2022. The report recommends maintaining the current trigger levels considering the low number of off-site exceedances observed throughout this reporting period and the risk of increased off-site impacts if trigger levels were increased.
Opportunities For Improvement in Dust Management	ABC's "Assessment of Options Report"– August 2018 approved by the EPA on 16 August 2018 identifies further opportunities to reduce particulate emissions from the site. The recommended improvement options from this report have been incorporated into an Environment Improvement Programme (EIP), approved by the EPA on 28/2/2019. The improvements are now being implemented and reported separately in accordance with the EIP.
Dust Management Plan Effectiveness	The DMP has raised the awareness of operations personnel to monitored dust levels. This has been achieved through the implementation of the Dust Management Dashboard, which provides • improved visibility and employee understanding of ambient particulate monitoring data • improved responsiveness to monitored dust levels, driven by dust trigger alerts This has resulted in • pro-active action taken to minimise dust in response to high trigger alerts, including meteorological forecasts • more timely response to plant issues
Appendix	Katestone report "Trigger Action Response Plan Annual Review", February 2023

Trigger Action Response Plan Annual Review

Prepared for:

Adelaide Brighton Cement Ltd

February 2023

Final

Prepared by:

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Document Control

Deliverable #:	D22058-2
Title:	Trigger Action Response Plan Annual Review
Version:	1.0 (Final)
Client:	Adelaide Brighton Cement Ltd
Document reference:	D22058-2 TARP Review 2023 v1.0.docx
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Reviewed by:	Ricky Gellatly
Approved by:	 Ricky Gellatly 6 February 2023

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Glossary

Term	Definition
µg/m^3	micrograms per cubic metre
°	degrees
°C	degrees Celsius
km	kilometres
m	metres
m/s	metres per second
mg/m^3	milligrams per cubic metre
Nomenclature	**Definition**
PM_{10}	particulate matter with a diameter less than 10 micrometres
$PM_{2.5}$	particulate matter with a diameter less than 2.5 micrometres
TSP	Total suspended particulates
Abbreviations	**Definition**
ABC	Adelaide Brighton Cement
DMP	Dust management plan
EPA	Environmental Protection Authority South Australia
GLPMRP	Ground Level Particulate Monitoring and Reporting Plan
SPMP	Stack Particulate Management Plan
TARP	Trigger Action Response Plan

EXECUTIVE SUMMARY

Katestone Environmental Pty Ltd was commissioned by Adelaide Brighton Cement Ltd to complete a review of Trigger Action Response Plan data collected for the period 1 January 2022 to 31 December 2022 inclusive.

The Trigger Action Response Plan is implemented and managed at Adelaide Brighton Cement Ltd's Birkenhead facility through a Dust Management Dashboard operated in the Birkenhead Control Room. This includes receiving alerts that are triggered by monitoring or forecast data or observations of visible dust, analysis of air quality monitoring data, logging responses/actions and closing alerts. Analysis of the Trigger Action Response Plan data during the reporting period shows the following:

- A total of 591 triggers were recorded, including 287 low level triggers (49%), 227 medium level triggers (38%) and 77 high level triggers (13%)
- Low, medium and high level triggers occurred with decreasing frequency at all sites
- The sites/parameters that generated the most triggers were Northern Grounds (219) and Eastern Grounds (152), followed by Meteorology – forecast (97), Southern Grounds (93) and Block 9 (30)
- No triggers were generated by on-site visual dust observations or meteorological observations during the reporting period
- A total of 1,662 actions were taken, including 457 actions against low level triggers (27%), 738 actions against medium level triggers (44%) and 467 actions against high level triggers (28%)
- The most actions were generated by Northern Grounds (634), Meteorology – forecast (398) and Eastern Grounds (297), followed by Southern Grounds (189) and Block 9 (144)
- On average, approximately 3 separate actions were performed for every trigger. This is a reduction in the number of actions per trigger compared to the previous reporting period (1 January 2021 to 31 December 2021)
- Although high trigger alerts regularly did not correspond with elevated PM_{10} concentrations at the off-site monitoring locations, the majority of actual elevated PM_{10} events at the off-site monitoring locations were also covered by a trigger alert of some level
- The highest PM_{10} levels recorded at both Community Park and Gunn Street did not coincide with high in-stack TSP concentrations
- The highest measured TSP levels in emissions from kiln stack 4A and pre-calciner stack 4B did not coincide with high off-site concentrations at Community Park or Gunn Street
- The lack of a positive relationship between particulate concentrations in stack emissions and ambient concentrations suggests that the stack emissions have little influence on local particulate concentrations

Ambient concentrations of PM_{10} and $PM_{2.5}$ are measured through the Dust Management Dashboard. Analysis of the Ground Level Particulate Monitoring Program data collected during the monitoring period shows the following:

- Data capture at the monitoring sites varied, and none of the Gunn Street, Community Park, Eastern Grounds or Northern Grounds monitors achieved the 90% data capture limit prescribed in the GLPMRP
- The lack of data capture over the reporting period was principally due to intermittent problems with data transfer from the monitors to the Katestone FTP server (this issue first appeared in April 2022 and was

resolved in December 2022), although the Gunn Street monitor was removed on 28 June 2022 due to the property on which it was located being sold for redevelopment

- The 24-hour average concentrations of $PM_{2.5}$ and PM_{10} did not exceed the EPA criteria at either the Community Park or Gunn Street monitoring sites during the reporting period
- This is a slight decrease compared to the previous reporting period (January 2021 to December 2021) which showed one PM_{10} exceedance at Community Park and one PM_{10} and $PM_{2.5}$ exceedance at Gunn Street. However, this may have been influenced by the deactivation of the Gunn Street monitoring site and reduced data capture at the Community Park monitoring site.
- The highest on-site 24-hour average concentrations of PM_{10} and $PM_{2.5}$ were both recorded at Northern Grounds on 20 January 2022 (63.7 µg/m^3 and 40.4 µg/m^3, respectively):
- It does not appear that on-site operations are significantly contributing to off-site particulate monitoring concentrations at Community Park or Gunn Street

Analysis of concentrations at community monitors in the hours before and after trigger alerts have been generated suggest that effective response actions are being taken to prevent unacceptable fugitive dust emissions from the Facility.

The analysis carried out has demonstrated that the TARP is working effectively to reduce off-site particulate concentrations and prevent exceedances, despite dust complaints continuing to be generated in the nearby community (albeit at much-reduced levels compared to previous years). Compared to the number of dust-related complaints and number of off-site exceedances recorded for the previous three reporting periods, there was a significant decrease in 2022.

It is recommended to maintain the current trigger levels considering the lack of off-site exceedances observed throughout this reporting period and the risk of increased off-site impacts if trigger levels were increased.

1. INTRODUCTION

Katestone Environmental Pty Ltd (Katestone) was commissioned by Adelaide Brighton Cement Ltd (ABC) to complete a review of the Trigger Action Response Plan (TARP) data collected for the period 1 January 2022 to 31 December 2022 inclusive (the reporting period).

The purpose of this report is to review and evaluate the effectiveness of the TARP and make any recommendations for improvement. The review has been prepared to satisfy the following annual reporting requirements in ABC's licence (Licence number 1126):

> *"1.1.2e a methodology and framework for the provision of an annual report to the EPA which includes the following but is not limited to:*
>
> *i a review of all the trigger values identified in sub paragraph 2(a) of this condition*
>
> *ii a review of the effectiveness of all action and response strategies identified in sub paragraph 2(c) of this condition*
>
> *iii a trend analysis of data collected*
>
> *iv a review and analysis of community complaints recorded in condition 300-9 with the exceedance of trigger values reported under sub paragraph 2(d) of this condition; and*
>
> *v opportunities for improvement in dust management*"

Accordingly, this report details the following:

- Description of ABC's TARP (Section 2)
- Reporting Period Data Summary (Section 3)
    - TARP data collected during the monitoring period (Section 3.1)
    - An analysis of data collected by ABC's other environmental monitoring programs during the monitoring period, including:
        - Ground Level Particulate Monitoring and Reporting Plan (GLPMRP) – required under Licence Conditions U-729 (Section 3.2)
        - Stack Particulate Management Plan (SPMP) - required under Licence Conditions U-749 (Section 3.3)
- Analysis of community complaints and TARP data during the reporting period (Section 4)
- Review of the effectiveness of the TARP during the reporting period (Section 5)
- Conclusion (Section 6)

Figure 1 shows the location and layout of the site, along with the specific locations of the air quality monitors and stacks referenced in this report.

Figure 1 Site layout and ambient air quality monitors

2. TRIGGER ACTION RESPONSE PLAN

The Trigger Action Response Plan (TARP) forms part of ABC's overall Dust Management Plan (DMP) at its Birkenhead Site. The DMP defines a range of triggers to assist ABC to meet its dust management obligations by identifying circumstances when:

- Ground-level concentrations at off-site receptors are likely to be elevated due to activities on-site
- Activities on-site are generating dust outside of the normal range.

Three levels of triggers are defined within the TARP:

1. Low trigger (Watch and wait). This is an early warning level put in place to increase awareness of potential dust issues before they arise.
2. Medium trigger (Investigate). A medium trigger indicates that there may be a potential dust issue and specific investigation is warranted.
3. High trigger (Escalate). A high trigger indicates that dust concentrations are outside of the normal range and that an action is warranted.

The TARP has been designed to provide as much warning as possible to allow proactive management of fugitive dust. Therefore, a trigger, particularly a low or medium trigger, does not indicate the presence of a dust impact.

The triggers and associated responses defined in ABC's DMP are reproduced in the following sections.

2.1 TARP for ambient dust monitoring

Certain responses are implemented when ABC's ambient dust monitoring network measures concentrations of PM_{10} that exceed the trigger values presented in Table 1. The responses that are triggered are presented in Table 2.

Table 1 Trigger values for 1-hour average concentrations of PM_{10}

Parameter	Block 9	North Grounds	East Grounds	South Grounds
Location	On-site	On-site	On-site	On-site
Low	35	20	22	19
Medium	41	27	28	26
High	66	47	48	44

Table 2 Actions and responses for ambient monitoring data triggers – on-site, 1-hour average

Trigger Level	Action required	Responsibility
Low	• Alert relevant operators that dust levels are elevated therefore heightened awareness to sources of dust may be required.	Shift supervisor
Medium	As for low, in addition: • Ensure all routine dust management practices have been implemented. • Visual observations on site to check if there are any significant visible dust emissions in the region of the exceeding monitor.	Shift supervisor
High	As for medium, in addition: • Ensure all routine dust management practices have been implemented. If not, correct this immediately. • Slow activities or reschedule to more suitable meteorological conditions.	Shift supervisor

Trigger Level	Action required	Responsibility
	• If dust mitigation equipment is unavailable, or at fault, investigate temporary alternative management practices. • Mobilise water cart or apply additional water sprays	

2.2 Trigger values for meteorological parameters

Certain responses are implemented when ABC's meteorological monitoring indicates that meteorological parameters correspond to the trigger values presented in Table 3. The responses that are triggered are presented in Table 4. The majority of these meteorological trigger alerts are generated from forecast data, only the trigger alert for an extended dry period is generated from observations.

Table 3 Trigger values for meteorological parameters

Trigger Level	Trigger
Low	Forecast of high temperatures (30 ºC) and north-easterly winds (0° – 90°)
Low	Forecast of strong winds (> 6 m/s as a 3-hour average) from the Facility towards receptor areas (wind direction between 0° and 180°)
Medium	Forecast of strong winds (> 7 m/s as a 3-hour average) from the Facility towards receptor areas (wind direction between 0° and 180°)
Medium	Extended dry period indicated by less than 1 mm of rain over a 20-day period
High	Forecast of strong winds (> 8 m/s as a 3-hour average) from the Facility towards receptor areas (wind direction between 0° and 180°)

Table 4 Actions and responses for meteorological data triggers

Trigger Level	Action required	Responsibility
Low	• Alert shift employees that dust potential is elevated. • Pre-emptive watering of stockpiles before handling. • Assess potential for shifting operations to more favourable conditions. • Ensure water truck is on standby to apply water. • Visual observations of site every 2 hours. • Application of water.	Shift supervisor
Medium	As for low, in addition: • Visual observations of major stockpiles. • Additional watering if warranted.	Shift supervisor
High	As for medium, in addition: • Minimise activity rate. • Apply water/suppressant immediately.	Shift supervisor

2.3 Trigger values for visual observations

Certain responses are triggered if visual observations of dust occur as detailed in Table 5. The responses that are triggered are presented in Table 6.

