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2023 Annual Report and TARP Review

Compliance date: 15/02/2024

EPA Licence 1126: Air Particulate Management Plan (U-1549)

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

62 Elder Road, Birkenhead, SA 5015

Date of Submission: **15 February 2024**

Version Number: **1**

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

Glossary

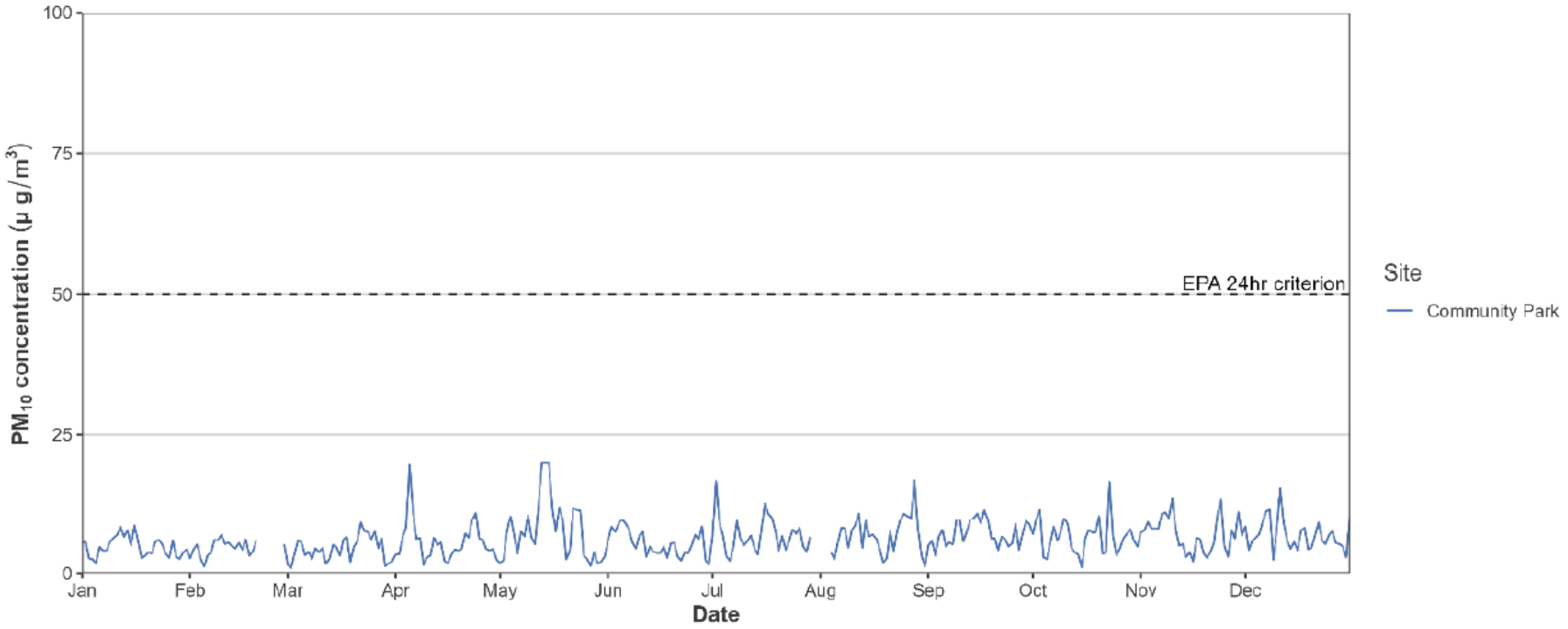
Term	Definition
µg/m^3	micrograms per cubic metre
mg/m^3	milligrams per cubic metre
µm	micrometre
°C	degrees Celsius
m	metre
m^3	cubic metre
m^3/s	cubic metres per second
Nomenclature	**Definition**
PM_{10}	Particulate matter with a diameter less than 10 micrometres
$PM_{2.5}$	Particulate matter with 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 Air Particulate Management Plan (APMP) (formerly Dust Management Plan) 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 Air Particulate Management Plan, approved 16 October 2023, by SA EPA. The plan is available on the ABC Birkenhead Community website: https:// http://www.birkenheadcommunity.com.au
Background Information	The APMP 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 APMP. 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 APMP is for the reporting period 1/1/2023 to 31/12/2023.

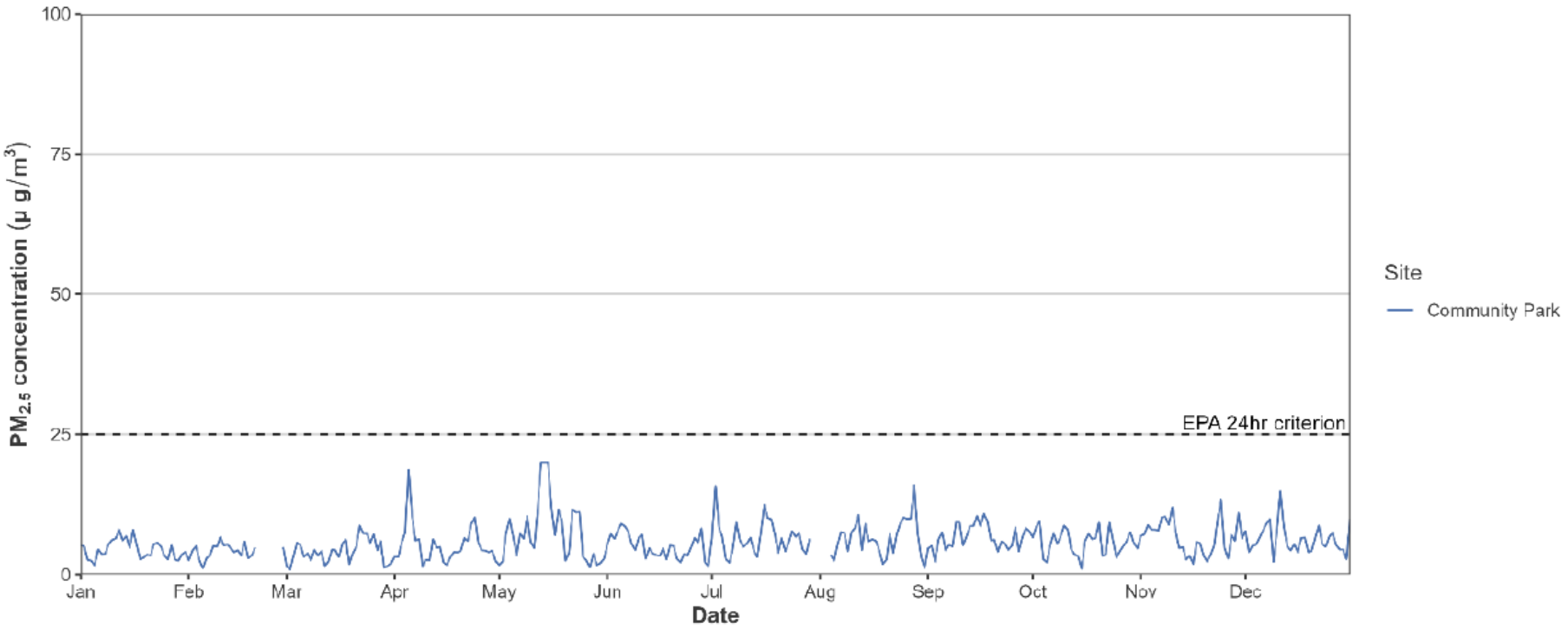
Reporting Objective	To review the effectiveness of the Trigger Action Response Plan (TARP) contained within the approved Air Particulate Management Plan (APMP) and includes; • Review of all trigger values and frequency of occurrence • A review of the effectiveness of all action and response strategies • 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-1555 and U-1556 • 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). The The property (not owned by ABC), on which the Gunn Street monitor was located, was sold for redevelopment and is no longer available for use. As a consequence the monitor was removed on 28 June 2022. A new monitoring location is currently being determined.

Summary of findings from the TARP Review	A review of the Trigger Action Response Plan data, for the reporting period, 1 January 2023 – 31 December 2023, has been undertaken by Katestone Pty Ltd. (Katestone), in accordance with the requirements of the Air Particulate Management Plan. Katestone's report is attached as an Appendix to this report. **Review of trigger values and frequency of occurrence** The data analysis shows that there were 639 trigger alerts during the reporting period, comprising of: • 342 low trigger alerts • 224 medium trigger alerts • 73 high trigger alerts. The sites that generated the most triggers were Northern Grounds (257) and Eastern Grounds (175), Southern Grounds (116), Meteorology – forecast (57) and Block 9 (32)and meteorology – observations (2). In response to the 639 trigger alerts, ABC undertook 1772 actions, including 501 actions against low level triggers (29%), 767 actions against medium level triggers (45%) and 454 actions against high level triggers (26%). Sites that generated the most actions were Northern Grounds (659), Eastern Grounds (473), Meteorology - forecast (268), Southern Grounds (227) and Block 9 (70), and Meteorology observations (25). **Review and analysis of data collected from licence conditions; Ground Level Particulate Monitoring and Reporting Plan (GLPMRP) - (U-1555) and Stack Particulate Management Plan (SPMP) - (U-1556)** 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 three times during the reporting period, on 16 and 17 January and 24 February 2023. The exceedances in January were during the annual plant shutdown period (from 10/1/2023 to 1/2/2023), it is unlikely that emissions from the site contributed significantly to these exceedances. EPA dust monitors at Adelaide CBD, Elizabeth, Le Fevre 2, Netley, Christies and Whyalla Schultz Reserve had high dust measurements, on the 24 February. It is therefore likely that the exceedance on Le Fevre 1 and elevated average concentrations at EPA monitors on the 24 February is due to a widespread regional dust event. The property (not owned by ABC), on which the Gunn Street Monitor was located, was sold for redevelopment and is 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.

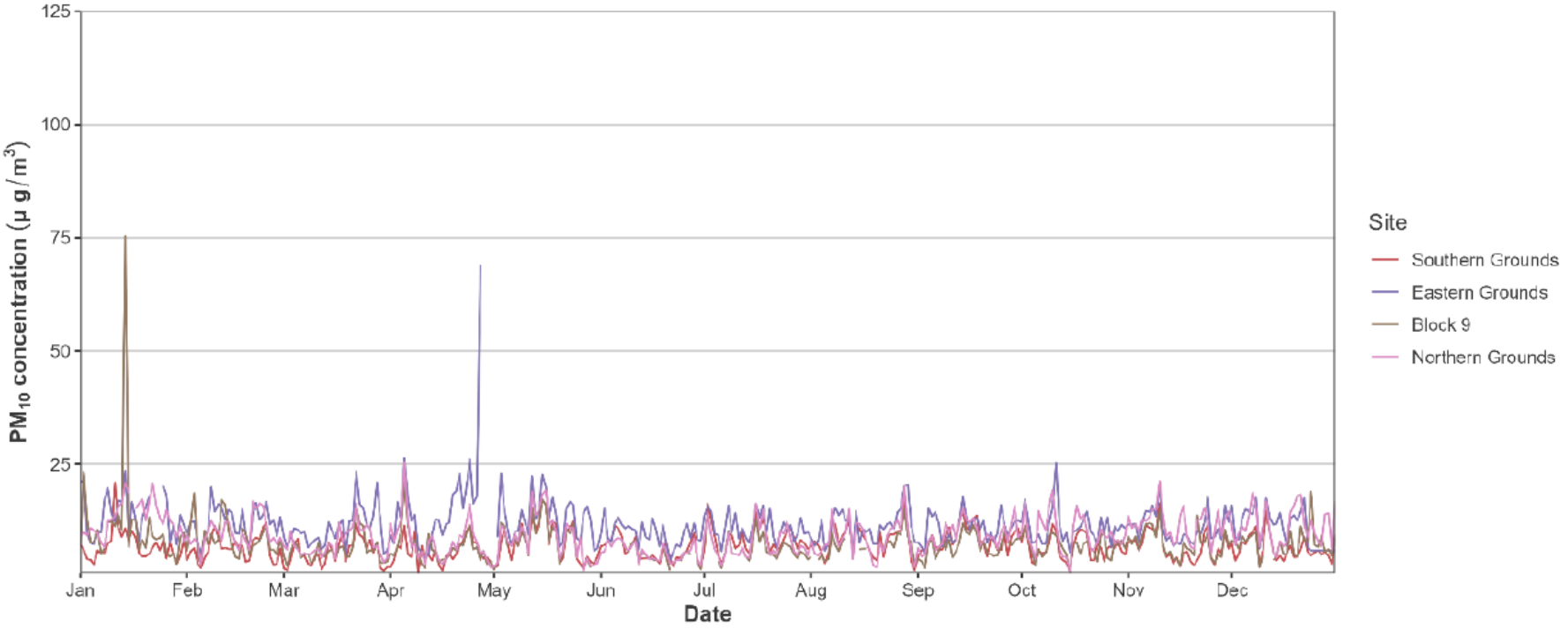
The following graph shows the 24-hr average concentrations for PM_{10} on the community monitor - 1/1/2023 – 31/12/2023