Table 5 Trigger values for visual observations

Trigger Level	Trigger
Low	General build-up of dust on non-worked areas at the Facility, e.g. carparks, alongside buildings etc.
Medium	Visible dust plume generated by Facility activity above normal/acceptable levels
High	Visible dust plume crossing the Facility boundary

Table 6 Actions and responses for visual observations

Trigger Level	Action required	Responsibility
Low	• Inspect site to determine source of dust. • Check whether routine (baseline) dust management practices have been applied to that source.	Shift supervisor
Medium	As for low, in addition: • Apply dust management. • If relevant, apply water and/or chemical suppressant to source of dust. • If dust mitigation equipment is unavailable, or at fault, investigate temporary alternative management practices. • Repair any faulty dust mitigation equipment.	Shift supervisor
High	As for medium, in addition: • Minimise activity rate. • Apply water/suppressant immediately.	Shift supervisor

2.4 TARP Implementation

The TARP is implemented and managed at ABC's Birkenhead facility through a Dust Management Dashboard operated in the Birkenhead Control Room. This includes analysis of monitoring data, logging responses/actions, closing alerts, and raising visual observation alerts.

Live, 1-minute average air quality monitoring data is collected from two off-site monitors (Community Park and Gunn Street) and four on-site monitors (Northern Grounds, Southern Grounds, Eastern Grounds and Block 9). The data are analysed hourly and compared with the site-specific trigger conditions (as detailed in the previous tables) to generate trigger alerts.

The property (not owned by ABC) on which the Gunn Street monitor was located has been sold for redevelopment and is no longer available for use. The Gunn Street monitor was consequently removed on 28 June 2022 in preparation for being relocated. A new monitoring location is currently being determined.

The Dust Management Dashboard also incorporates meteorological data (forecast and observational), which are updated at 3-hour intervals and analysed daily between 5am-6am and 5pm-6pm. Trigger alerts are generated if meteorological data (observations and forecast) satisfy the relevant trigger level criteria (as detailed in the previous tables).

Staff in the Birkenhead Control Room are notified of any new or escalated alerts.

3. REPORTING PERIOD DATA SUMMARY

3.1 TARP

3.1.1 Triggers

TARP triggers generated during the reporting period (1 January 2022 to 31 December 2022) are summarised in Table 7 and Table 8. Triggers generated over consecutive hours at a particular site are recorded as a single trigger of the highest level during the alert period. As set out in Table 3, the only meteorological trigger generated by observational data is an alert for an extended dry period, none of which occurred in 2022.

The data show that:

- A total of 591 triggers were recorded, including 287 low level triggers (49%), 227 medium level triggers (38%) and 77 high level triggers (13%)
- Low, medium and high level triggers occurred with decreasing frequency at all sites
- The sites that generated the most triggers were Northern Grounds (219) and Eastern Grounds (152), followed by Meteorology – forecast (97), Southern Grounds (93) and Block 9 (30)
- No triggers were generated by on-site visual observations or meteorological observations during the reporting period

Table 7 Number of triggers during the reporting period

Site	Trigger level			Total (% of all alerts)
	Low	Medium	High	
Southern Grounds	51	37	5	93 (16%)
Eastern Grounds	66	65	21	152 (26%)
Block 9	16	10	4	30 (5%)
Northern Grounds	97	88	34	219 (37%)
Meteorology – forecast	57	27	13	97 (16%)
Meteorology – observations	-	-	-	-
Onsite visual observations	-	-	-	-
All sites	**287**	**227**	**77**	**591**

Table 8 Frequency of triggers during the reporting period

Site	Trigger level		
	Low	Medium	High
Southern Grounds	55%	40%	5%
Eastern Grounds	43%	43%	14%
Block 9	53%	33%	13%
Northern Grounds	44%	40%	16%
Meteorology – forecast	59%	28%	13%
All sites	**49%**	**38%**	**13%**

3.1.2 Actions

Actions recorded in response to TARP triggers during the reporting period are summarised in Table 9 and Table 10. Note that percentages may not sum to 100% due to rounding. These actions include but are not limited to: alerting operators, checking for dust emissions, checking dust controls are in place and working, implementing temporary mitigation, reducing activity rates and rescheduling activities.

The data show that:

- A total of 1,662 actions were taken, including 457 actions against low level triggers (27%), 738 actions against medium level triggers (44%) and 467 actions against high level triggers (28%)
- The most actions were generated by Northern Grounds (634), Meteorology – forecast (398) and Eastern Grounds (297), followed by Southern Grounds (189) and Block 9 (144)

Table 9 Number of actions taken during the reporting period

Site	Actions			Total (% of all actions)
	Low trigger	Medium trigger	High trigger	
Southern Grounds	63	117	9	189 (11%)
Eastern Grounds	78	153	66	297 (18%)
Block 9	17	54	73	144 (9%)
Northern Grounds	121	272	241	634 (38%)
Meteorology – forecast	178	142	78	398 (24%)
All sites	**457**	**738**	**467**	**1662**

Table 10 Frequency of actions taken during the reporting period

Site	Actions		
	Low trigger	Medium trigger	High trigger
Southern Grounds	33%	62%	5%
Eastern Grounds	26%	52%	22%
Block 9	12%	38%	51%
Northern Grounds	19%	43%	38%
Meteorology – forecast	45%	36%	20%
All sites	**27%**	**44%**	**28%**

3.1.3 TARP Implementation Summary

Table 11 summarises the TARP triggers and actions during the reporting period. On average, 3 separate actions were performed for every trigger.

Table 11 Summary of TARP implementation during the reporting period

Site	Triggers	Actions	Average Actions/Trigger
Southern Grounds	93	189	2.0
Eastern Grounds	152	297	2.0
Block 9	30	144	4.8

Site	Triggers	Actions	Average Actions/Trigger
Northern Grounds	219	634	2.9
Meteorology - forecast	97	398	4.1
All sites	**591**	**1662**	**2.8**

3.2 Ground Level Particulate Monitoring and Reporting Plan

PM_{10} and $PM_{2.5}$ data collected during the reporting period in accordance with the GLPMRP are summarised in Table 12. Concentrations measured at the off-site monitoring locations (Community Park and Gunn Street) are compared with the EPA 24-hour average criteria for PM_{10} (50 µg/m^3) and $PM_{2.5}$ (25 µg/m^3) – no exceedances of either criterion were recorded during the reporting period. Timeseries of 24-hour average particulate concentrations measured during the reporting period are presented for the off-site monitors in Figure 2 and Figure 3, and for the on-site monitors in Figure 4 and Figure 5.

Data capture at the monitoring sites varied, and none of the Gunn Street, Community Park, Eastern Grounds or Northern Grounds monitors achieved the 90% data capture limit prescribed in the GLPMRP:

- Data capture at Gunn Street was 43%, due to this monitor being removed at the end of June 2022
- Data capture at Community Park was 86-87%, partially due to data removed by Katestone in the validation process
- Data capture at Southern Grounds and Block 9 was 91-93%
- Data capture at Eastern Grounds was 76-78% and at Northern Grounds was 82-83%

This is a significant decrease from the minimum data capture over the past three reporting periods (93% in 2021, 97% in 2020 and 98% in 2019), which has never dropped below the 90% goal. The lack of data capture in 2022 is due to intermittent problems with data transfer from the monitors to the Katestone FTP server. This issue appeared in April 2022 and was resolved after lengthy and complex investigative work in December 2022.

Despite the data transfer issues, all monitors except Gunn Street achieved greater than 75% data capture for the reporting period, and the Gunn Street monitor achieved greater than 80% data capture for the reporting period up to when it was removed. This level of data capture is considered sufficient to perform the annual TARP review as required.

The data show that:

- The 24-hour average concentrations of $PM_{2.5}$ and PM_{10} did not exceed the EPA criteria at either the Community Park or Gunn Street monitoring sites during the reporting period
- This is a decrease compared to the previous reporting period (January 2021 to December 2021), which showed one PM_{10} exceedance at Community Park and one PM_{10} and $PM_{2.5}$ exceedance at Gunn Street. However, this may have been influenced by the deactivation of the Gunn Street monitoring site and reduced data capture at the Community Park monitoring site.
- The highest on-site 24-hour average concentrations of PM_{10} and $PM_{2.5}$ were both recorded at Northern Grounds on 20 January 2022 (63.7 µg/m^3 and 40.4 µg/m^3, respectively):
    - All other on-site and off-site monitors except Southern Grounds also recorded spikes in 24-hour average concentrations of PM_{10} and $PM_{2.5}$ on this day, though less extreme; Southern Grounds had insufficient data capture on this day to calculate a robust 24-hour average
    - These spikes are not unusually high and are consistent with the monitor-specific variation in concentrations observed over the reporting period

- The spikes in 24-hour average concentrations on 20 January 2022 do not represent the maximum recorded concentrations at any monitor except Northern Grounds

- It does not appear that on-site operations are significantly contributing to off-site particulate monitoring concentrations at Community Park or Gunn Street

Table 12 Summary of GLPMRP data collected during the reporting period (µg/m^3)

Location	Site	Avg period	Size	Max	Min	Mean	99th %ile	95th %ile	Data capture
Off-site	Community Park	1-hour	PM_{10}	66.3	-4.9	5.5	24.1	14.1	87%
			$PM_{2.5}$	59.6	-4.9	5.0	22.2	12.7	87%
		24-hour	PM_{10}	20.7	0.9	5.5	14.0	10.7	86%
			$PM_{2.5}$	18.6	0.9	5.0	12.6	10.0	86%
	Gunn Street	1-hour	PM_{10}	65.9	-2.9	5.5	21.4	13.1	43%
			$PM_{2.5}$	63.4	-3.0	5.1	19.7	12.4	43%
		24-hour	PM_{10}	15.6	1.3	5.5	12.6	10.2	43%
			$PM_{2.5}$	15.0	1.2	5.1	12.2	9.2	43%
On-site	Southern Grounds	1-hour	PM_{10}	102.0	-1.2	7.2	29.3	17.2	93%
			$PM_{2.5}$	82.1	-3.8	6.5	27.3	15.6	93%
		24-hour	PM_{10}	24.8	1.5	7.2	17.1	13.2	92%
			$PM_{2.5}$	23.4	1.3	6.5	15.0	11.7	92%
	Eastern Grounds	1-hour	PM_{10}	1165.8	-7.0	12.0	42.4	25.8	78%
			$PM_{2.5}$	835.2	-7.0	8.5	30.7	18.3	78%
		24-hour	PM_{10}	27.4	-1.3	11.9	24.5	20.7	76%
			$PM_{2.5}$	22.2	-1.3	8.4	19.4	14.8	76%
	Northern Grounds	1-hour	PM_{10}	281.4	-5.0	10.7	58.2	30.0	83%
			$PM_{2.5}$	145.6	-5.0	7.9	38.3	21.6	83%
		24-hour	PM_{10}	63.7	1.6	10.8	31.8	24.6	82%
			$PM_{2.5}$	40.4	1.1	7.9	21.2	16.1	82%
	Block 9	1-hour	PM_{10}	193.9	-5.5	6.7	29.9	16.4	91%
			$PM_{2.5}$	130.2	-5.6	5.5	23.5	13.7	91%
		24-hour	PM_{10}	38.4	0.9	6.7	20.0	12.6	91%
			$PM_{2.5}$	24.4	0.7	5.5	16.2	10.5	91%

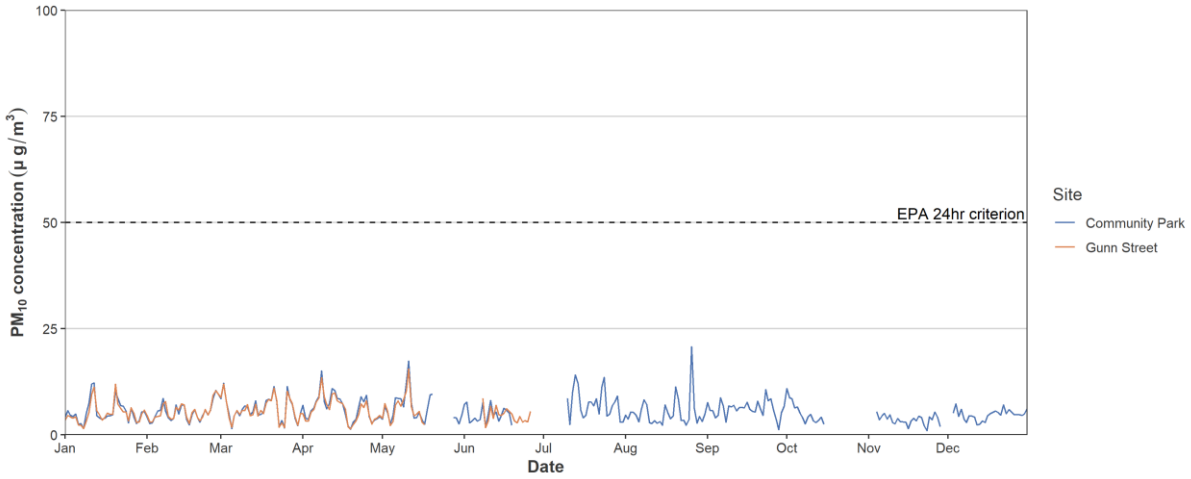

Figure 2 24-hour average concentrations of PM_{10} measured off-site during the reporting period

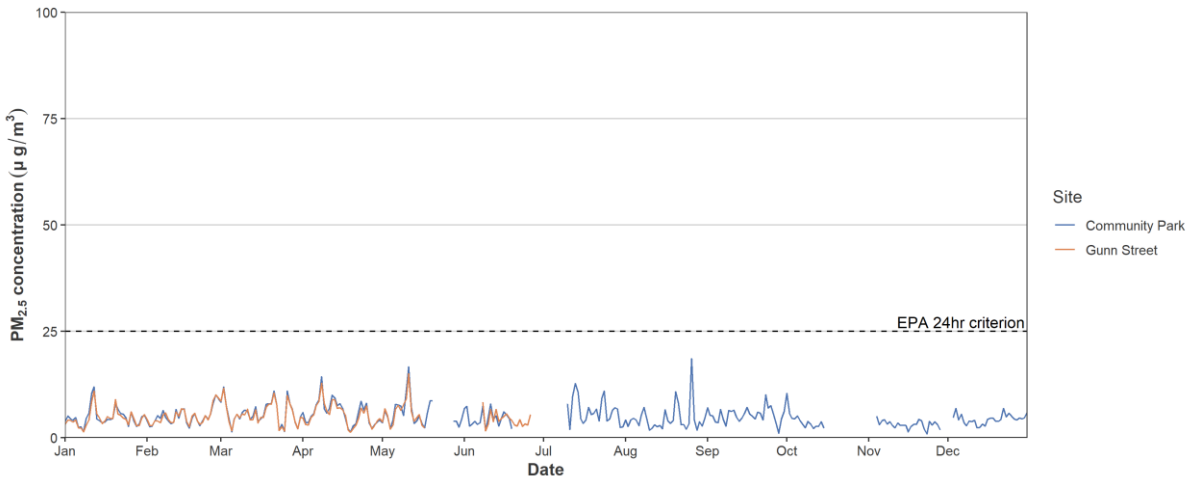

Figure 3 24-hour average concentrations of $PM_{2.5}$ measured off-site during the reporting period

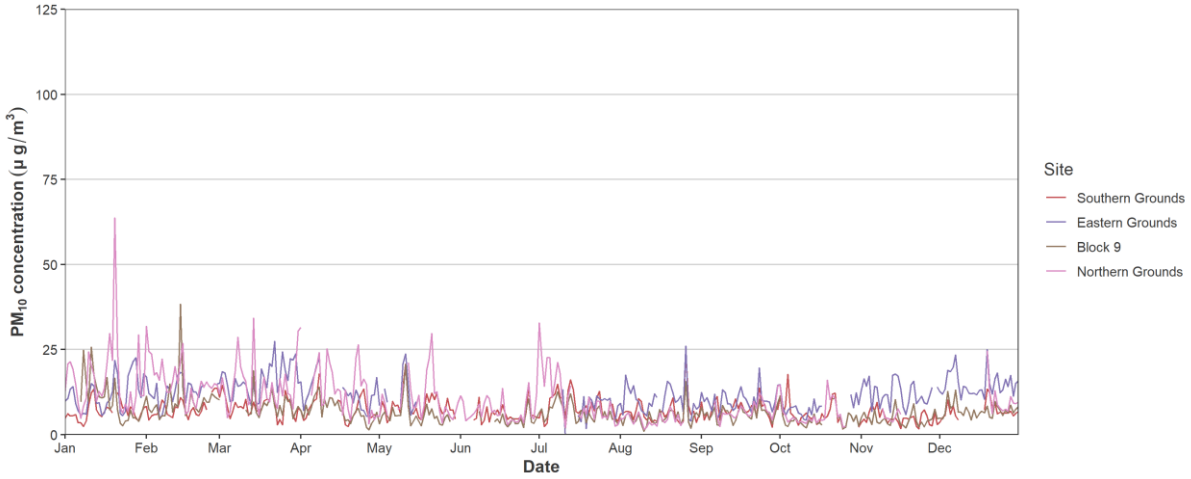

Figure 4 24-hour average concentrations of PM_{10} measured on-site during the reporting period

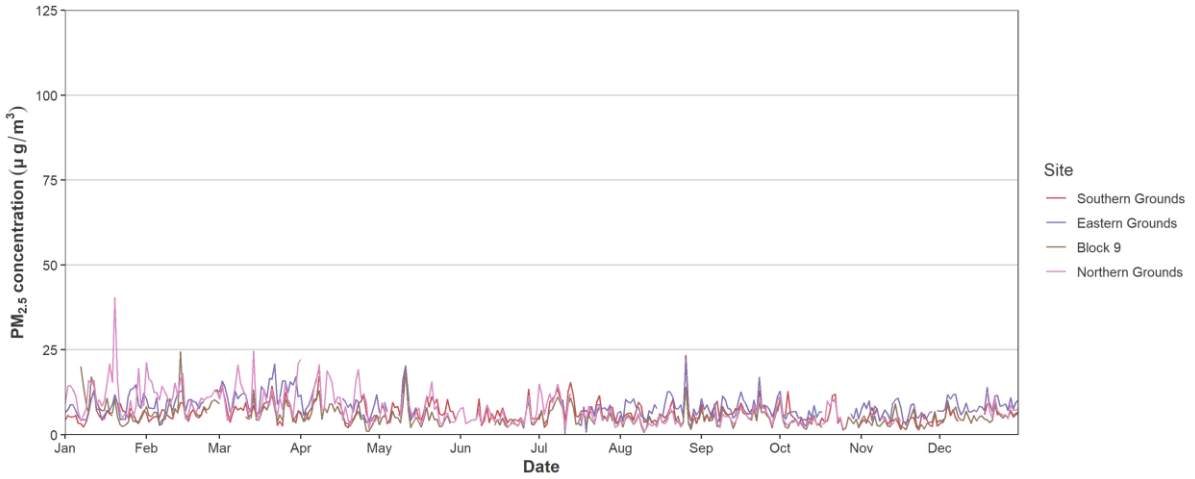

Figure 5 24-hour average concentrations of $PM_{2.5}$ measured on-site during the reporting period

3.3 Stack Particulate Management Plan

The data collected from sampling equipment within kiln stack 4A and pre-calciner stack 4B during the reporting period in accordance with the SPMP is summarised in Table 13. This equipment measures concentrations of total suspended particulates (TSP). Time series of 1-hour rolling average and 24-hour average in-stack concentrations are presented in Figure 6 and Figure 7, respectively.

The SPMP data shows the following:

- Data capture for the reporting period was 100% for both Stack 4A and Stack 4B. The data flatline from 7 January 2022 to 6 February 2022 observed in Figure 6 and Figure 7 correlates with the annual plant shutdown period for maintenance. There were three other notable kiln shutdown periods, these being between 14 and 16 July, between 6 and 10 September and from 9 to 12 November, most obvious in the plot for Stack 4A.
- The annual average TSP concentration in Stack 4A (15.3 mg/Nm^3) was considerably higher than in Stack 4B (1.8 mg/Nm^3). The maximum 1-hour rolling average concentration of TSP of 160.1 mg/Nm^3 was measured in Stack 4A.
- The 1-hour rolling average TSP concentrations in Stack 4A were elevated for a two-month period after the plant shutdown, with several peaks above 100 mg/Nm^3 in February and March and a single peak above 150 mg/Nm^3 on 6 March. Concentrations in Stack 4A were also elevated in May, with two peaks above 100 mg/Nm^3 on 1 May and 19 May. Concentrations were relatively consistent throughout the remainder of the reporting period, excepting a single peak above 100 mg/Nm^3 on 20 December.
- The 1-hour rolling average TSP concentrations for Stack 4B were relatively consistent throughout the reporting period, with scattered peaks throughout the year. Exceptions include peaks above 100 mg/Nm^3 on 12 February and 20 December.

Table 13 Summary of SPMP data collected during the reporting period (mg/Nm^3)

Stack	Avg period	Max	Min	Mean	99th %ile	95th %ile	Data capture
4A	1-hour	160.1	0.0	15.3	61.5	40.2	100%
	24-hour	53.2	0.0	15.3	47.6	31.1	100%
4B	1-hour	118.1	0.0	1.8	18.4	5.7	100%
	24-hour	13.3	0.0	1.8	8.4	4.8	100%

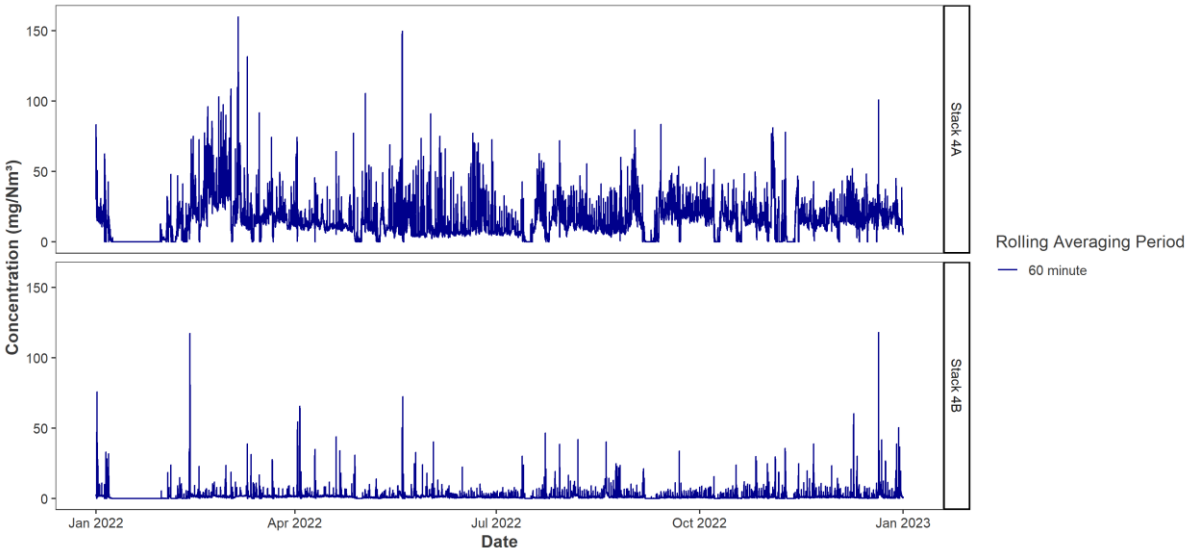

Figure 6 **Rolling 1-hour average in-stack TSP concentrations (mg/Nm^3) measured at Stacks 4A and 4B during the reporting period**

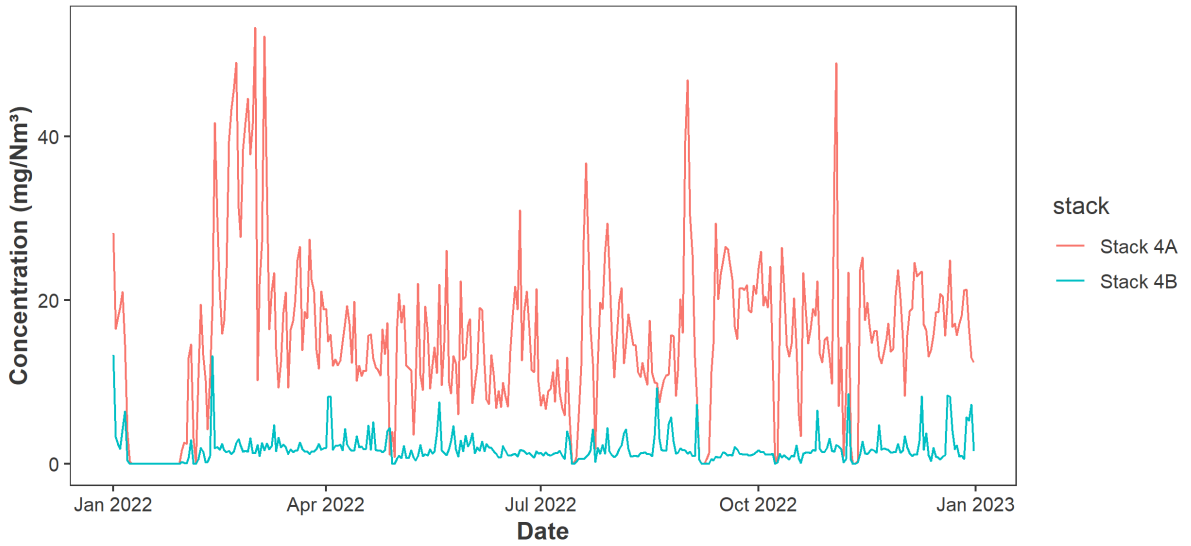

Figure 7 **24-hour average in-stack TSP concentrations (mg/Nm^3) measured at Stacks 4A and 4B during the reporting period**

3.4 Meteorology

Forecast and observed meteorological data was provided by the Dark Sky data service. A timeseries of hourly average meteorological observations for the reporting period is presented in Figure 8. Meteorological data is also collected at each of the dust monitoring locations. The distribution of wind speed and wind direction measured at each monitor is presented as a wind rose in Figure 9.