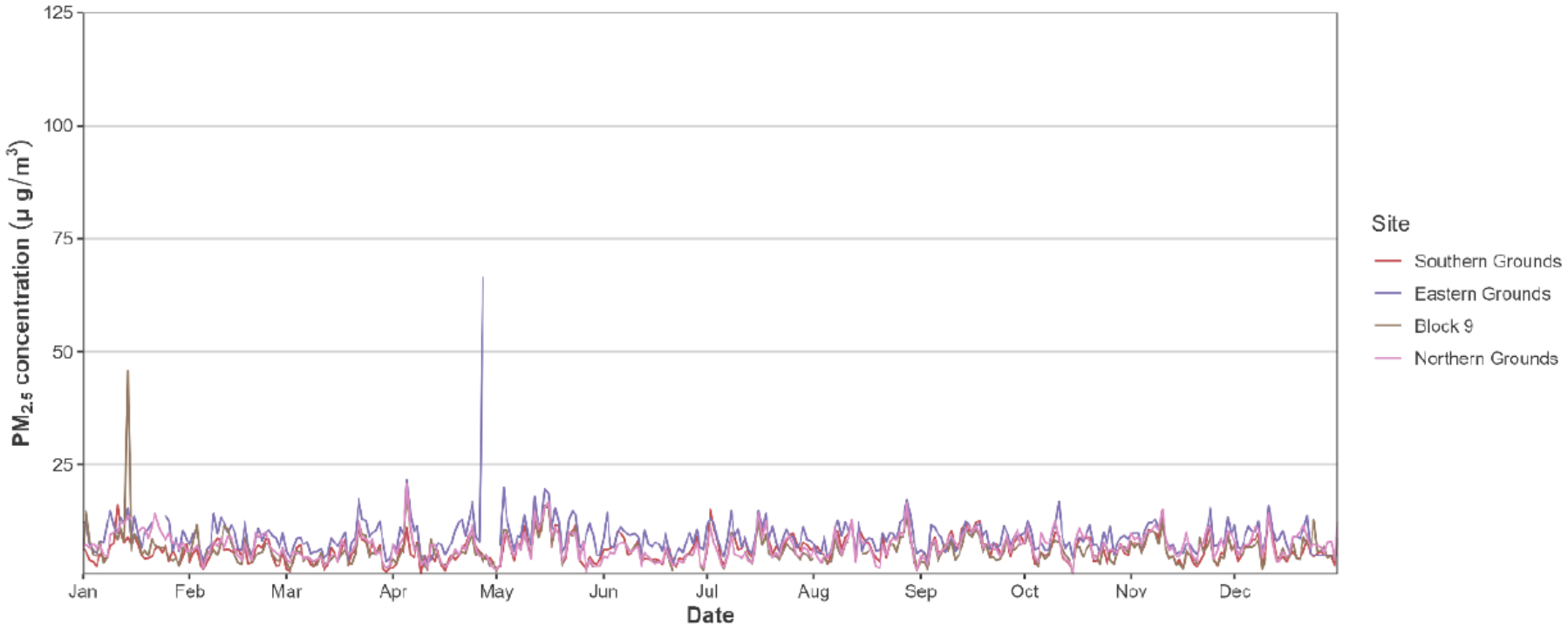
The following graph shows the 24-hr average concentrations for $PM_{2.5}$ on the community monitor - 1/1/2023 – 31/12/2023



The following graph shows the 24-hr average concentrations for PM_{10} from the on-site monitors - 1/1/2023 – 31/12/2023



The following graph shows the 24-hr average concentrations for $PM_{2.5}$ from the on-site monitors 1/1/2023 – 31/12/2023



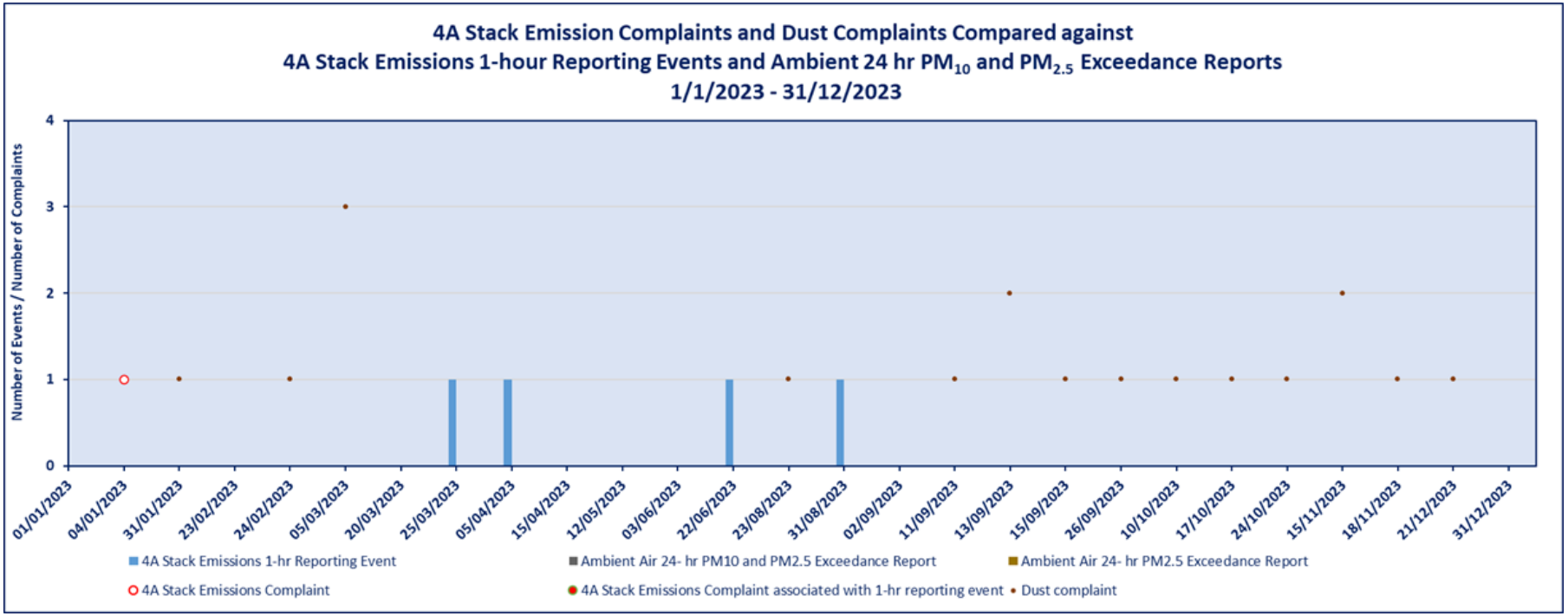
Review and analysis of community complaints, trigger values, 24-hour PM_{10} and $PM_{2.5}$ ambient air exceedance criteria and stack reporting events

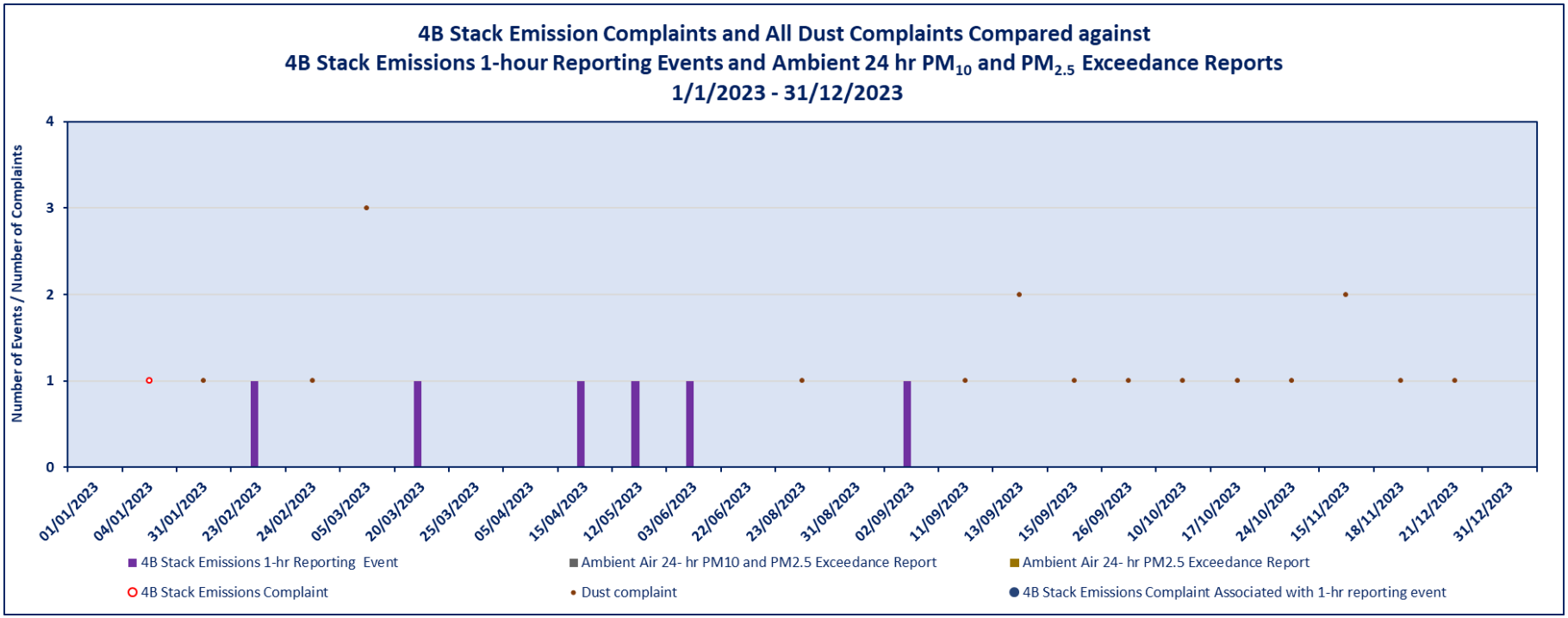
The table below captures community complaints by type, 1-hr stack reporting events and 24-hr ambient PM_{10} and $PM_{2.5}$ exceedance events for reporting period.

Date	Start 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
04/01/2023	21:28			1	1					
04/01/2023	21:28									
31/01/2023	15:30							1		
23/02/2023	5:44		1							
24/02/2023	16:34							1		
5/03/2023	13:05							1		
5/03/2023	13:21							1		
05/03/2023	13:21							1		
20/03/2023	07:12		1							
25/03/2023	09:08	1								
05/04/2023	16:08	1								
15/04/2023	20:46		1							
12/05/2023	16:39		1							
03/06/2023	09:12		1							
22/06/2023	21:08	1								
23/08/2023	12:44							1		
31/08/2023	20:57	1								
02/09/2023	16:42		1							
11/09/2023	11:01							1		
13/09/2023	16:00							1		
13/09/2023	12:56							1		
15/09/2023	13:35							1		
26/09/2023	16:00							1		
10/10/2023	10:23							1		
17/10/2023	16:12							1		
24/10/2023	15:30							1		
15/11/2023	16:45							1		
15/11/2023	17:30							1		
18/11/2023	09:47							1		
21/12/2023	10:16							1		

Legend
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
Enquiry about stack emissions

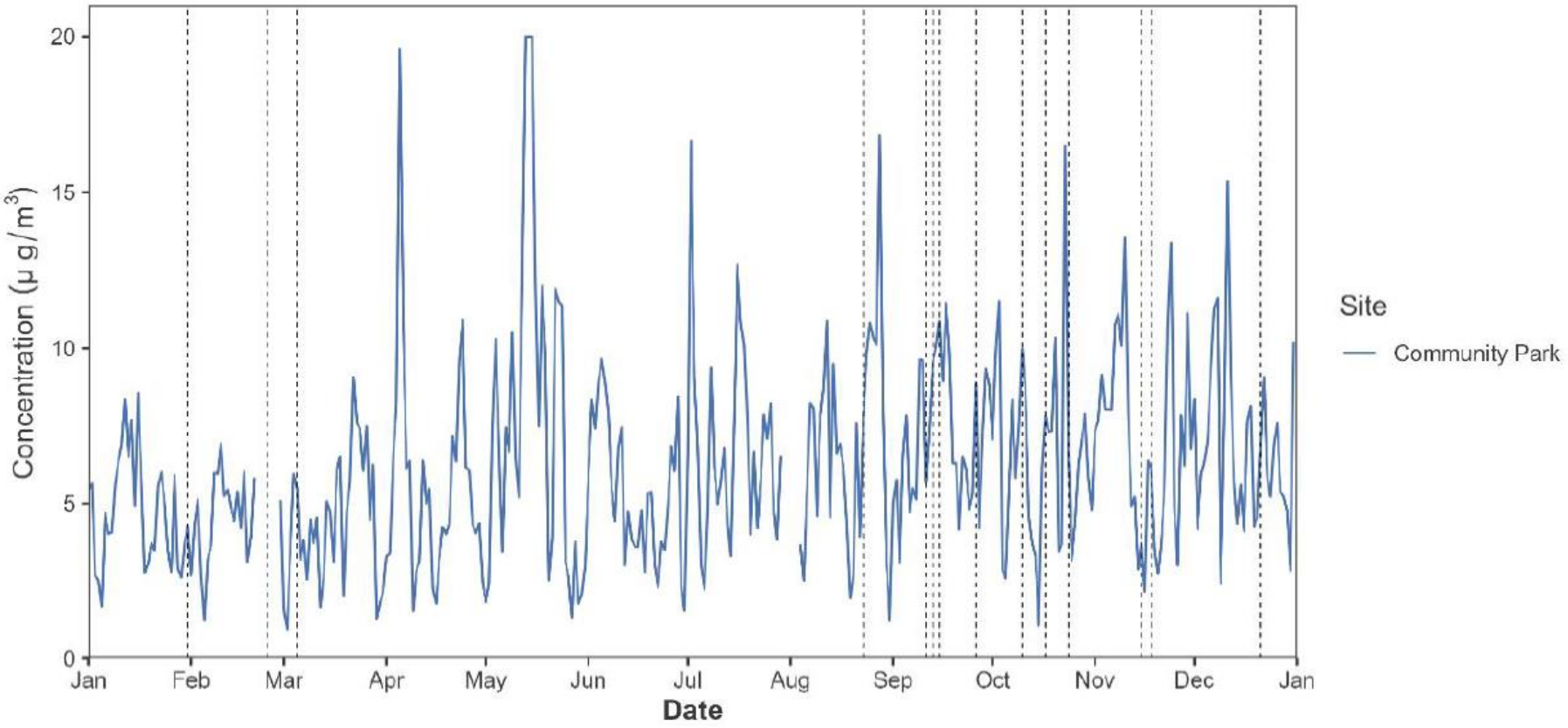
The above data is plotted on the following time series graphs for each stack.