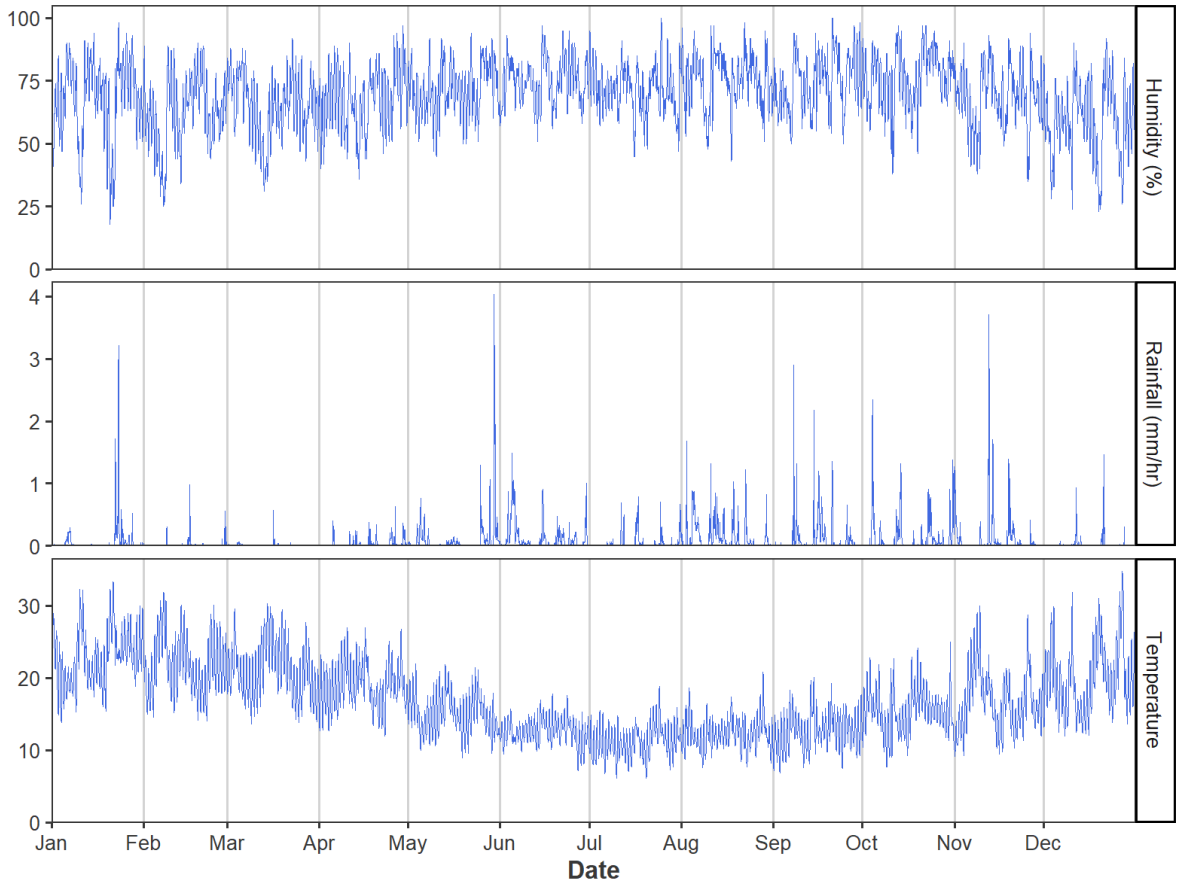

Figure 8 **Meteorological observations for Birkenhead during the reporting period**

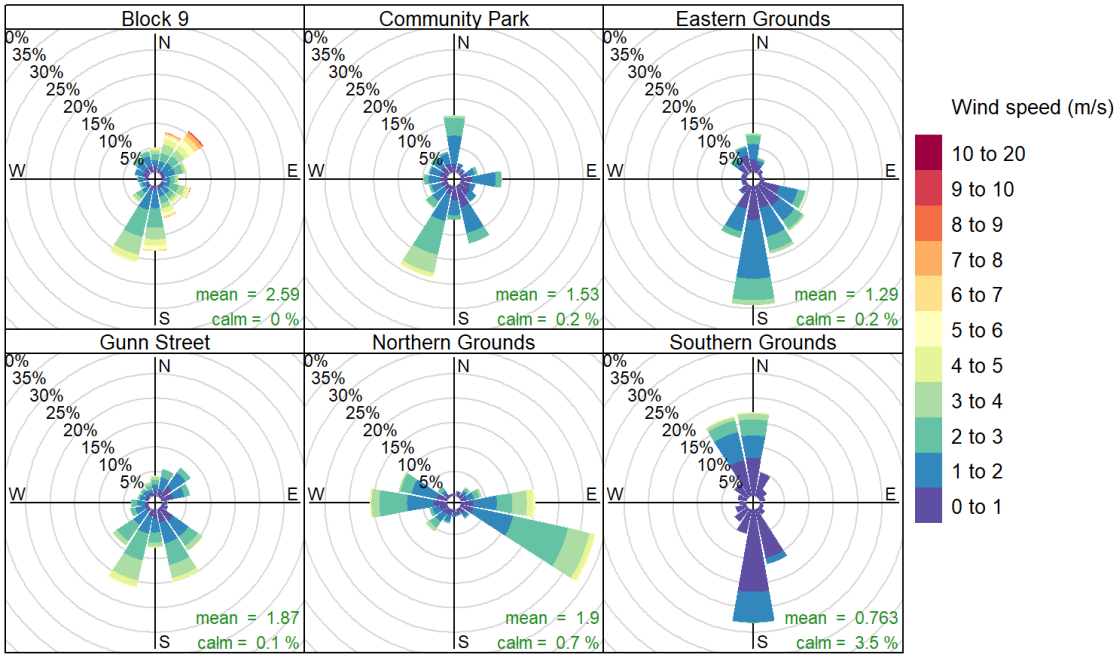

Figure 9 **Distribution of wind speed and direction measured at ABC monitoring sites during the reporting period**

3.5 EPA Monitoring

The closest EPA monitoring site to ABC's Birkenhead facility is Le Fevre 1. The 24-hour average concentrations of PM_{10} and $PM_{2.5}$ collected at Le Fevre 1 during the reporting period are shown in Figure 10 and Figure 11, respectively. Concentrations of PM_{10} and $PM_{2.5}$ measured at the other monitors within the EPA network are also shown in the figures as grey lines to provide the context of regional dust levels.

The data show that:

- 24-hour average concentrations of PM_{10} at Le Fevre 1 exceeded the EPA criterion of 50 µg/m^3 once during the reporting period, on 20 January 2022 – this correlates with the maximum 24-hour average concentration recorded at the Northern Grounds monitor,
- 24-hour average concentrations of PM_{10} at Le Fevre 1 were also elevated on 21 January 2022 (46.2 µg/m^3) but did not exceed the EPA criterion
- 24-hour average concentrations of $PM_{2.5}$ at Le Fevre 1 did not exceed the EPA criterion of 25 µg/m^3 during the reporting period

Two other EPA monitors also recorded exceedances of the EPA criterion for PM_{10} around 20 January 2022:

- 24-hour average concentrations of PM_{10} at Netley exceeded the EPA criterion on 20 January 2022
- 24-hour average concentrations of PM_{10} at Whyalla Walls St exceeded the EPA criterion on 21 January 2022

The Netley monitor is located close to Le Fevre 1, to the west of Adelaide CBD, and so the exceedance at this monitor is likely related to the exceedance at Le Fevre 1 on the same day. The Whyalla Walls St monitor is located far from Le Fevre 1. Combined with the lack of significantly elevated concentrations at monitors between Whyalla Walls St and Le Fevre 1, it is considered unlikely that the exceedance at Whyalla Walls St is related to the exceedance at Le Fevre 1 the previous day. Furthermore, as discussed in Section 3.2, the on-site monitor at Northern Grounds recorded the highest on-site 24-hour average concentrations of PM_{10} and $PM_{2.5}$ on 20 January 2022. This indicates that the exceedance of the 24-hour EPA criterion for PM_{10} at Le Fevre 1 was likely due to a source of dust reasonably local to Adelaide.

Since this exceedance was during the annual plant shutdown period (from 7January 2022 to 6 February 2022) it is unlikely that emissions from the Facility contributed significantly to the exceedance.

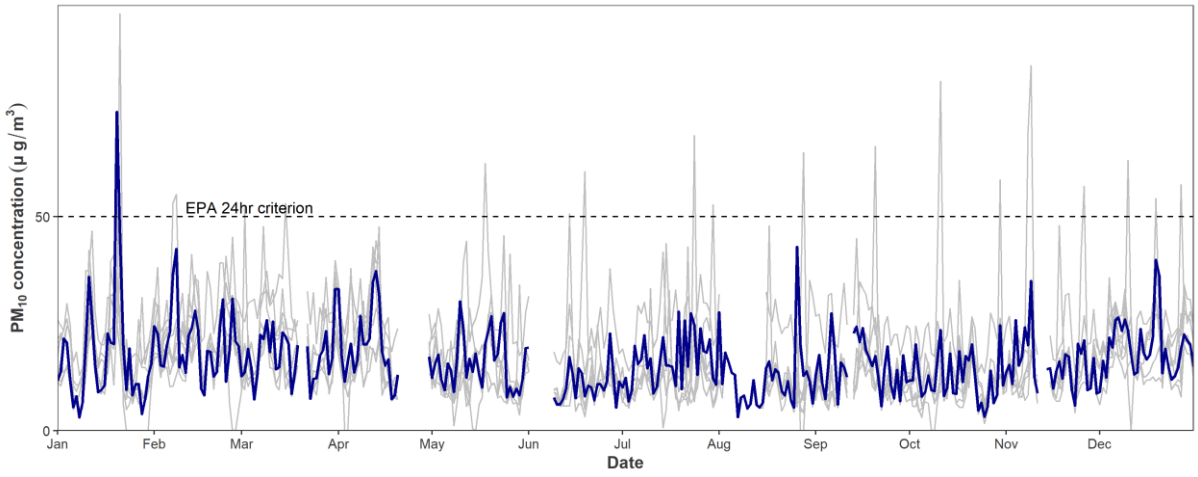

Figure 10 24-hour average concentrations of PM_{10} recorded at Le Fevre 1 (blue) and other EPA monitoring sites (grey) during the reporting period

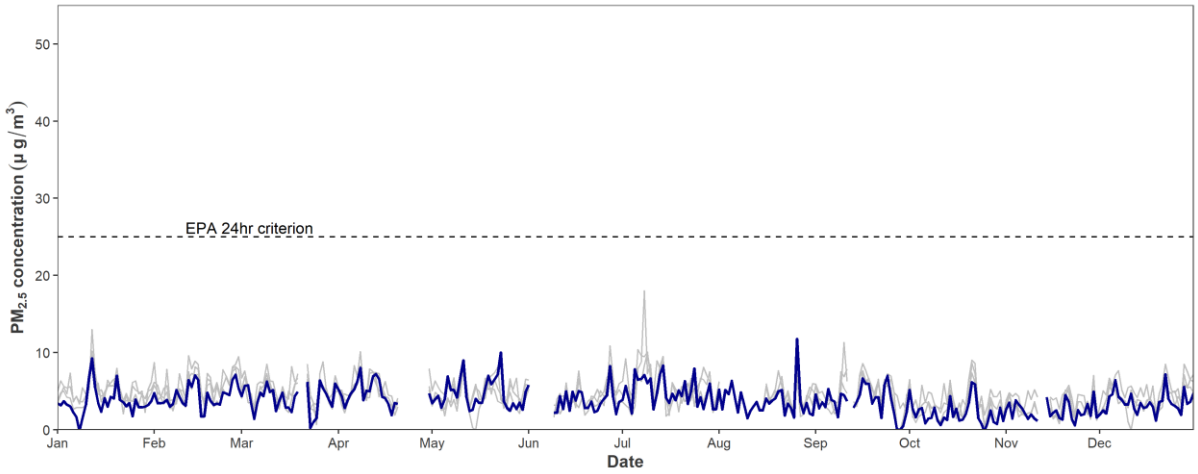

Figure 11 24-hour average concentrations of $PM_{2.5}$ recorded at Le Fevre 1 (blue) and other EPA monitoring sites (grey) during the reporting period

4. COMPLAINTS

There were 11 complaints relating to dust made during the reporting period; these are detailed in Table 14. This is a significant decrease in comparison to the dust-related complaints generated in 2021 (37), 2020 (22) and 2019 (47).