The data in these graphs show 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 Community Park monitor 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 or other local sources.

TARP Review and 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 the Community Park monitor in the hours before and after trigger alerts have been generated suggests that effective response actions are being taken to prevent unacceptable fugitive dust emissions from the site in almost all circumstances. However, in the case of high meteorological triggers, it would appear that the actions taken in 2023 were not entirely effective in preventing an increase in PM10 concentrations at Community Park. It is possible that this apparent trend was a result of a few exceptional events and/or outside factors (e.g., regional events), thus it is recommended that this outcome is reviewed again in next year's review of the 2024 TARP effectiveness, to see if it persists or if it was an anomaly. If it persists, then consideration will be given to what additional measures could be taken to prevent offsite impacts following high meteorological triggers. Nevertheless, ABC should be especially diligent in its responses to high meteorological triggers in 2024 to prevent off-site impacts. The analysis carried out has otherwise 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. While there were more dust-related complaints in 2023 than in 2022, the number was a decrease in comparison to the 2019, 2020 and 2021 reporting periods. Furthermore, analysis of ambient monitoring data found no evidence that emissions from the facility significantly contributed to elevated concentrations of PM_{10} or $PM_{2.5}$ criteria at the Community Park monitor in 2023, which was also the case in 2022, but not in 2019, 2020 and 2021. Based on the apparent continued effectiveness of the TARP in preventing off-site exceedances, it is recommended that the current trigger levels are maintained.
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.
APMP Effectiveness	The APMPP 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 2024

Trigger Action Response Plan Annual Review

Prepared for:

Adelaide Brighton Cement Ltd

February 2024

Final

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Reviewed by:	Ricky Gellatly
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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
Abbreviation	**Definition**
ABC	Adeliade Brighton Cement
APMP	Air Particulate Management Plan
EPA	Environment 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 was commissioned by ABC to complete a review of the TARP data collected for the period 1 January 2023 to 31 December 2023, inclusive.

The TARP is implemented and managed at ABC's Birkenhead facility though 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 639 triggers were recorded, including 342 low level triggers (54%), 224 medium level triggers (35%) and 73 high level triggers (11%)
- Low, medium and high level triggers occurred with decreasing frequency at all sites
- The sites that generated the most triggers were Northern Grounds (257), Eastern Grounds (175) and Southern Grounds (116), followed by Meteorology – forecast (57), Block 9 (32) and Meteorology – observations (2)
- No triggers were generated by on-site visual observations during the reporting period
- A total of 1,722 actions were taken, including 501 actions against low level triggers (29%), 767 actions against medium level triggers (45%) and 454 actions against high level triggers (26%)
- The most actions were generated by Northern Grounds (659) and Eastern Grounds (473), followed by Meteorology – forecast (268), Southern Grounds (227), Block 9 (70) and Meteorology – observations (25)
- On average, approximately 3 separate actions were performed for every trigger, the same as in the 2022 reporting period
- Although high trigger alerts regularly did not correspond with elevated PM_{10} concentrations at Community Park, the majority of actual elevated PM_{10} events at Community Park were also covered by a trigger of some level
- The highest PM_{10} levels recorded at Community Park 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
- 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.

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 during the reporting period was greater than 93% at all sites, meeting the 90% data capture limit prescribed in the GLPMRP
- The 24-hour average concentrations of PM_{10} and $PM_{2.5}$ did not exceed the EPA criteria at the Community Park monitoring site during the reporting period
- This is the same as the previous reporting period (January 2022 to December 2022)
- The highest on-site 24-hour average concentration of PM_{10} was 75.4 $\mu g/m^3$ and was recorded at Block 9 on 14 January 2023

- The highest on-site 24-hour average concentration of $PM_{2.5}$ was 66.6 µg/m^3 and was recorded at Eastern Grounds on 27 April 2023
- It does not appear that on-site operations are significantly contributing to off-site particulate monitoring concentrations at Community Park.

Analysis of concentrations at Community Park in the hours before and after trigger alerts have been generated suggests that effective response actions are being taken to prevent unacceptable fugitive dust emissions from the Facility in almost all circumstances. However, in the case of high meteorological triggers, it would appear that the actions taken in 2023 were not entirely effective in preventing an increase in PM_{10} concentrations at Community Park. It is possible that this apparent trend was a result of a few exceptional events and/or outside factors (e.g. regional events), thus it is recommended that this outcome is reviewed again in next year's review of the 2024 TARP effectiveness, to see if it persists or if it was an anomaly. If it persists then consideration will be given to what additional measures could be taken to prevent offsite impacts following high meteorological triggers. Nevertheless, ABC should be especially diligent in its responses to high meteorological triggers in 2024 to prevent offsite impacts.

The analysis carried out has otherwise 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. While there were more dust-related complaints in the 2023 reporting period than in 2022, the total was less than in the 2019, 2020 and 2021 reporting periods. There were no exceedances of the PM_{10} or $PM_{2.5}$ criteria at the Community Park monitor in 2023, which was also the case in 2022 but not in 2019, 2020 or 2021.

Based on this apparent continued effectiveness of the TARP in preventing off-site exceedances, it is recommended that the current trigger levels are maintained.

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 2023 to 31 December 2023 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 set out in Condition U - 1549 in ABC's licence (Licence number 1126):

> *"1.1.4 submit an annual report to the EPA by the 15th day of February of each year, that includes but need not be limited to:*
>
> *a a review of all the trigger values identified in sub paragraph 2(a) of this condition*
>
> *b a review of the effectiveness of all action and response strategies identified in sub paragraph 2(c) of this condition*
>
> *c a trend analysis of data collected*
>
> *d a review and analysis of community complaints received and recorded pursuant to condition U-1553 with the exceedance of trigger values identified in sub paragraph 2(a) of this condition; and*
>
> *e opportunities for improvement in air particulate 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 Condition U-1555 (Section 3.2)
        - Stack Particulate Management Plan (SPMP) - required under Licence Condition U-1556 (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)
- Conclusions (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 Air Particulate Management Plan (APMP) at its Birkenhead Site, which was most recently updated in October 2023.

The APMP 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 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 necessarily indicate the presence of a dust impact.

The triggers and associated responses defined in ABC's APMP are reproduced in the following sections. The trigger levels were unaffected by the October 2023 update; however, the update did include several changes to the actions to be performed in response to these trigger alerts.

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	• Alert relevant operators that dust levels are elevated therefore heightened awareness to sources of dust may be required. • 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	• Alert relevant operators that dust levels are elevated therefore heightened awareness to sources of dust may be required. • 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. • Reduce the relevant dust producing activities or reschedule to more suitable meteorological conditions. • If dust mitigation equipment is unavailable, or at fault, investigate temporary alternative management practices.	Shift supervisor

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. • Assess potential for shifting operations to more favourable conditions. • Visual observations of site every 3 hours.	Shift supervisor
Medium	• Alert shift employees that dust potential is elevated. • Assess potential for shifting operations to more favourable conditions. • Ensure all routine dust management practices have been implemented. • Visual observations on site to check if there are any significant visible dust emissions every 3 hours.	Shift supervisor
High	• Alert shift employees that dust potential is elevated. • Assess potential for shifting operations to more favourable conditions. • Ensure water truck is on standby to apply water. • Ensure all routine dust management practices have been implemented. • Visual observations of site every 3 hours. Review ambient monitoring PM_{10} levels and implement the action response if the high level trigger is activated.	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	• Inspect site to determine source of dust. • Check routine (baseline) dust management practices have been applied to that source. • 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	• Inspect site to determine source of dust. • Check routine (baseline) dust management practices have been applied to that source. • 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. • Minimise activity rate of dust producing activity.	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 one off-site monitor (Community Park) 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.

A second off-site monitor at Gunn Street was removed for relocation on 28 June 2022 due to the property on which it was located (not owned by ABC) being sold for redevelopment. A replacement monitor is expected to be operational some time in 2024.

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 2023 to 31 December 2023) are summarised in Table 7 and Table 8 (percentages may not sum to 100 due to rounding). Triggers generated over consecutive hours at a particular monitor 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.

The data show that:

- A total of 639 triggers were recorded, including 342 low level triggers (54%), 224 medium level triggers (35%) and 73 high level triggers (11%)
- Low, medium and high level triggers occurred with decreasing frequency at all sites
- The sites that generated the most triggers were Northern Grounds (257), Eastern Grounds (175) and Southern Grounds (116), followed by Meteorology – forecast (57), Block 9 (32) and Meteorology – observations (2)
- No triggers were generated by on-site visual 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	80	33	3	116 (18%)
Eastern Grounds	91	66	18	175 (27%)
Block 9	23	8	1	32 (5%)
Northern Grounds	118	99	40	257 (40%)
Meteorology – forecast	30	16	11	57 (9%)
Meteorology – observations	-	2	-	2 (0.3%)
Onsite visual observations	-	-	-	-
All sites	**342**	**224**	**73**	**639**

Table 8 Frequency of triggers during the reporting period

Site	Trigger level		
	Low	Medium	High
Southern Grounds	69%	28%	3%
Eastern Grounds	52%	38%	10%
Block 9	72%	25%	3%
Northern Grounds	46%	39%	16%
Meteorology – forecast	53%	28%	19%
Meteorology – observations	-	100%	-
All sites	**54%**	**35%**	**11%**

There were no alerts recorded for the Eastern grounds monitor in July. Investigation of this identified that the wind direction sensor had accumulated dust build up, causing intermittent wind measurement data. Prior to this, the wind sensor had been operating reliably and without issue for six years. It was cleaned and has operated effectively since.

This event highlighted a limitation to ABC's dust management system, which was that when no wind direction data were available, no alert was generated. As a result, ABC's Dust Management Dashboard and Control System was reprogrammed in October 2023 to:

- Generate an alarm when there is no wind direction data for a period of four hours
- When determining if an alert needs to be generated (i.e. when there is a PM_{10} concentration above an alert threshold), if there is no valid wind direction record, assume that the wind is blowing towards receptors (a conservative approach).

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 1,722 actions were taken, including 501 actions against low level triggers (29%), 767 actions against medium level triggers (45%) and 454 actions against high level triggers (26%)
- The most actions were generated by triggers at Northern Grounds (659) and Eastern Grounds (473), followed by Meteorology – forecast (268), Southern Grounds (227), Block 9 (70) and Meteorology – observations (25)

Table 9 Number of actions taken during the reporting period

Site	Actions			Total (% of all actions)
	Low trigger	Medium trigger	High trigger	
Southern Grounds	106	100	21	227 (13%)
Eastern Grounds	108	205	160	473 (27%)
Block 9	28	36	6	70 (4%)
Northern Grounds	174	296	189	659 (38%)
Meteorology – forecast	85	105	78	268 (16%)
Meteorology – observations	-	25	-	25 (1%)
All sites	**501**	**767**	**454**	**1722**

Table 10 Frequency of actions taken during the reporting period

Site	Actions		
	Low trigger	Medium trigger	High trigger
Southern Grounds	47%	44%	9%
Eastern Grounds	23%	43%	34%
Block 9	40%	51%	9%
Northern Grounds	26%	45%	29%
Meteorology – forecast	32%	39%	29%
Meteorology – observations	-	100%	-
All sites	**29%**	**45%**	**26%**

3.1.3 TARP Implementation Summary

Table 11 summarises the TARP triggers and actions during the reporting period. On average, approximately 3 separate actions were performed for every trigger, the same as in the 2022 reporting period.