It should be noted that dust complaints often relate to a gradual build-up of dust, so the day of the complaint does not necessarily relate to the day of the dust emissions that led to the complaint. This is acknowledged as a limitation to some of the analysis presented in Section 5. Despite this, multiple complaints on a single day can indicate more significant dust impacts at that time – on no day in 2022 was there more than one dust-related complaint.

Table 14 Dust complaints made during the reporting period

Date	Complaint Description	Direction from Site	Distance from Site (km)
8/01/2022	ESCL #1558 Dust from Block 9	N	0.05
3/02/2022	Grey dust found in heat exchanger area within the adjoining Viva plant	N	0.05
18/05/2022	Dust on Car	WNW	0.46
23/05/2022	ESCL#1586 dust complaint on car	W	0.53
9/07/2022	Smoke (initial) - following investigation classified as a dust issue	Undefined	0.00
28/07/2022	Dust on Cars	WNW	0.41
27/08/2022	ESCL # 1596 - Complaint of cement dust on 2 brand new cars that would not wash off	N	2.31
29/08/2022	EPA CARES# 159480 - 29 August 2022 Dust on car	N	2.31
28/09/2022	ESCL#1598 Smoke, soot Semaphore park	N	0.00
10/10/2022	ESCL # 1600 Resident required information about cement dust	Undefined	0.00
11/10/2022	ESCL # 1601 Dust/sediment on roof solar panels	WSW	0.79

5. TARP EFFECTIVENESS

The data analysis detailed in Section 3 shows that there were 591 trigger alerts during the reporting period of 365 days, comprised of:

- 287 low trigger alerts
- 227 medium trigger alerts
- 77 high trigger alerts

It must be remembered that trigger alerts are not necessarily a result of emissions from the Facility; they can be caused by a variety of factors, including meteorological forecasts and regional dust episodes. The majority of trigger alerts (63%) were generated based on measured concentrations at the Northern Grounds and Eastern Grounds monitors, with the remaining trigger alerts (37%) being generated based on measured concentrations at the Southern Grounds and Block 9 monitors and forecast meteorology. There were no trigger alerts generated from visual dust observations, or from meteorological observations, indicating that there was no period of 20 consecutive days with less than 1 mm of total rainfall.

In response to the 591 trigger alerts, ABC undertook 1,662 actions, or, on average, approximately 3 actions per trigger alert. This is a reduction in the number of actions per trigger compared to the previous reporting period (1 January 2021 to 31 December 2021).

One metric of TARP effectiveness is a lack of dust impacts on the nearby community potentially attributable to emissions from the Facility. Figure 12 plots measured TSP concentrations in kiln stack 4A and pre-calciner stack 4B against measured concentrations at the nearby community ambient air quality monitors, to see if there is a relationship between the two (i.e. whether the stack emissions appear to influence ambient concentrations in the community). The figure shows that:

- The highest PM_{10} levels recorded at both Community Park and Gunn Street did not coincide with high in-stack TSP concentrations
- The highest in-stack TSP levels did not coincide with high off-site concentrations at Community Park or Gunn Street
- The lack of a positive relationship between stack particulate emissions concentrations and ambient concentrations suggests that the stack emissions have little influence on local particulate concentrations

There is, therefore, little evidence that off-site concentrations of particulates in the local community depend on in-stack concentrations.

Dust-related complaints and off-site ambient monitoring of particulates have also been analysed as indicators of possible dust impacts. The GLPMRP data for off-site monitors presented in Section 3.2 shows that there were no exceedances of the 24-hour average criterion for PM_{10} or $PM_{2.5}$ at either Community Park or Gunn St during the reporting period. The EPA monitoring data presented in Section 3.5 further indicates that there were no exceedances of the 24-hour average criteria for PM_{10} or $PM_{2.5}$ at Le Fevre 1 attributable to emissions from the Facility. Hence there were no exceedances attributable to emissions from the Facility at any off-site or EPA monitor. Additionally, as discussed in Section 4, there were significantly fewer dust-related complaints in 2022 than in any of the previous three reporting periods and no day in 2022 saw more than one complaint filed. This indicates that dust impacts on the nearby community from all sources were less frequent and/or lesser in magnitude than in previous years.

While analysis of the relationships between the complaints and ambient monitoring data is complicated by the small number of complaints, some qualitative conclusions can still be drawn. Timeseries of 24-hour average concentrations of PM_{10} at the off-site monitors are shown in Figure 13, with the dust complaint dates marked as vertical dashed lines. Figure 13 shows that there were two dust complaints shortly after the highest measured

concentration at Community Park; however, complaints were also submitted at times when measured concentrations were not elevated, such as in October.

It is relevant to note that complaints may not reflect specific elevated dust events, instead reflecting extended periods of low levels of dust accumulating over time. This possibility may indicate a cumulative combination of broader dust sources, as measured by the EPA monitoring network (Figure 10 and Figure 11), in combination with on-site operations. However, given that many of the elevated particulate concentrations recorded by the EPA monitoring network are not observed at the Community Park, Gunn St or on-site monitors, and considering the proximity of complaints to the site being largely less than 1 km, local sources of dust at least contributing to the cause of these complaints is likely.

Given that local sources are likely contributors to dust-related complaints in the nearby community, another metric of TARP effectiveness is whether dust impacts in the community are covered by trigger alerts at the Facility. The relationship between daily trigger alert numbers (the coloured boxes) and complaints (dashed lines) is investigated in Figure 14. Some complaints appear to coincide with periods of frequent trigger level exceedances, but this is less the case for some of the complaints. As has been mentioned previously, these trigger level exceedances could relate to regional dust episodes or other factors, and do not necessarily indicate that the Facility is the source of the dust emissions that have led to the complaints. What this does suggest is that the triggers are likely effective in identifying certain conditions that could lead to dust complaints.

Figure 15 provides the 1-hour average concentration of PM_{10} at the Community Park and Gunn St off-site monitoring sites during the reporting period, along with the 1-hour rolling average in-stack concentrations of TSP (mg/m^3) from Stacks 4A and 4B. High trigger alerts are identified with a grey vertical marker in Figure 15 and their frequency is shown in Figure 16. The figures show that although high trigger alerts regularly do not correspond with elevated PM_{10} concentrations at the off-site monitoring locations, the majority of actual elevated PM_{10} events were also covered by a trigger alert. This further suggests that the triggers are likely effective in identifying certain conditions that could lead to elevated concentrations of particulates at the off-site monitors.

Combined with the complaints analysis, this suggests that the triggers are likely effective in identifying certain conditions that could lead to dust impacts in the community and should in turn, through the actions and responses taken by ABC staff, reduce the likelihood of the Facility contributing to these impacts.

A third metric of TARP effectiveness is, therefore, how dust impacts in the nearby community are affected when an action is performed in response to a trigger alert at the Facility. To examine these effects, Figure 17 to Figure 22 show boxplots of the mean concentration of PM_{10} at the off-site monitors 3-6 hours before an alert is triggered, 0-3 hours before an alert is triggered, 0-3 hours after an alert is triggered and 3-6 hours after an alert is triggered. Each figure corresponds to a particular source of alerts.

For the concentration-based alerts, which are triggered when measured concentrations of PM_{10} or $PM_{2.5}$ at a particular site exceed certain thresholds, effective response actions would be expected to be associated with increasing concentrations over the 6 hours before the alert was triggered and decreasing concentrations over the 6 hours after the alert was triggered. It is relevant to note that the concentration-based alerts do not consider wind speed or direction, and so the expected trend is affected by the location of the alerting site relative to the off-site monitors and the Facility. The alerting site and off-site monitor(s) would need to be experiencing elevated dust at the same time for this trend to be expected.

A trend suggesting effective response actions is observed most strongly in Figure 17 for alerts from Southern Grounds, as would be expected since this monitor is downwind of the Facility under similar wind conditions to the off-site monitors. Figure 18 (Eastern Grounds) and Figure 21 (Northern Grounds) both also show this expected trend. These monitors would likely be affected at the same time as the off-site monitors under calm conditions with low dispersion of fugitive dust. The trends in these plots indicate that actions taken in response to these trigger alerts in accordance with the TARP are effective at managing fugitive dust emissions from the Facility.

Figure 20 (Block 9) does not show the same trend. The Block 9 monitor is located on the northeastern boundary of the Facility and so is never downwind of the Facility at the same time as the off-site monitors. It is, therefore,

expected that measured concentrations at the off-site monitors would have little dependence on actions taken in response to alerts from Block 9. Given the evidence of the effectiveness of the actions taken in response to trigger alerts from the other sites, it is reasonable to assume that actions taken in response to trigger alerts from Block 9 are likely to be similarly effective at managing fugitive dust emissions from the Facility.

For the meteorological forecast-based alerts, which inform ABC staff of dust risk before elevated concentrations have the opportunity to occur, an effective response action would be associated with minimal change in the concentrations measured off-site. Figure 22 does indeed show no obvious dependence of measured off-site concentrations on actions taken in response to forecast meteorology trigger alerts, indicating that the actions being taken are effective at preventing significant fugitive dust emissions. Since these trigger alerts do not consider on-site or in-stack concentrations, the large amount of variance in the boxplots is expected.

Taken as a whole, these results indicate that the TARP is working effectively in maintaining dust levels off-site within guideline values. The analysis indicates that dust controls are being applied effectively and trigger levels are sufficient to identify periods of elevated dust risk. The large number of alerts suggests that the trigger levels may be conservative, but the evidence of trigger actions affecting offsite concentrations suggests that revision would risk increasing off-site impacts. The current trigger levels are, therefore, considered appropriate.