Table 11 Summary of TARP implementation during the reporting period

Site	Triggers	Actions	Average Actions/Trigger
Southern Grounds	116	227	2.0
Eastern Grounds	175	473	2.7
Block 9	32	70	2.2
Northern Grounds	257	659	2.6
Meteorology - forecast	57	268	4.7
Meteorology – observations	2	25	12.5
All sites	**639**	**1722**	**2.7**

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 location (Community Park) are compared with the Environmental Protection Authority South Australia (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 monitor in Figure 2 and Figure 3, and for the on-site monitors in Figure 4 and Figure 5.

The following observations can be made regarding the ambient monitoring data:

- Data capture during the reporting period was greater than 93% at all sites
- The 24-hour average concentrations of PM_{10} and $PM_{2.5}$ did not exceed the EPA criteria at the Community Park monitoring site during the reporting period
- This is the same as the previous reporting period (January 2022 to December 2022)
- The highest on-site 24-hour average concentration of PM_{10} was 75.4 µg/m^3 and was recorded at Block 9 on 14 January 2023:
    - Block 9 also recorded the second-highest on-site 24-hour average concentration of $PM_{2.5}$ (45.8 µg/m^3) on 14 January 2023
    - No other on-site or off-site monitors recorded spikes in 24-hour average concentrations of PM_{10} or $PM_{2.5}$ on this day
    - The next-highest 24-hour average concentration of PM_{10} recorded at Block 9 was 23.4 µg/m^3
    - The next-highest 24-hour average concentration of $PM_{2.5}$ recorded at Block 9 was 19.1 µg/m^3
- The highest on-site 24-hour average concentration of $PM_{2.5}$ was 66.6 µg/m^3 and was recorded at Eastern Grounds on 27 April 2023:
    - Eastern Grounds also recorded the second-highest on-site 24-hour average concentration of PM_{10} (69.2 µg/m^3) on 27 April 2023
    - No other on-site or off-site monitors recorded spikes in 24-hour average concentrations of PM_{10} or $PM_{2.5}$ on this day
    - The next-highest 24-hour average concentration of PM_{10} recorded at Eastern Grounds was 26.4 µg/m^3
    - The next-highest 24-hour average concentration of $PM_{2.5}$ recorded at Eastern Grounds was 21.6 µg/m^3
- It does not appear that on-site operations are significantly contributing to off-site particulate monitoring concentrations at Community Park

Table 12 Summary of GLPMRP data collected during the reporting period (µg/m³)

Location	Site	Avg period	Size	Max	Min	Mean	99th %ile	95th %ile	Data capture
Off-site	Community Park	1-hour	PM_{10}	293.5	-6.4	6.2	23.0	16.5	97%
			$PM_{2.5}$	134.3	-6.4	5.8	22.5	15.3	97%
		24-hour	PM_{10}	20.0	0.9	6.2	18.2	11.5	96%
			$PM_{2.5}$	20.0	0.8	5.8	17.3	10.7	96%
On-site	Southern Grounds	1-hour	PM_{10}	143.1	-4.0	7.0	25.3	17.3	100%
			$PM_{2.5}$	92.6	-4.1	6.4	23.5	15.7	100%
		24-hour	PM_{10}	20.9	1.0	7.0	16.3	12.2	100%
			$PM_{2.5}$	16.8	1.0	6.4	15.4	11.5	100%
	Eastern Grounds	1-hour	PM_{10}	223.7	-12.3	11.8	39.9	24.7	98%
			$PM_{2.5}$	218.9	-19.1	9.2	29.9	19.2	98%
		24-hour	PM_{10}	69.2	3.7	11.8	24.3	20.1	98%
			$PM_{2.5}$	66.6	2.8	9.2	19.0	14.7	98%
	Northern Grounds	1-hour	PM_{10}	95.2	-1.9	9.3	40.0	23.5	99%
			$PM_{2.5}$	67.7	-2.6	7.0	28.5	16.9	99%
		24-hour	PM_{10}	25.5	1.4	9.3	20.4	16.6	99%
			$PM_{2.5}$	20.9	1.1	7.0	15.4	11.9	99%
	Block 9	1-hour	PM_{10}	840.4	-7.2	7.4	32.5	18.1	96%
			$PM_{2.5}$	498.9	-7.3	6.1	25.0	15.0	96%
		24-hour	PM_{10}	75.4	1.1	7.4	18.8	12.9	93%
			$PM_{2.5}$	45.8	0.8	6.1	15.1	10.8	93%

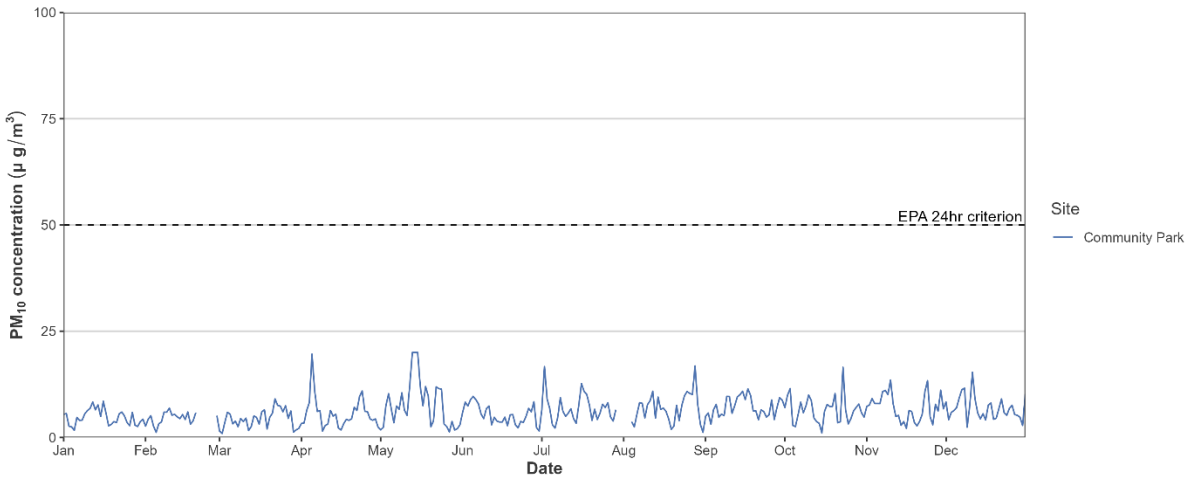

Figure 2 24-hour average concentrations of PM_{10} measured off-site during the reporting period

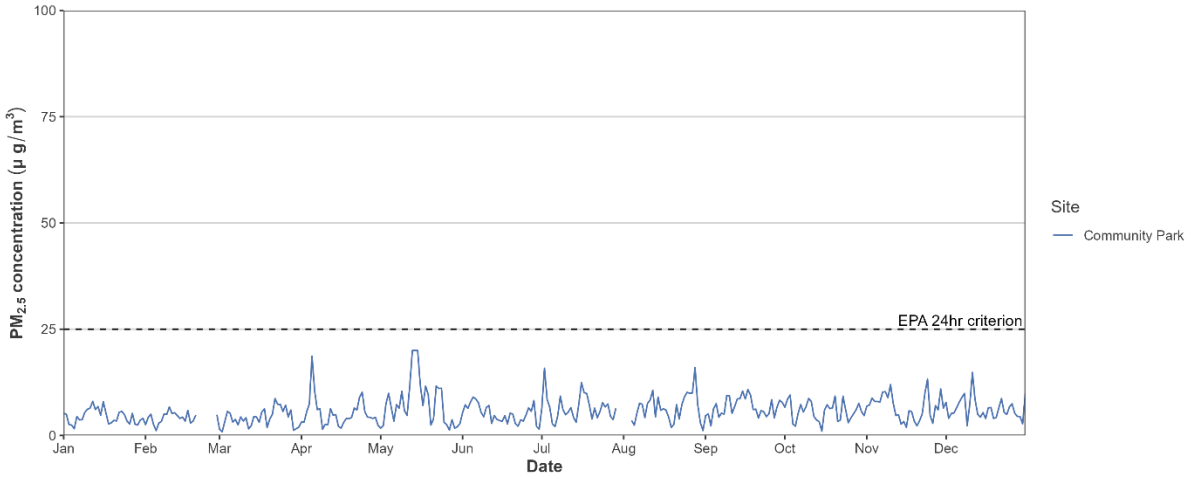

Figure 3 24-hour average concentrations of $PM_{2.5}$ measured off-site during the reporting period

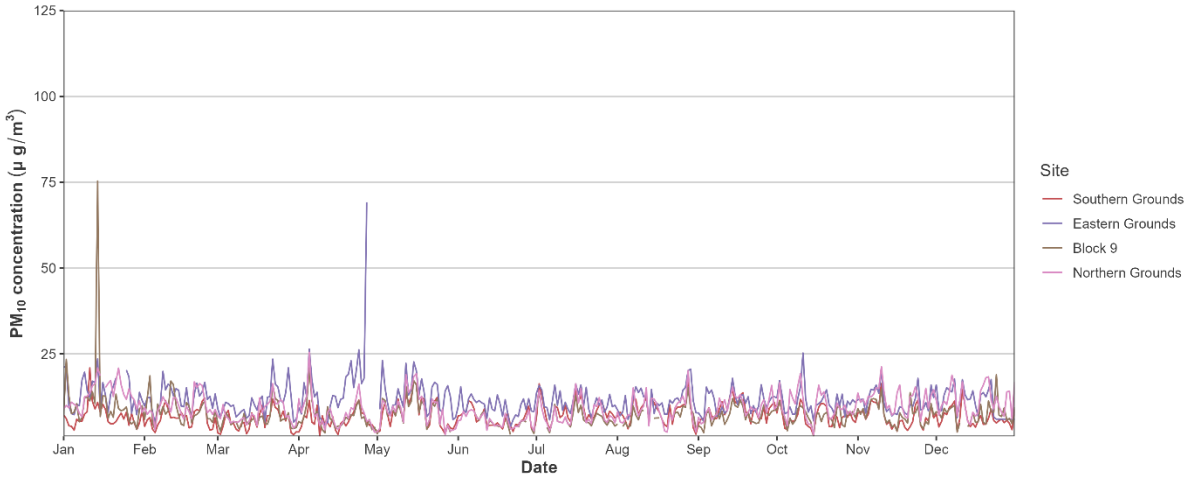

Figure 4 24-hour average concentrations of PM_{10} measured on-site during the reporting period

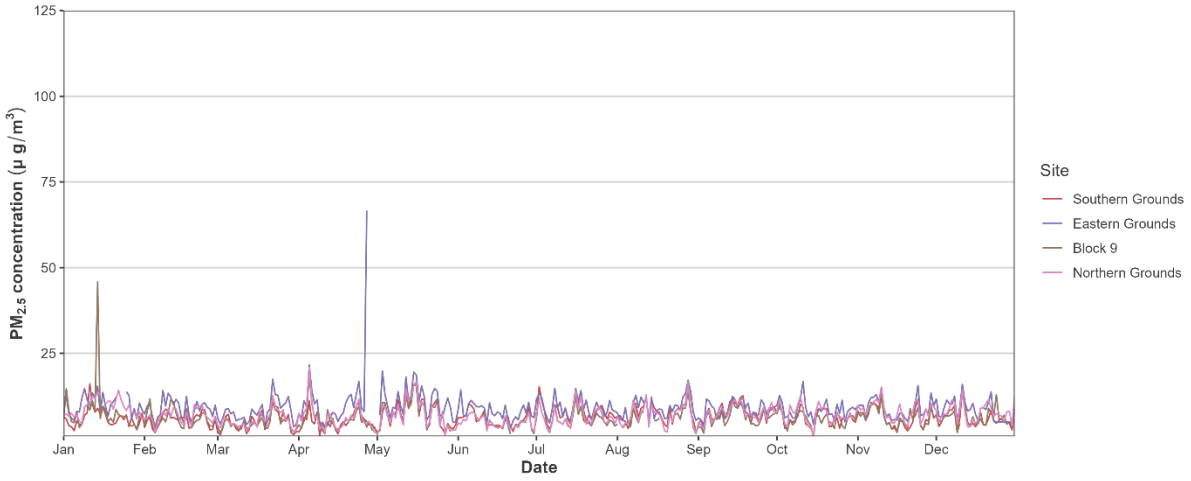

Figure 5 24-hour average concentrations of $PM_{2.5}$ measured on-site during the reporting period

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 show the following:

- Data capture for the reporting period was 100% for both Stack 4A and Stack 4B. The data flatline from 10 January to 1 February observed in Figure 6 and Figure 7 reflects the annual plant shutdown period for maintenance.
- The annual average TSP concentration in Stack 4A (13.7 mg/Nm^3) was considerably higher than in Stack 4B (2.0 mg/Nm^3). The maximum 1-hour rolling average concentration of TSP of 163.9 mg/Nm^3 was measured in Stack 4A.
- The 1-hour rolling average TSP concentrations in Stack 4A were elevated from March to June, with multiple peaks exceeding 50 mg/Nm^3 each month. Concentrations were particularly elevated in April, with a peak above 100 mg/Nm^3 on 5 April. Concentrations were relatively consistent throughout the remainder of the reporting period.
- The 1-hour rolling average TSP concentrations for Stack 4B were relatively consistent throughout the reporting period, with scattered peaks throughout the year. The exception to this is a single peak above 100 mg/Nm^3 on 2 September.