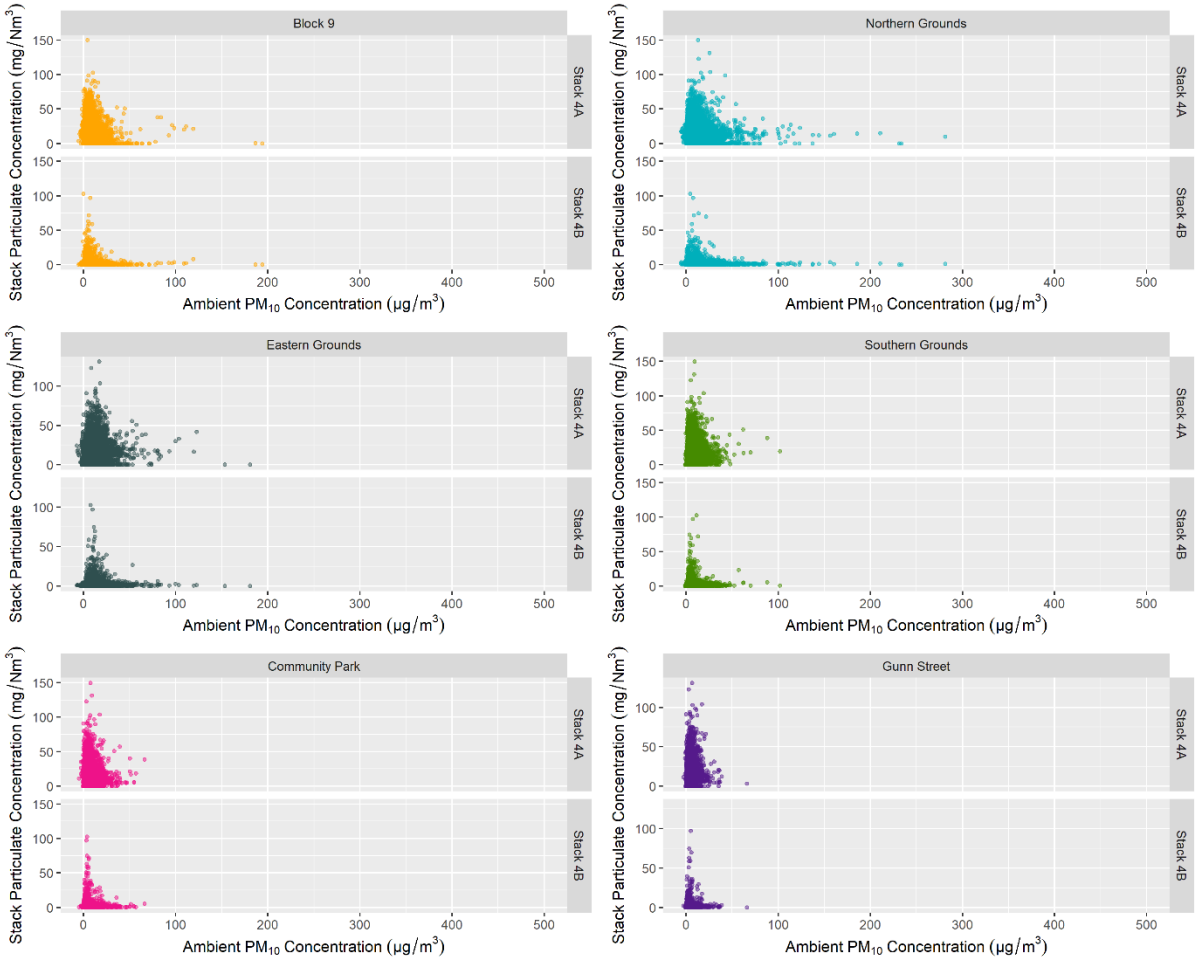

Figure 12 Scatter plot of 1-hour average in-stack TSP concentrations (mg/Nm^3) measured at Stacks 4A and 4B compared to 1-hour average ambient measurements at all on-site and off-site monitors for the reporting period

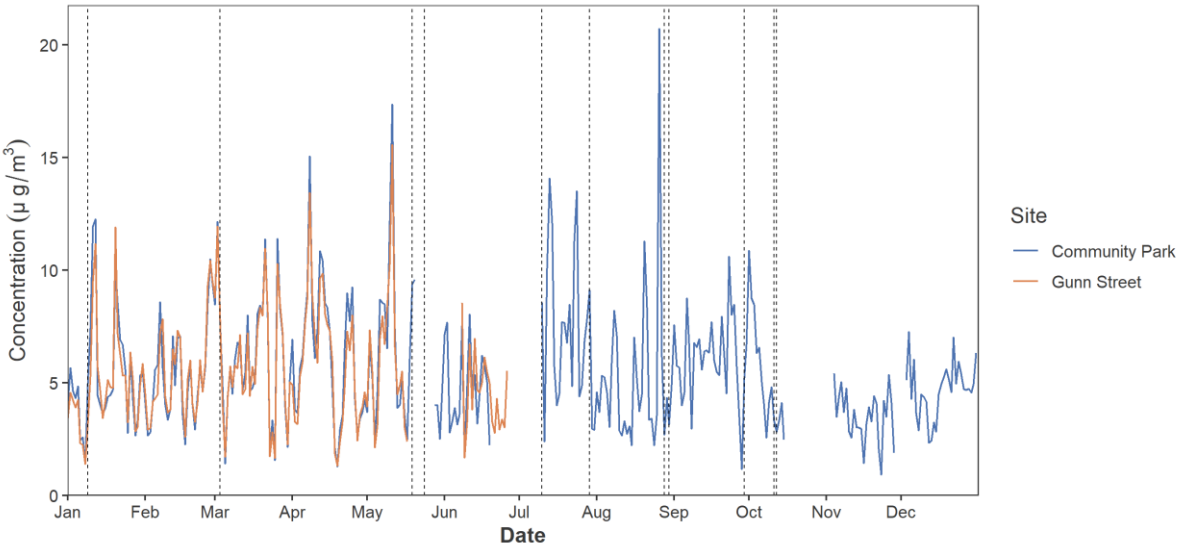

Figure 13 Dust complaints reported (vertical dashed lines) and corresponding 24-hour average concentration of PM_{10} (µg/m³) at the off-site monitoring stations

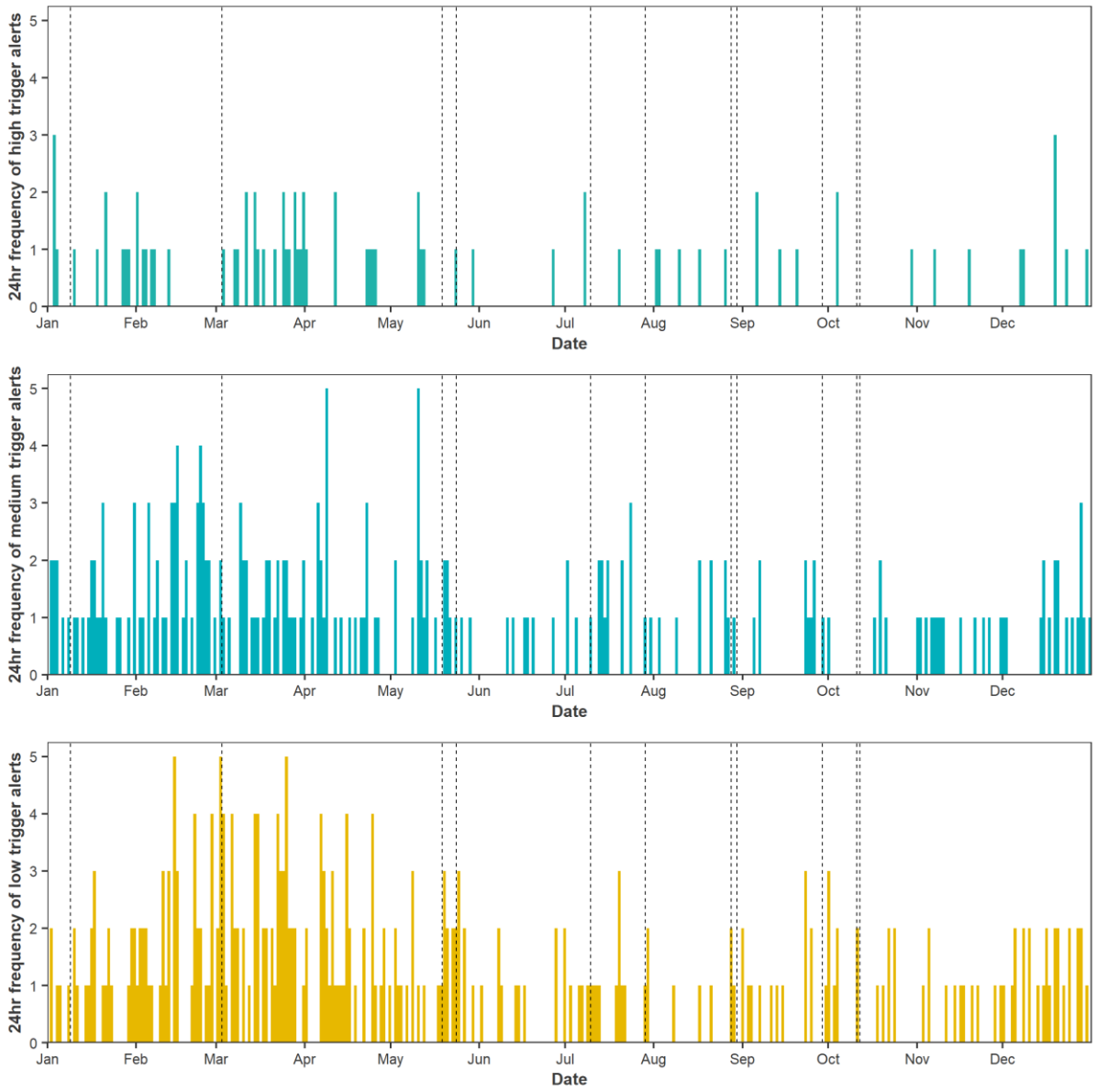

Figure 14 Trigger alerts and complaints during the reporting period

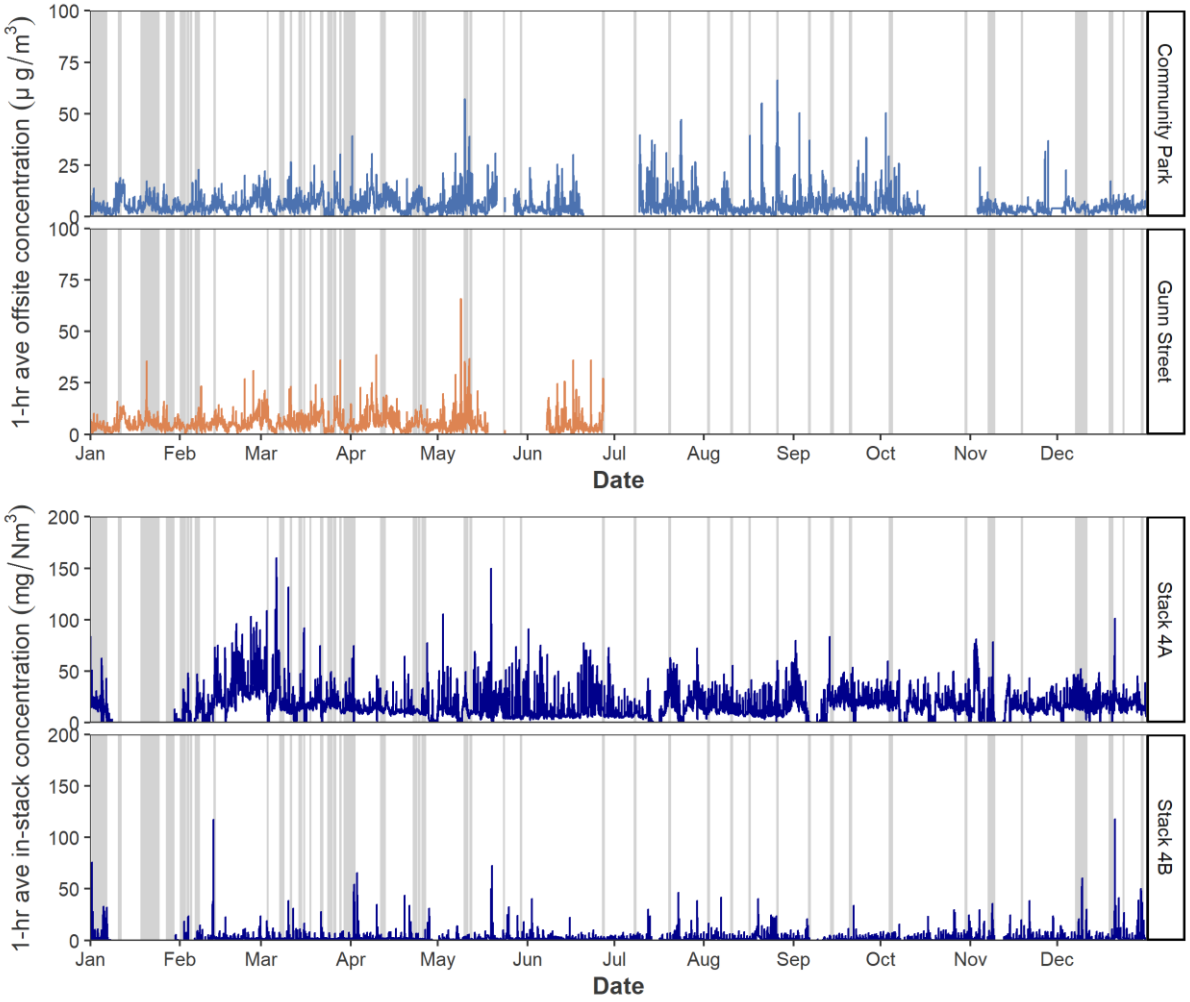

Figure 15 **1-hour average concentration of PM_{10} (µg/m^3) at off-site monitoring sites and rolling 1-hour average in-stack TSP concentrations (mg/Nm^3) from Stacks 4A and 4B with period of 'high' triggers marked in grey**

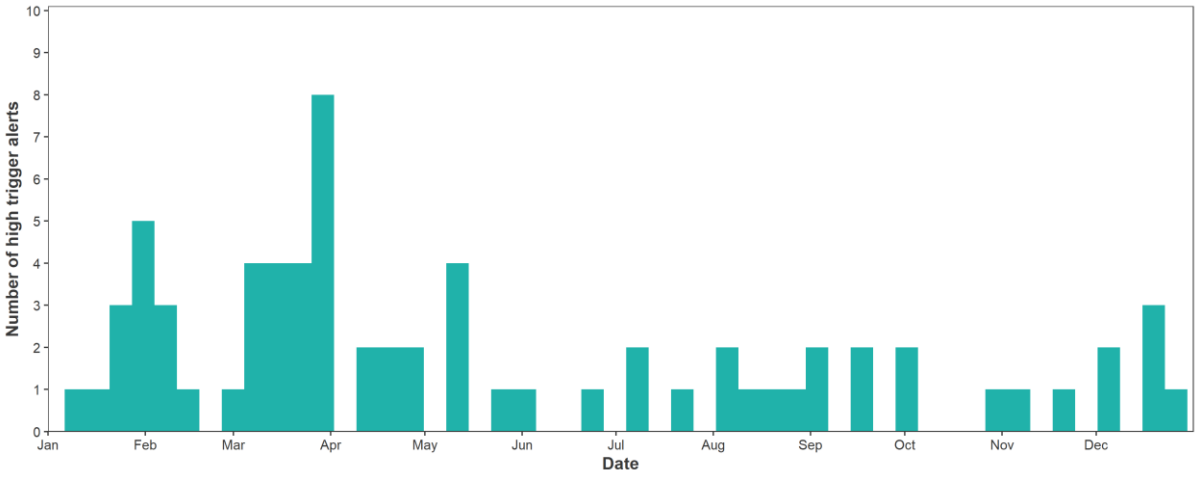

Figure 16 **Frequency of high trigger alerts during the reporting period**

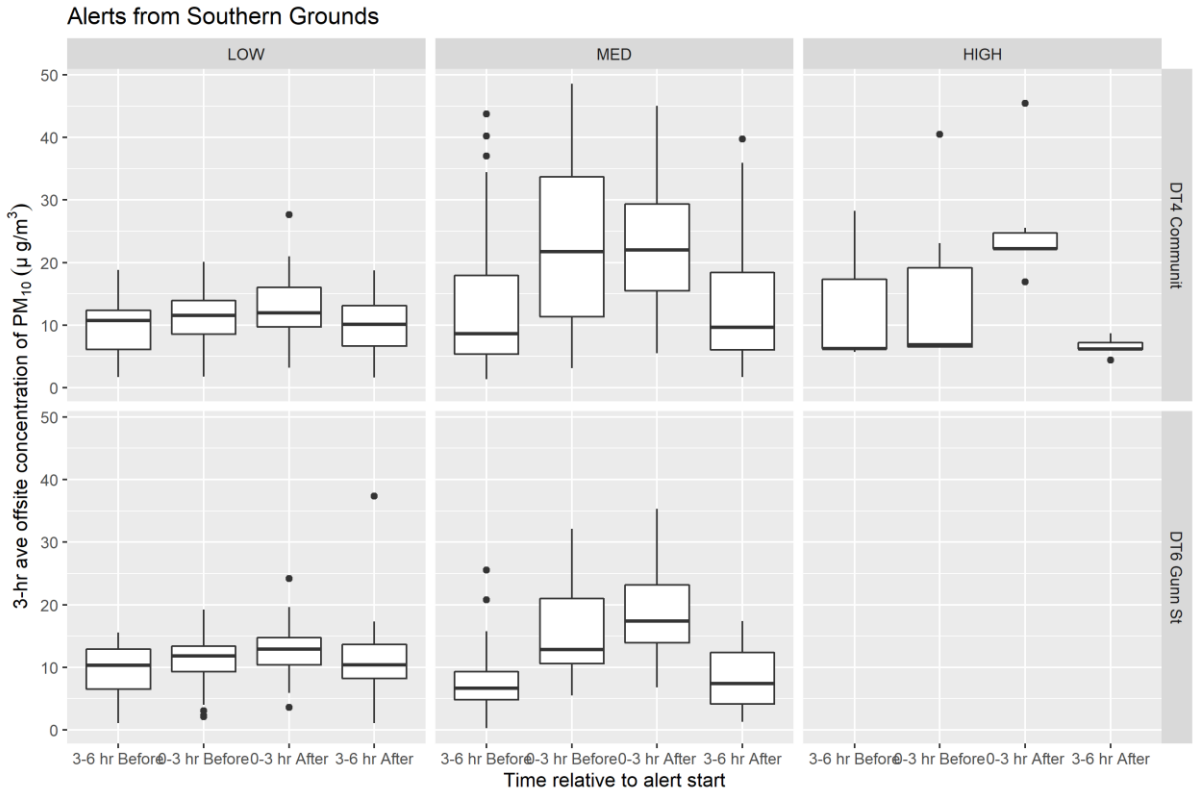

Figure 17 **Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a trigger alert from the Southern Grounds monitor**

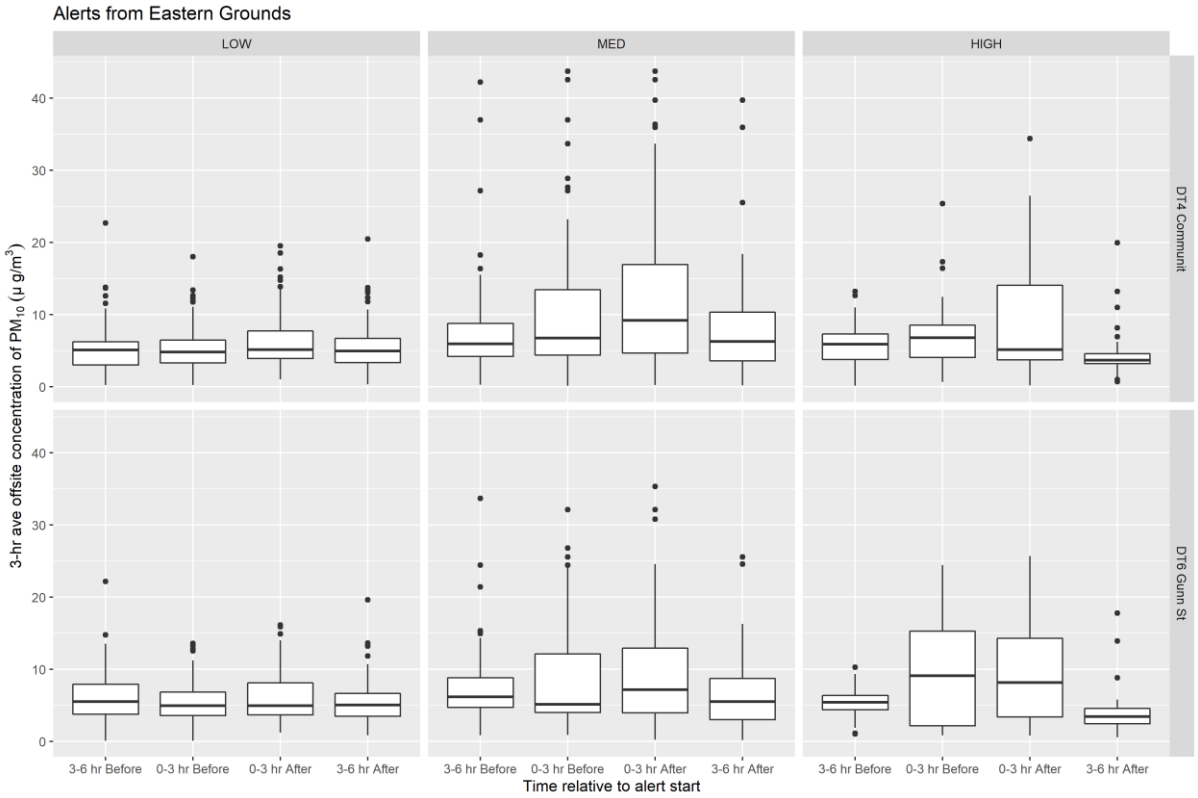

Figure 18 **Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a trigger alert from the Eastern Grounds monitor**

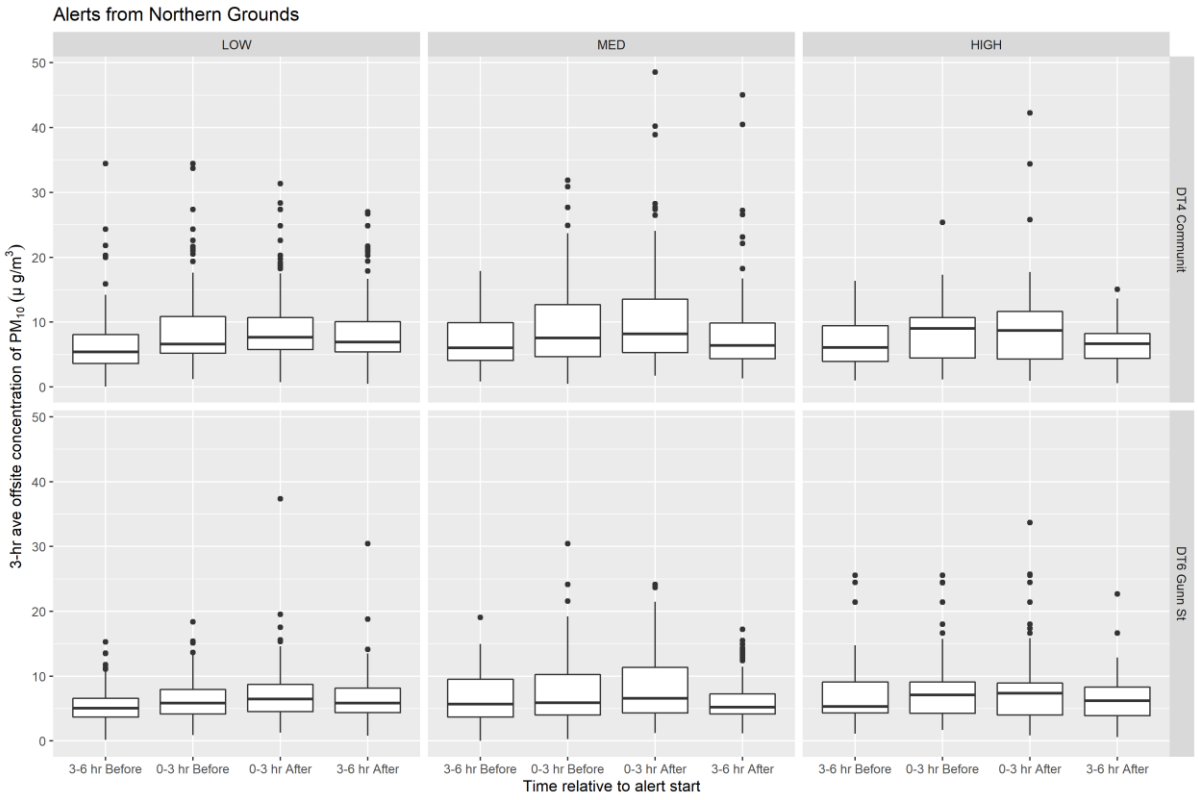

Figure 19 **Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a trigger alert from the Northern Grounds monitor**

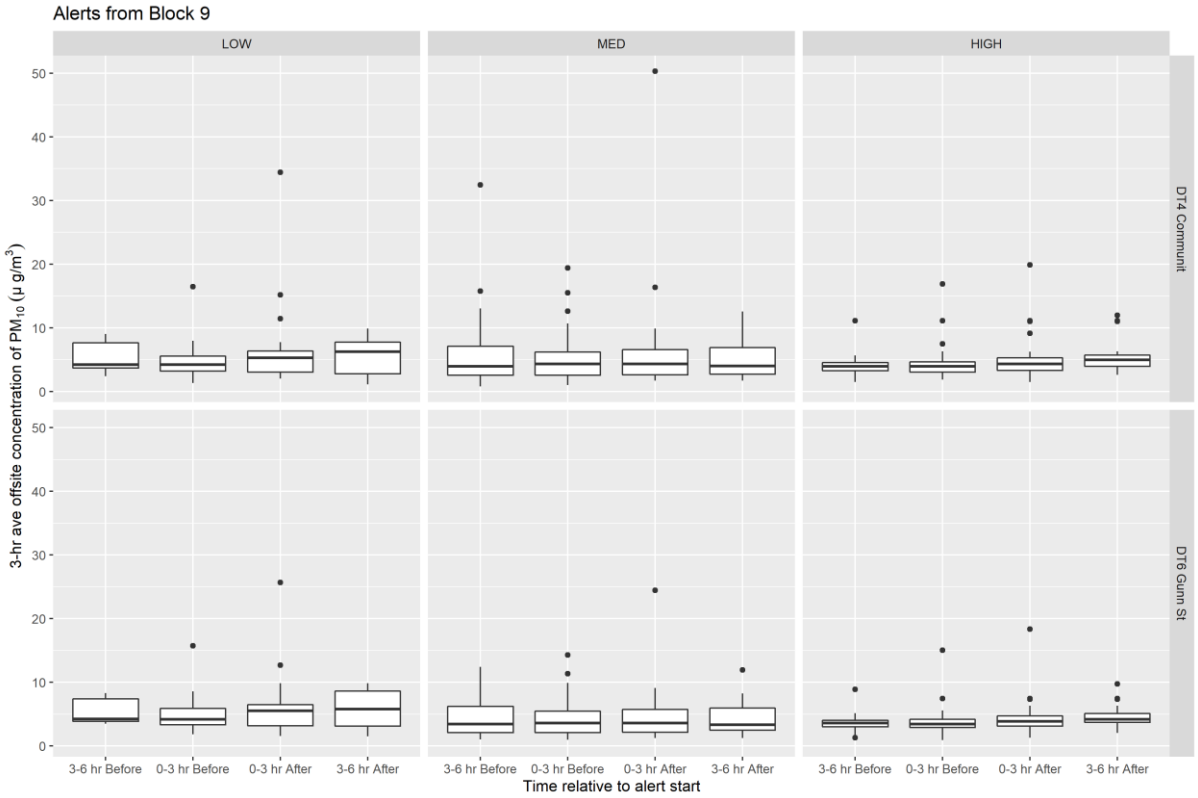

Figure 20 **Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a trigger alert from the Block 9 monitor**