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	118.8	0.0	13.6	39.1	27.3	100%
	24-hour	33.6	0.0	13.7	27.7	23.1	100%
4B	1-hour	101.1	0.0	2.0	13.5	6.5	100%
	24-hour	12.0	0.0	2.0	6.6	4.9	100%

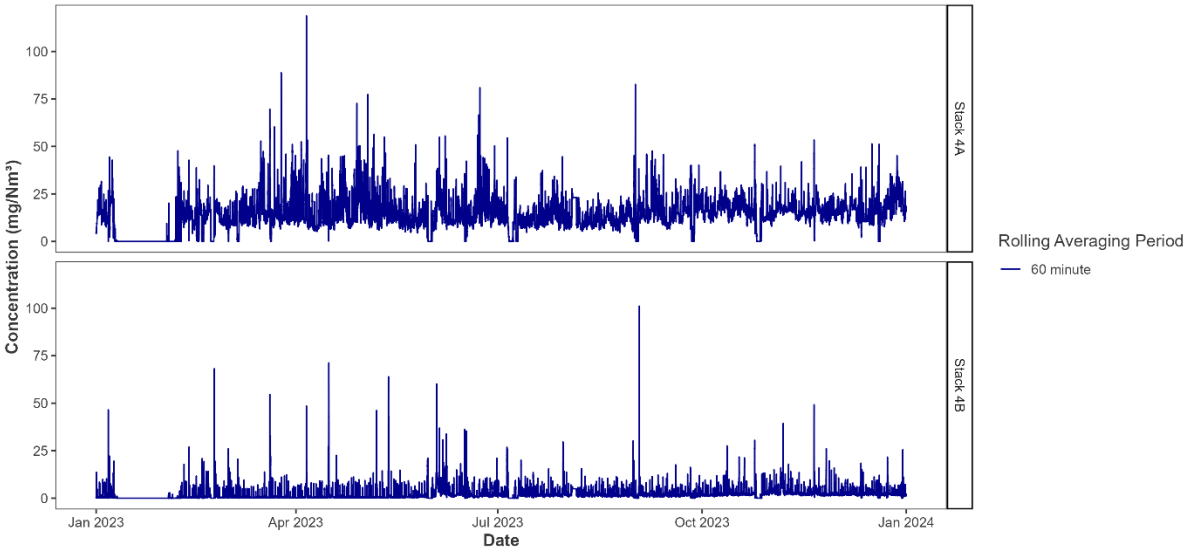

Figure 6 Rolling 1-hour average in-stack TSP concentrations (mg/Nm^3) measured at Stacks 4A and 4B during the reporting period

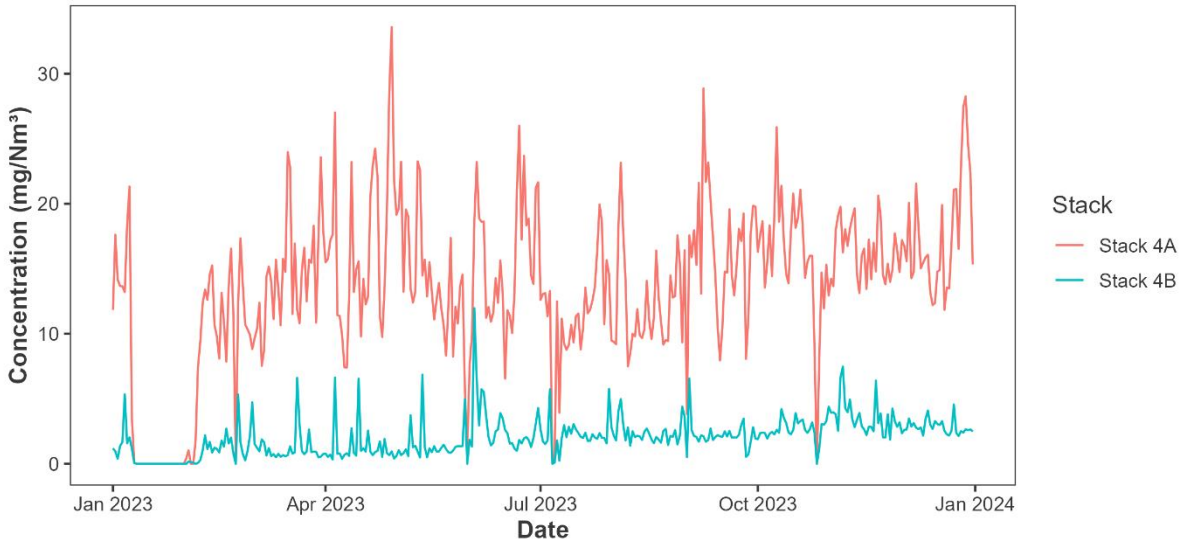

Figure 7 **24-hour average in-stack TSP concentrations (mg/Nm^3) measured at Stacks 4A and 4B during the reporting period**

3.4 Meteorology

Forecast and observed meteorological data was provided by the Dark Sky data service until 22 March 2023, from which time forecast and observed meteorological data was provided by the Meteomatics data service. This switch of data service was made in anticipation of the shutdown of Dark Sky on 31 March 2023. 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.

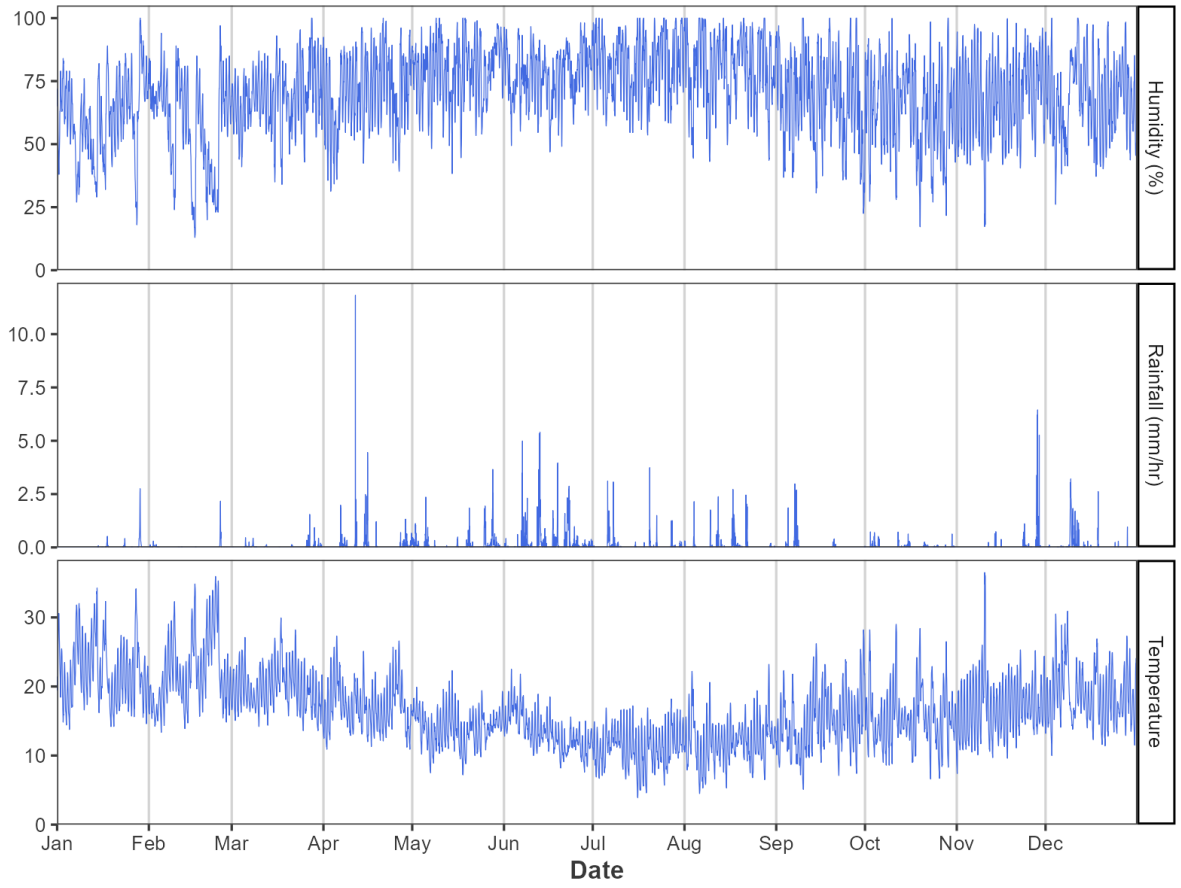

Figure 8 **Meteorological observations for Birkenhead during the reporting period**

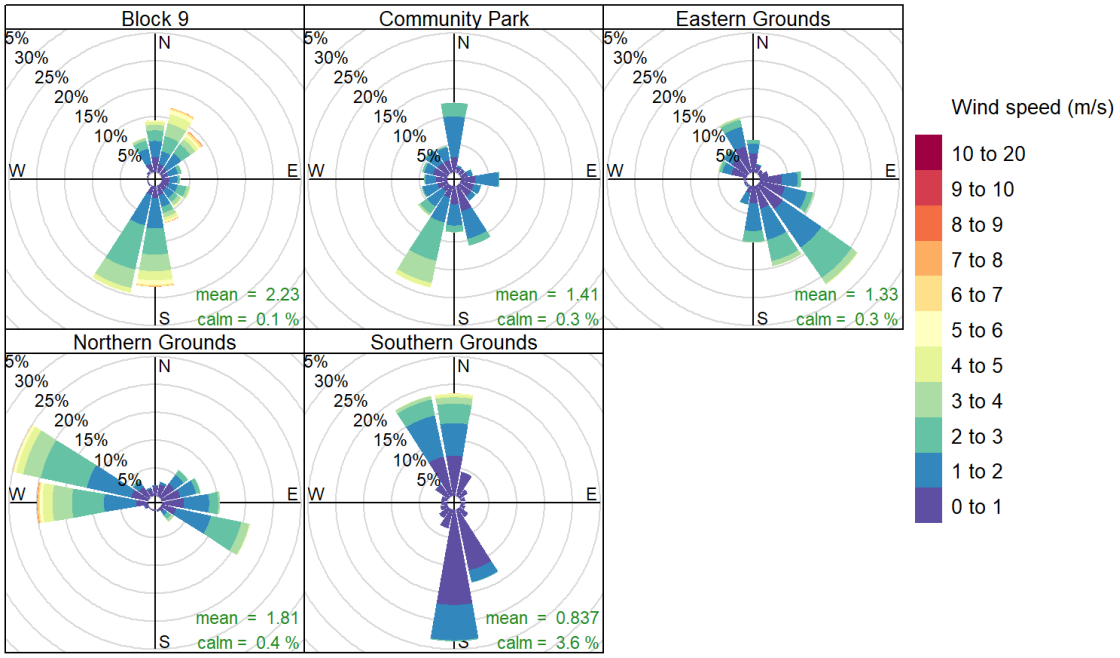

Figure 9 **Distribution of wind speed and direction measured at ABC monitoring sites during the reporting period**

3.5 EPA Monitoring

The closest EPA monitoring site to ABC's Birkenhead facility is Le Fevre 1 (see Figure 1). The 24-hour average concentrations of PM_{10} and $PM_{2.5}$ measured 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 (Adelaide CBD, Elizabeth, Le Fevre 2 (North Haven), Netley, Christies, Port Pirie Oliver St, Whyalla Walls St and Whyalla Schulz Reserve) 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 three times during the reporting period, on 16 and 17 January and 24 February 2023 – none of these dates coincide with particularly elevated concentrations at the on-site monitors
- 24-hour average concentrations of PM_{10} at Le Fevre 1 were also elevated on 23 February 2023 (43.8 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

Other EPA monitors also recorded exceedances of the EPA criterion for PM_{10} around 16 and 17 January and 24 February 2023:

- 24-hour average concentrations of PM_{10} at Whyalla Walls St exceeded the EPA criterion on 17 January 2023
- 24-hour average concentrations of PM_{10} at Port Pirie Oliver St and Whyalla Walls St exceeded the EPA criterion on 24 February 2023

Since the exceedances in January occurred during the annual plant shutdown period (from 10 January to 1 February 2023) it is unlikely that emissions from the Facility contributed significantly to these exceedances. The grey lines representing the other EPA monitors in Figure 10 appear to track closely to that of Le Fevre 1 during January of 2023, indicating a regional dust episode around 16 and 17 January 2023.

The Whyalla Walls St and Port Pirie Oliver St monitors are located far from Le Fevre 1; however, all other monitors also recorded elevated concentrations on 24 February 2023. 24-hour average concentrations of PM_{10} recorded by the EPA monitors at Adelaide CBD, Elizabeth, Le Fevre 2 (North Haven), Netley, Christies, and Whyalla Schulz Reserve on 24 February 2023 were their 6th, 11th, 5th, 6th, 3rd and 4th highest measurements for 2023, respectively. It is, therefore, likely that the exceedances and elevated average concentrations at the EPA monitors on 24 February 2023 were due to a widespread regional dust event.

It is, therefore, unlikely that emissions from the Facility contributed significantly to any exceedances of the 24-hour EPA criteria for PM_{10} or $PM_{2.5}$ at the Le Fevre 1 EPA monitoring site.

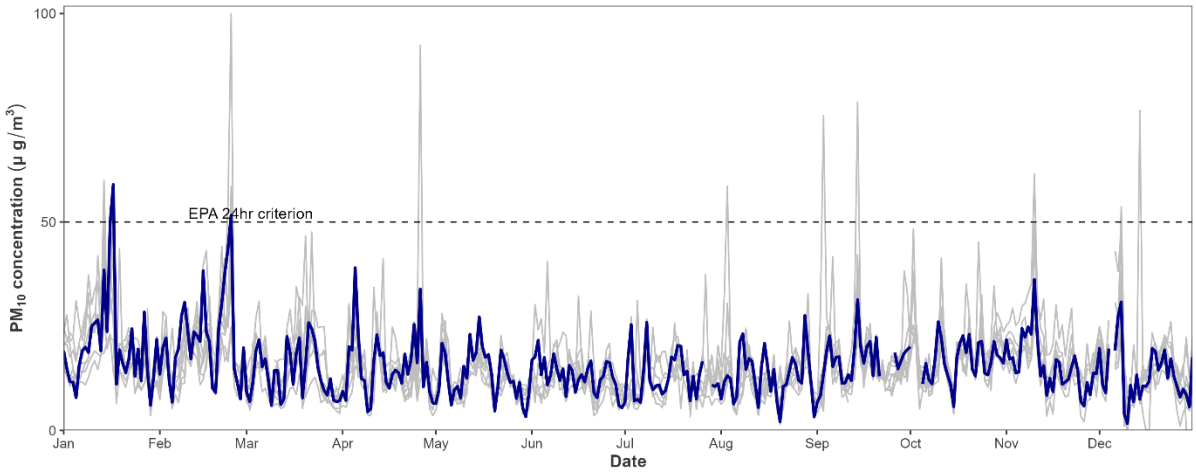

Figure 10 **24-hour average concentrations of PM_{10} recorded at Le Fevre 1 (blue) and other EPA monitoring sites (grey) during the reporting period**

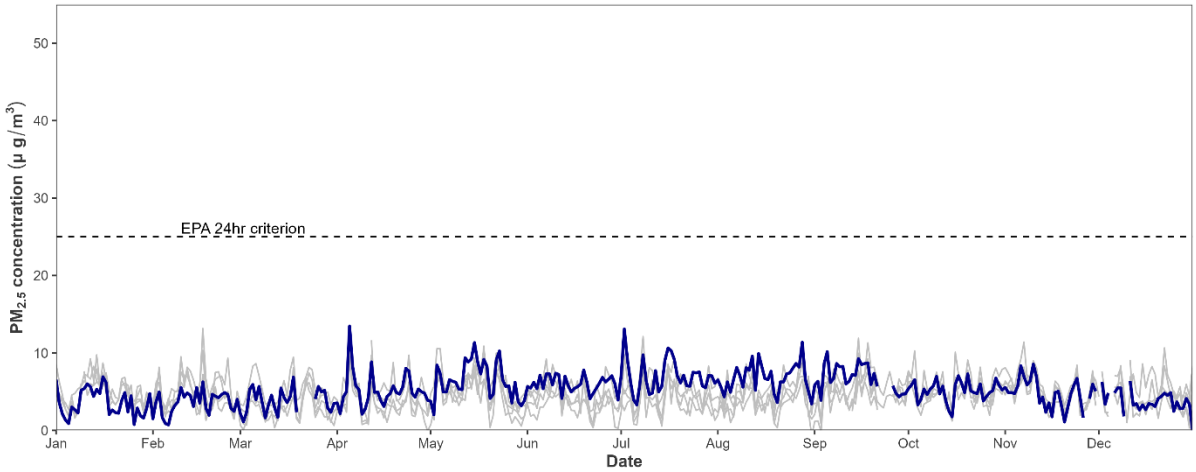

Figure 11 **24-hour average concentrations of $PM_{2.5}$ recorded at Le Fevre 1 (blue) and other EPA monitoring sites (grey) during the reporting period**

4. COMPLAINTS

There were 18 complaints relating to dust made during the reporting period; these are detailed in Table 14. This is an increase in comparison to the dust-related complaints generated in 2022 (11) but is a decrease in comparison to 2021 (37), 2020 (22) and 2019 (47).

Table 14 Dust complaints made during the reporting period

Date	Complaint Description
31/01/2023	ESCL # 1621 Pollution on car
24/02/2023	Dust on Car
5/03/2023	Enquiry concerning dust from the plant yesterday afternoon.
5/03/2023	ESCL #1626 Dust
5/03/2023	ESCL#1625 Dust
23/08/2023	Claim damage to roof from cement dust, asking if Adbri would support
11/09/2023	Car covered in dust - initially logged as general enquiry about car washes - changed to complaint
13/09/2023	Dust on car - resident called in at reception to get car wash voucher
13/09/2023	Claims cement dust on cars,
15/09/2023	Dust on car
26/09/2023	complaint via solar operator of dust on solar panels
10/10/2023	Nearby resident to Birkenhead cement dust on car
17/10/2023	ESCL#1655 dust from plant stripping away paint on nearby vehicles, Call back 0434639813
24/10/2023	Dust on Car
15/11/2023	Resident concerned about dust on his cars - and damage to paint work.
15/11/2023	Dust on car
18/11/2023	ESCL#1662 dust on car, same as ESCL#1661 Monday 13/11 but no one responded
21/12/2023	Dust on Car - occurred over last few weeks - seeking car wash

Multiple complaints on a single day can indicate more significant dust impacts at that time; there were three days in 2023 on which multiple complaints were made:

- Three complaints on 5 March 2023
- Two complaints on 13 September 2023
- Two complaints on 15 November 2023.

These dates were not associated with elevated off-site concentrations of PM_{10}:

- None of these dates coincide with any exceedances at Community Park or Le Fevre 1
- Le Fevre 1 recorded its 54th, 78th and 221st highest 24-hour average concentrations of PM_{10} on 5 March, 13 September and 15 November 2023, respectively
- Community Park recorded its 188th, 50th and 269th highest 24-hour average concentrations of PM_{10} on 5 March, 13 September and 15 November 2023, respectively.

Of the days on which a single complaint was made, three were associated with elevated concentrations of PM_{10} (in the top decile) at an off-site monitor:

- The 24-hour average concentration of PM_{10} at Le Fevre 1 on 24 February 2023 exceeded the EPA criterion of 50 µg/m^3 and was its 2nd highest concentration over the reporting period
- Le Fevre 1 recorded its 21st highest 24-hour average concentration of PM_{10} on 10 October 2023
- Community Park recorded its 27th highest 24-hour average concentration of PM_{10} on 15 September 2023.

As discussed in Section 3.5, the PM_{10} exceedance at Le Fevre 1 and elevated concentrations of PM_{10} and $PM_{2.5}$ recorded at the EPA monitors on 24 February 2023 were likely due to a widespread regional dust event and it is unlikely that emissions from the Facility contributed significantly to this event.

On 10 October 2023, two on-site monitors also recorded relatively elevated 24-hour average concentrations of PM_{10} (Northern Grounds recorded its 7th highest concentration, and Southern Grounds recorded its 25th highest concentration). Wind speed and direction data from the EPA's Le Fevre 1 monitor has been analysed to determine the wind conditions under which the on-site monitors, Community Park and Le Fevre 1 recorded elevated concentrations of PM_{10} on this day. This analysis found that all monitors recorded elevated concentrations of PM_{10} under easterly winds, including the Block 9 and Eastern Grounds monitors. Furthermore, the Eastern Grounds monitor recorded the second-highest 24-hour average concentration of PM_{10} out of all the on-site monitors, despite primarily recording elevated concentrations under easterly winds. It is, therefore, considered likely that the primary contributor to elevated average concentrations of PM_{10} at the monitors on 10 October 2023 was an off-site source to the east of the Facility, and unlikely that emissions from the Facility significantly contributed to ambient concentrations of PM_{10} on this day.

Neither Le Fevre 1 nor any on-site monitors recorded particularly elevated 24-hour average concentrations of PM_{10} on 15 September 2023. Analysis of the wind conditions under which the on-site monitors, Community Park and Le Fevre 1 recorded elevated concentrations of PM_{10} on this day found no evidence that emissions from the Facility contributed significantly to PM_{10} concentrations, with all monitors showing significant contributions under winds from the northeast, southeast and east regardless of their location with respect to the Facility. It is, therefore, considered unlikely that emissions from the Facility significantly contributed to ambient concentrations of PM_{10} on 15 September 2023.

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 above. The following analysis qualitatively investigates the relationship between ambient concentrations of PM_{10} and the frequency of dust complaints in the following days.

A timeseries of 24-hour average concentrations of PM_{10} at the Community Park monitor is shown in Figure 12, with the dust complaint dates marked as vertical dashed lines. Figure 12 shows that while there was a complaint shortly after a peak in concentrations at Community Park in October, there were no complaints made after the higher peaks in April, May, July and August. Furthermore, complaints were also submitted at times when concentrations were not elevated, such as in March. There is, therefore, no evidence that elevated concentrations of PM_{10} at Community Park are associated with an increase in the frequency of dust-related complaints in the following days.

Complaints may also reflect extended periods of low levels of dust accumulating over time, rather than short-lived events of elevated concentrations. Under this scenario, dust impacts may be due to 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 or other local sources. Given the lack of correlation between elevated concentrations at the EPA monitors and elevated concentrations at the on-site monitors and Community Park, local sources of dust at least contributing to the cause of these complaints is likely.

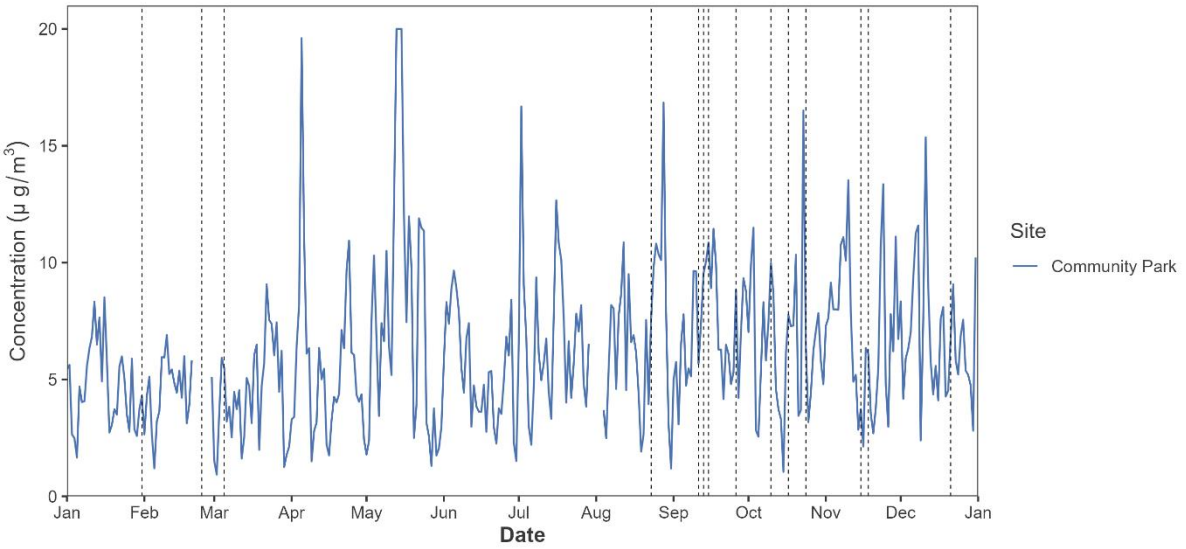

Figure 12 Dust complaints reported (vertical dashed lines) and corresponding 24-hour average concentration of PM_{10} (µg/m³) at the Community Park monitoring station

5. TARP EFFECTIVENESS

The data analysis in Section 3 shows that there were 639 trigger alerts during the reporting period of 365 days, comprised of:

- 342 low trigger alerts
- 224 medium trigger alerts
- 73 high trigger alerts

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 (68%) were generated based on measured concentrations at the Northern Grounds and Eastern Grounds monitors, with a further 23% being generated based on measured concentrations at the Southern Grounds and Block 9 monitors. 9% of all trigger alerts were generated based on forecast and observed meteorology. There were no trigger alerts generated from visual dust observations.

In response to the 639 trigger alerts, ABC undertook 1,722 actions, or, on average, approximately 3 actions per trigger alert. This is the same approximate number of actions per trigger as the previous reporting period (1 January 2022 to 31 December 2022).

The following sections evaluate the effectiveness of the TARP through analysis of the dust impacts experienced by the community during the reporting period.

5.1 Frequency of dust impacts

One metric of TARP effectiveness is a lack of dust impacts on the nearby community potentially attributable to emissions from the Facility. Figure 13 plots measured TSP concentrations in kiln Stack 4A and pre-calciner Stack 4B against measured concentrations at the nearby community ambient monitor (Community Park) 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 Community Park 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
- 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. These results, and the conclusion drawn, are similar to those drawn for the previous reporting period (1 January 2022 to 31 December 2022).