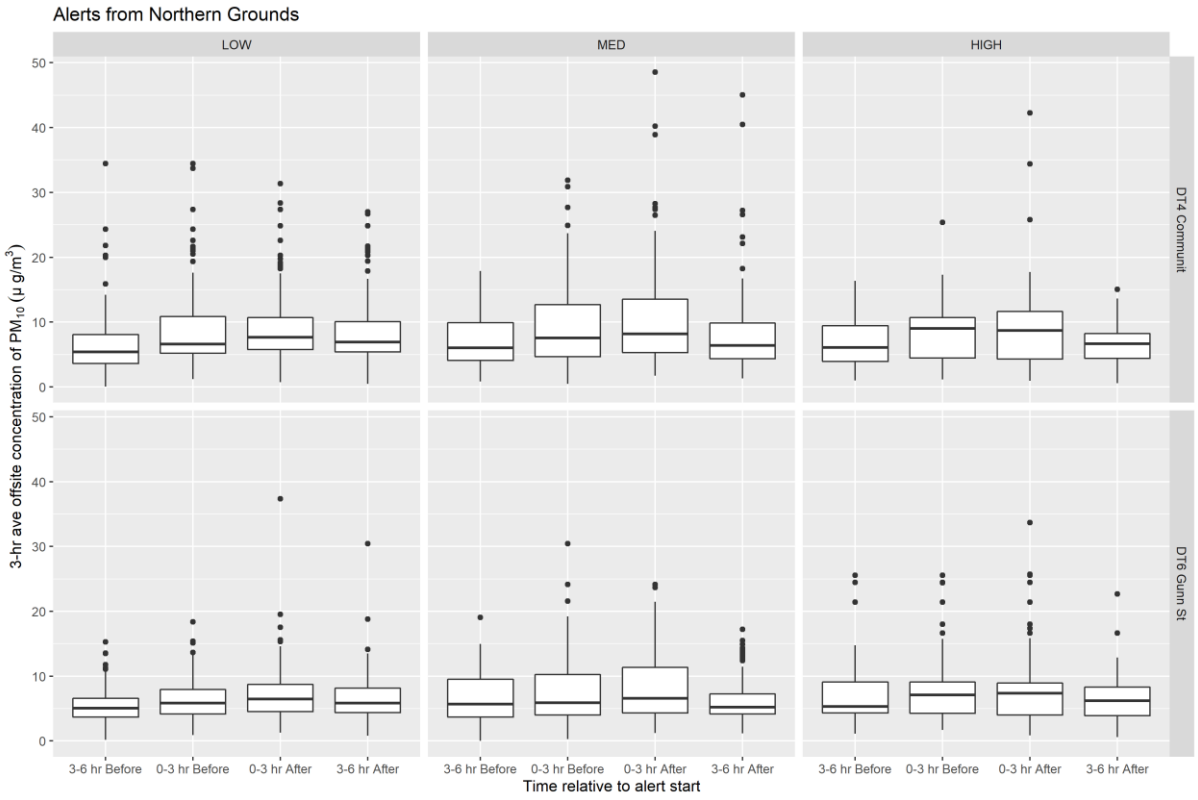

Figure 21 Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a trigger alert from the Northern Grounds monitor

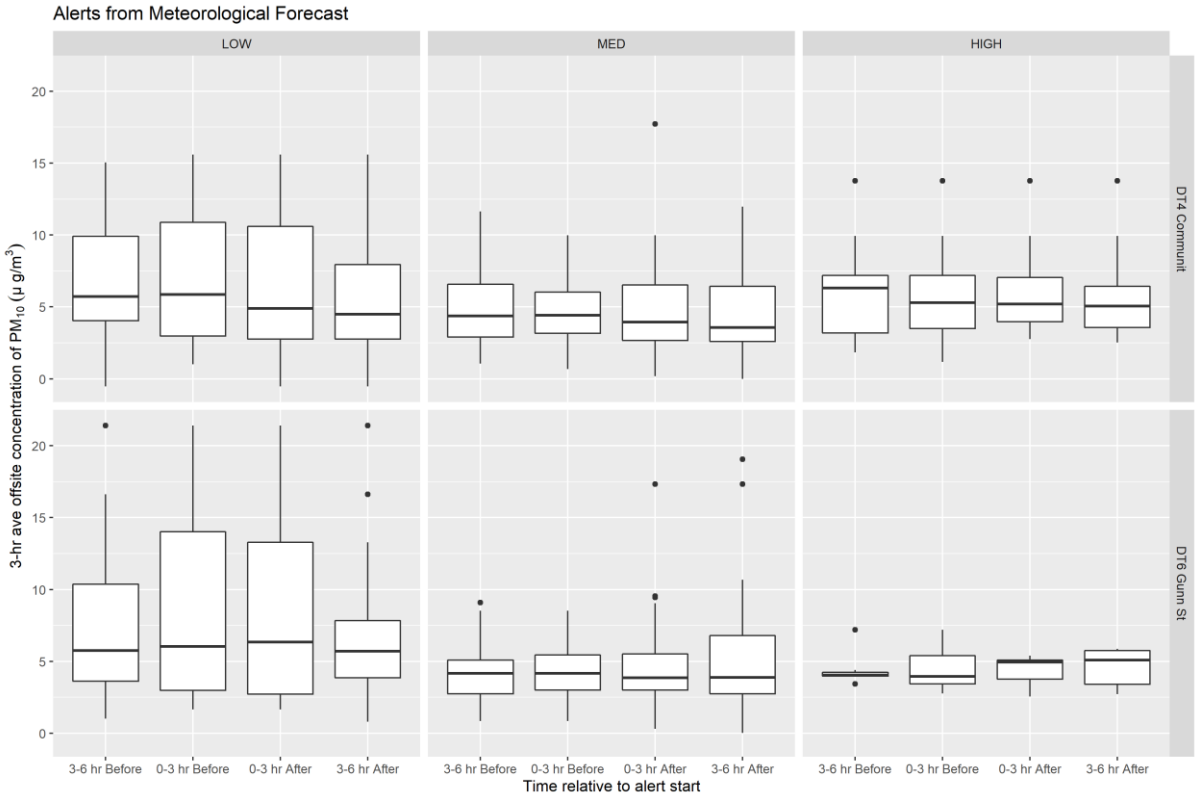

Figure 22 Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a Meteorology Forecast trigger alert

6. CONCLUSIONS

Katestone was commissioned by ABC to complete a review of the TARP data collected for the period 1 January 2022 to 31 December 2022 inclusive (the reporting period).

The TARP is implemented and managed at ABC's Birkenhead facility through a Dust Management Dashboard operated in the Birkenhead Control Room. This includes receiving alerts that are triggered by monitoring or forecast data or observations of visible dust, analysis of air quality monitoring data, logging responses/actions and closing alerts. Analysis of the TARP data during the reporting period shows the following:

- A total of 591 triggers were recorded, including 287 low level triggers (49%), 227 medium level triggers (38%) and 77 high level triggers (13%)
- Low, medium and high level triggers occurred with decreasing frequency at all sites
- The sites/parameters that generated the most triggers were Northern Grounds (219) and Eastern Grounds (152), followed by Meteorology – forecast (97), Southern Grounds (93) and Block 9 (30)
- No triggers were generated by on-site visual dust observations or meteorological observations during the reporting period
- A total of 1,662 actions were taken, including 457 actions against low level triggers (27%), 738 actions against medium level triggers (44%) and 467 actions against high level triggers (28%)
- The most actions were generated by Northern Grounds (634), Meteorology – forecast (398) and Eastern Grounds (297), followed by Southern Grounds (189) and Block 9 (144)
- On average, approximately 3 separate actions were performed for every trigger. This is a reduction in the number of actions per trigger compared to the previous reporting period (1 January 2021 to 31 December 2021)
- Although high trigger alerts regularly did not correspond with elevated PM_{10} concentrations at the off-site monitoring locations, the majority of actual elevated PM_{10} events at the off-site monitoring locations were also covered by a trigger alert of some level
- The highest PM_{10} levels recorded at both Community Park and Gunn Street did not coincide with high in-stack TSP concentrations
- The highest measured TSP levels in emissions from kiln stack 4A and pre-calciner stack 4B did not coincide with high off-site concentrations at Community Park or Gunn Street
- The lack of a positive relationship between particulate concentrations in stack emissions concentrations and ambient concentrations suggests that the stack emissions have little influence on local particulate concentrations

Ambient concentrations of PM_{10} and $PM_{2.5}$ are measured through the Dust Management Dashboard. Analysis of the Ground Level Particulate Monitoring Program data collected during the monitoring period shows the following:

- Data capture at the monitoring sites varied, and none of the Gunn Street, Community Park, Eastern Grounds or Northern Grounds monitors achieved the 90% data capture limit prescribed in the GLPMRP
- The lack of data capture over the reporting period was principally due to intermittent problems with data transfer from the monitors to the Katestone FTP server (this issue first appeared in April 2022 and was resolved in December 2022), although the Gunn Street monitor was removed on 28 June 2022 due to the property on which it was located being sold for redevelopment
- The 24-hour average concentrations of $PM_{2.5}$ and PM_{10} did not exceed the EPA criteria at either the Community Park or Gunn Street monitoring sites during the reporting period

- This is a slight decrease compared to the previous reporting period (January 2021 to December 2021) which showed one PM_{10} exceedance at Community Park and one PM_{10} and $PM_{2.5}$ exceedance at Gunn Street. However, this may have been influenced by the deactivation of the Gunn Street monitoring site and reduced data capture at the Community Park monitoring site.
- The highest on-site 24-hour average concentrations of PM_{10} and $PM_{2.5}$ were both recorded at Northern Grounds on 20 January 2022 (63.7 µg/m^3 and 40.4 µg/m^3, respectively):
- It does not appear that on-site operations are significantly contributing to off-site particulate monitoring concentrations at Community Park or Gunn Street

Analysis of concentrations at community monitors in the hours before and after trigger alerts have been generated suggest that effective response actions are being taken to prevent unacceptable fugitive dust emissions from the Facility.

The analysis carried out has demonstrated that the TARP is working effectively to reduce off-site particulate concentrations and prevent exceedances, despite dust complaints continuing to be generated in the nearby community (albeit at much-reduced levels compared to previous years). Compared to the number of dust-related complaints and number of off-site exceedances recorded for the previous three reporting periods, there was a significant decrease in 2022, as shown in Table 15.

It is recommended to maintain the current trigger levels considering the lack of off-site exceedances observed throughout this reporting period and the risk of increased off-site impacts if trigger levels were increased.

Table 15 Comparison of community impacts between the 2022 and 2021 reporting periods

Dust impact	Frequency of dust impact over each reporting period			
	1 January 2019 – 31 December 2019	**1 January 2020 – 31 December 2020**	**1 January 2021 – 31 December 2021**	**1 January 2022 – 31 December 2022**
Dust-related complaints	47	22	37	11
PM_{10} exceedance at Gunn St and/or Community Park	5	5	1	0
$PM_{2.5}$ exceedance at Gunn St and/or Community Park	10	36	2	0