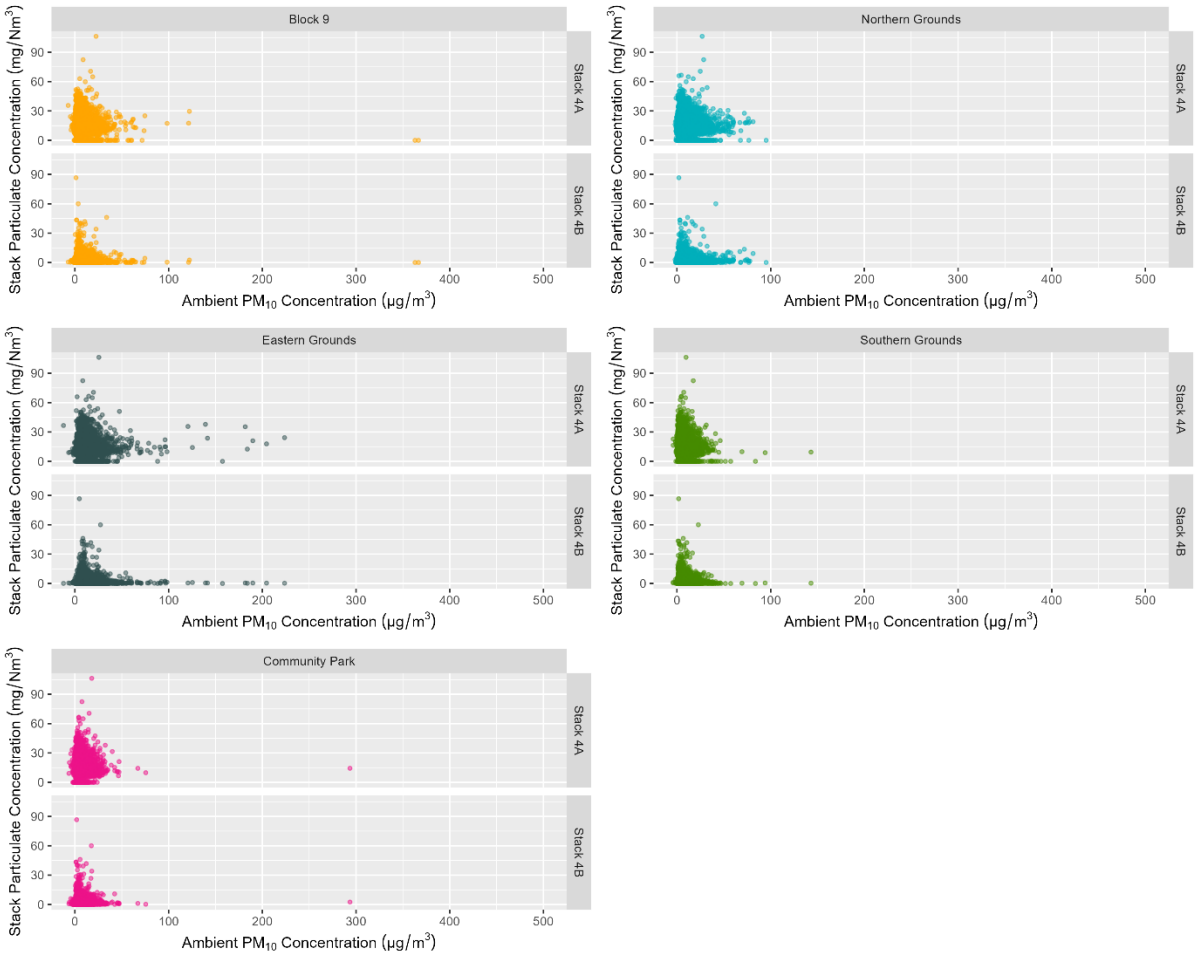

Figure 13 Scatter plot of 1-hour average in-stack TSP concentration (mg/Nm^3) measured at Stacks 4A and 4B compared to 1-hour average ambient measurements at all on-site and off-site monitors for the reporting period

Dust-related complaints and off-site ambient monitoring of particulates have also been analysed as indicators of possible dust impacts.

The GLPMRP data for the off-site monitor presented in Section 3.2 shows that there were no exceedances of the 24-hour average criteria for PM_{10} or $PM_{2.5}$ at Community Park 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.

As discussed in Section 4, while there were more dust-related complaints in 2023 than in 2022, the number was a decrease in comparison to the 2021, 2020 and 2019 reporting periods. Furthermore, analysis of ambient monitoring data found no evidence that emissions from the facility significantly contributed to elevated concentrations of PM_{10} on complaint days, nor that elevated concentrations of PM_{10} at Community Park were associated with an increase in dust complaints over the following days.

5.2 Coverage of dust impacts by alerts

It was noted in Section 4 that emissions from local sources likely contributed to dust-related complaints relating to extended periods of low levels of dust accumulating over time. Another metric of TARP effectiveness is, therefore, whether dust impacts in the community are predictable based on 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 not the case for others. 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.

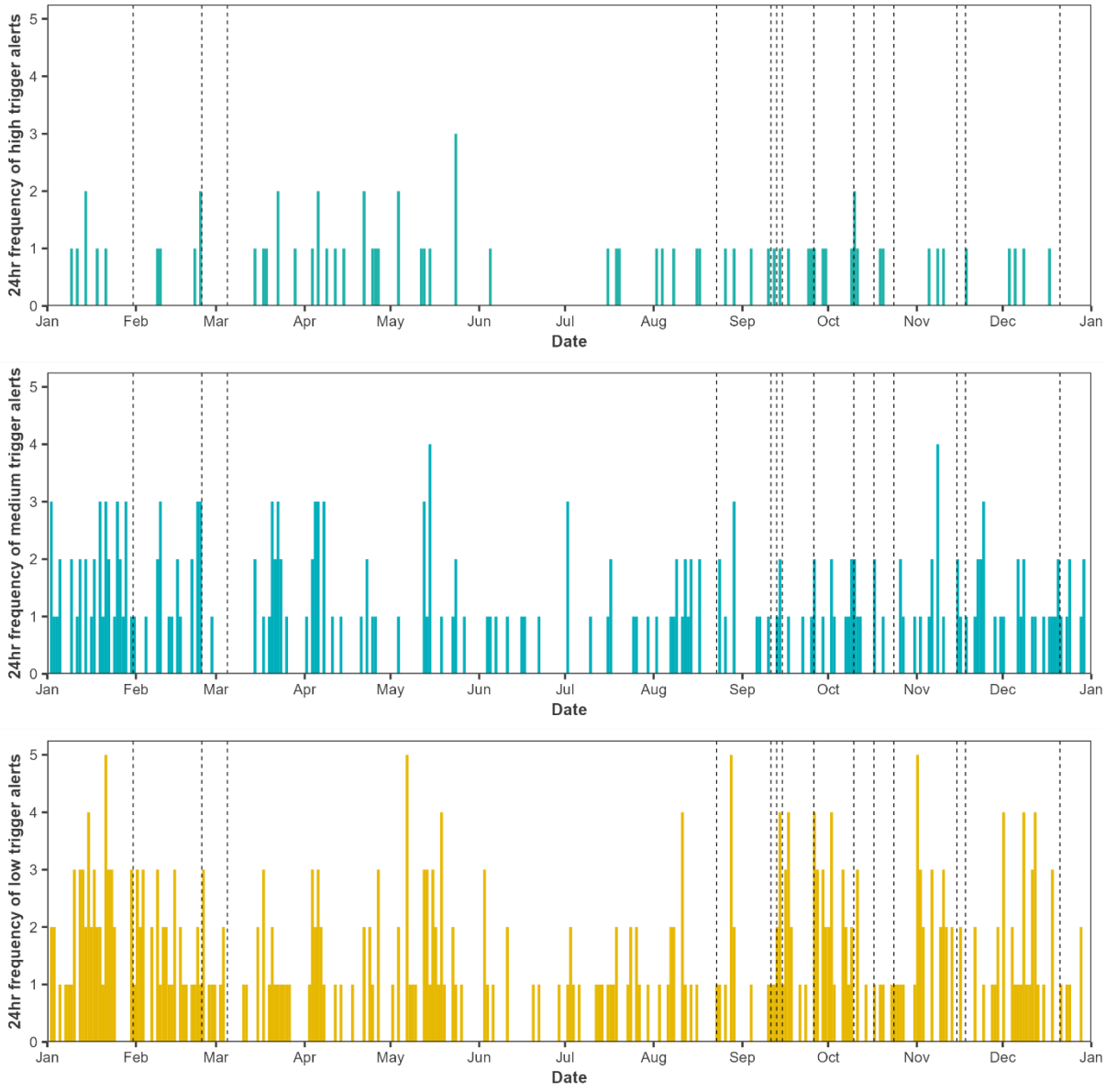

Figure 14 Trigger alerts and complaints during the reporting period

Figure 15 provides the 1-hour average concentration of PM_{10} at the Community Park monitoring site during the reporting period along with high trigger alerts identified by grey vertical markers. The frequency of high trigger alerts by week of the year is shown in Figure 16. Figure 15 shows that, while some spikes in concentrations do not have an accompanying high trigger alert, many elevated PM_{10} events do. This suggests that in many cases the triggers are likely effective in identifying certain conditions that could lead to elevated concentrations of particulates at the off-site monitors. Looking at Figure 15 and Figure 16 together, there are no obvious periods of especially elevated concentrations or elevated numbers of high rigger alerts that might otherwise warrant further investigation.

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.

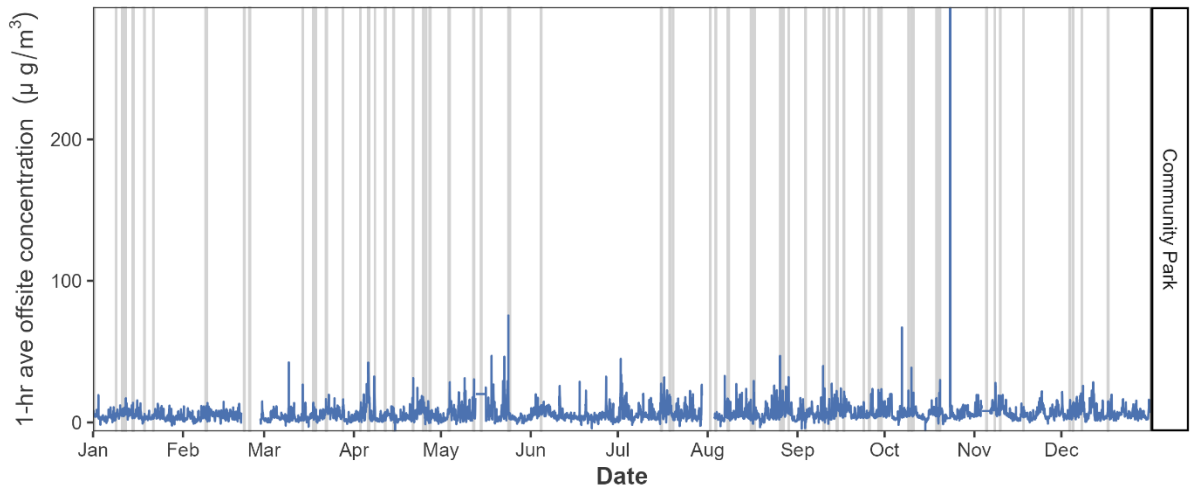

Figure 15 1-hour average concentration of PM_{10} (µg/m^3) at the Community Park monitoring station with periods of 'high' triggers marked in grey

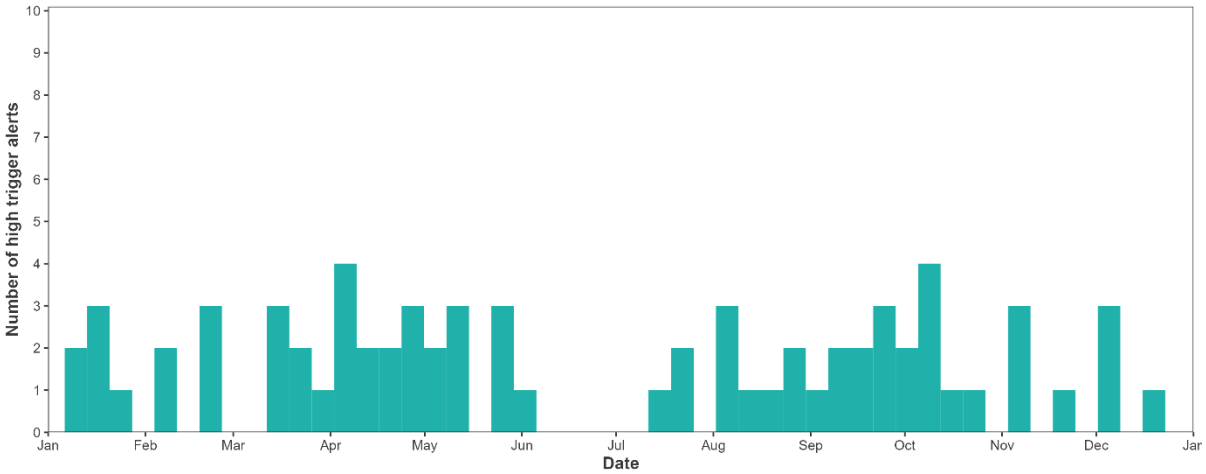

Figure 16 Frequency of high trigger alerts during the reporting period

5.3 Effects of actions on dust impacts

A third metric of TARP effectiveness is 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 21 show boxplots of the mean concentration of PM_{10} at Community Park 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 and is split into low, medium, and high alert levels.

No figure is included for the meteorological observations-based alerts (indicating a 20-day period with less than 1 mm of rain) since these alerts are associated with a more gradual increase in dust risk which likely would not be visible within 6 hours of the alert being triggered. Furthermore, these alerts indicate an increased risk of dust emissions in general, not that ambient concentrations are currently elevated (unlike the concentration-based alerts), nor that a specific upcoming 3-hour period has an elevated risk of dust impacts (unlike the meteorological forecast-based alerts). Therefore, it is possible that no change in actual ambient concentrations of PM_{10} in the 6 hours following a meteorology – observations trigger would occur, regardless of the actions taken by operators.

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. 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 Community Park monitor and the Facility. The alerting site and Community Park monitor 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 and Figure 18 for alerts from Southern Grounds and Eastern Grounds, respectively. Figure 20 (Northern Grounds) also shows the expected trend. This is expected for the Southern Grounds as this monitor is downwind of the Facility under similar wind conditions to the Community Park monitor. The Northern Grounds and Southern Grounds monitors would likely be affected at the same time as Community Park 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 19 (Block 9) shows the same trend for medium alerts, but not for high or low alerts. 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 Community Park monitor. It is, therefore, expected that measured concentrations at the Community Park monitor would have little dependence on actions taken in response to alerts from Block 9. Similar to the Eastern Grounds and Northern Grounds monitors, the Block 9 monitor would likely be affected at the same time as Community Park under calm conditions with low dispersion of fugitive dust. The effective response trend for medium alerts at Block 9 may be a result of this. Given the evidence of the effectiveness of the actions taken in response to trigger alerts of all levels 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 21 does indeed show no obvious dependence of measured concentrations at Community Park on actions taken in response to low and medium level forecast meteorology trigger alerts, indicating that the actions being taken in response to these alerts are effective at preventing significant fugitive dust emissions. This is, however, not the case for high level meteorological forecast-based alerts, which instead show a similar trend to the concentration-based alerts, indicating that the actions taken in response to these alerts did not prevent increases in PM_{10} concentrations at Community Park. Such a trend was not visible in the 2022 reporting period, potentially indicating that the actions taken in response to high meteorological forecast-based triggers in 2022 were more effective at preventing increases to PM_{10} concentrations at Community Park than the actions taken in 2023. It is, however, also possible that this apparent trend was a result of a few exceptional events and/or outside factors (e.g. regional events), thus it is recommended that this outcome is reviewed again in next year's review of the 2024 TARP effectiveness, to see if it persists or if it was an anomaly. If it persists then consideration will be given to what additional measures could be taken to prevent offsite impacts following high meteorological triggers. Nevertheless, ABC should be especially diligent in its responses to high meteorological triggers in 2024 to prevent offsite impacts.

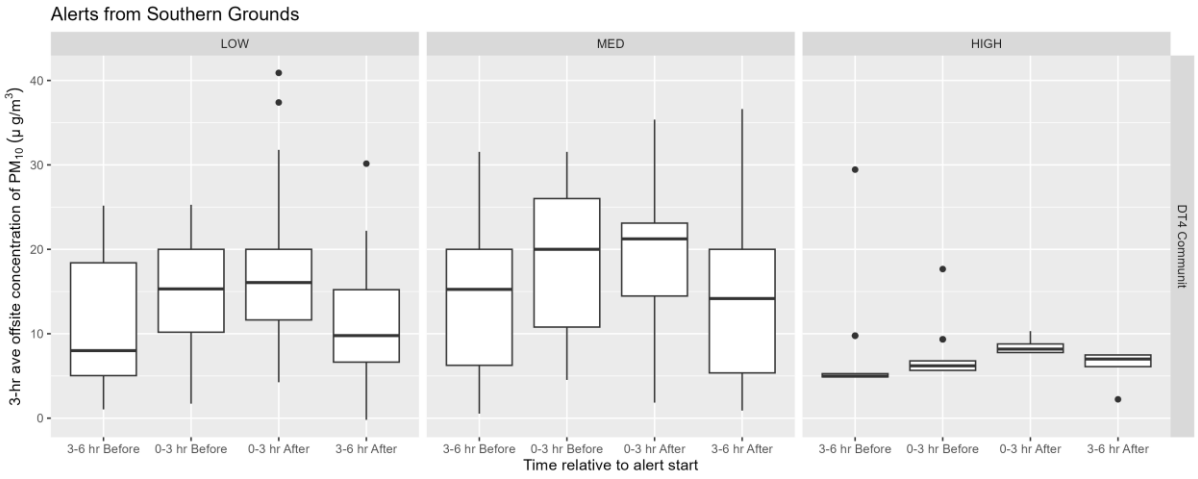

Figure 17 Boxplots of 3-hr average concentrations of PM_{10} at Community Park within 6 hours of a trigger alert from the Southern Grounds monitor

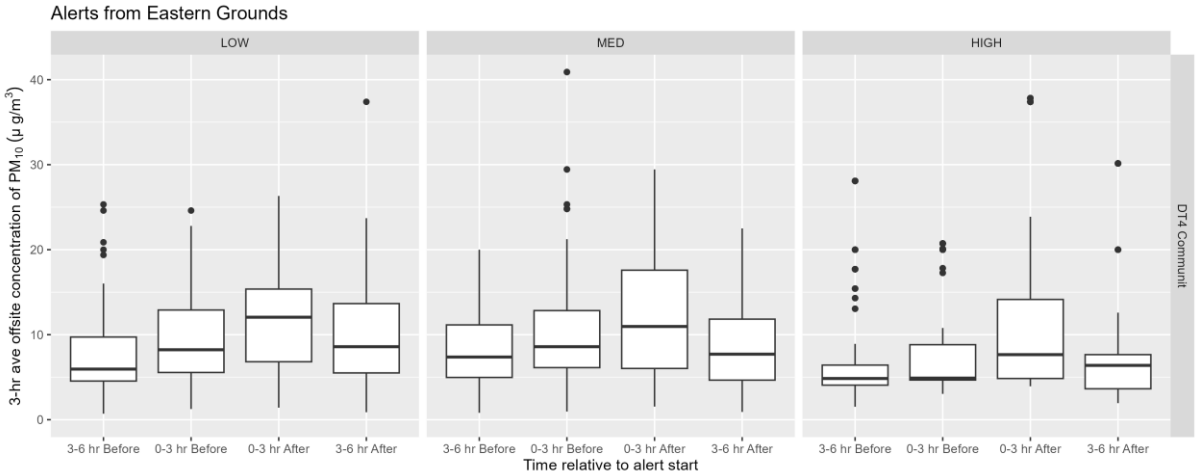

Figure 18 Boxplots of 3-hr average concentrations of PM_{10} at Community Park within 6 hours of a trigger alert from the Eastern Grounds monitor

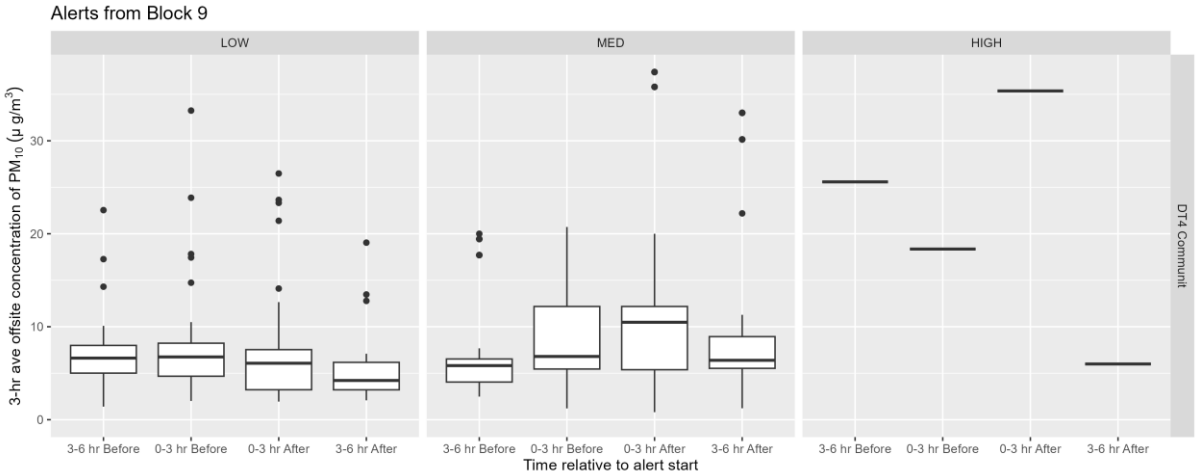

Figure 19 Boxplots of 3-hr average concentrations of PM_{10} at Community Park within 6 hours of a trigger alert from the Block 9 monitor

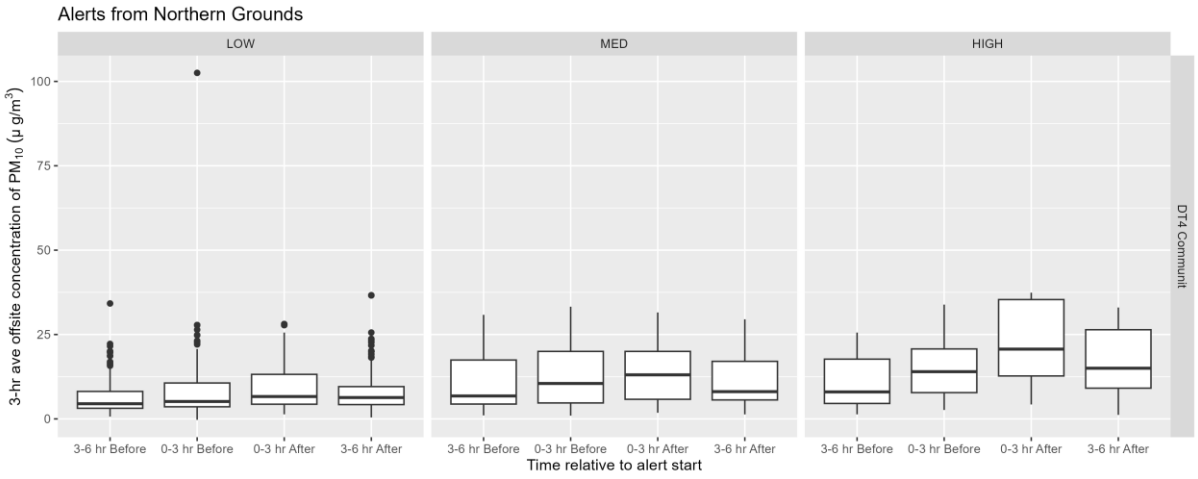

Figure 20 **Boxplots of 3-hr average concentrations of PM_{10} at Community Park within 6 hours of a trigger alert from the Northern Grounds monitor**

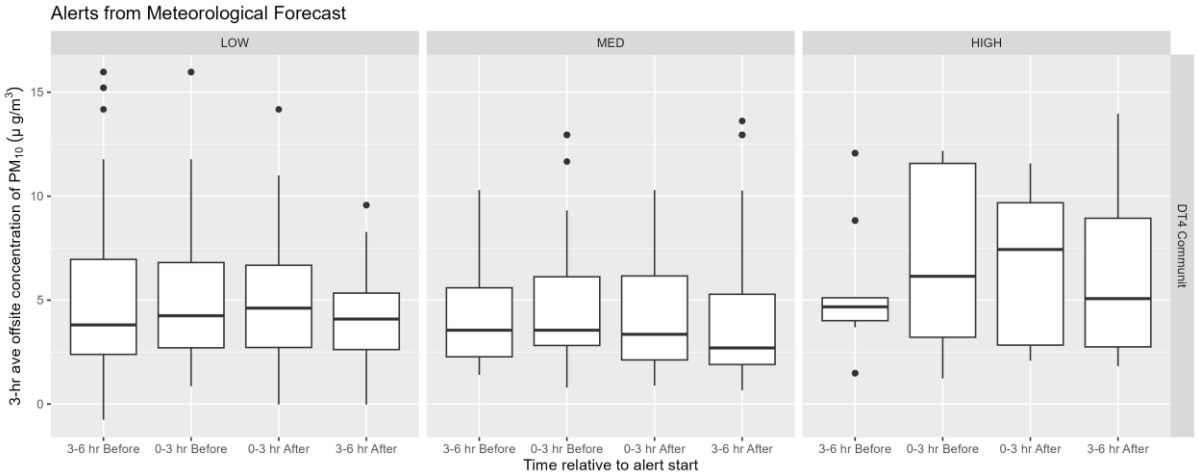

Figure 21 **Boxplots of 3-hr average concentrations of PM_{10} at Community Park within 6 hours of a Meteorology Forecast trigger alert**

6. CONCLUSIONS

Katestone was commissioned by ABC to complete a review of the TARP data collected for the period 1 January 2023 to 31 December 2023, inclusive.

The TARP is implemented and managed at ABC's Birkenhead facility though 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 639 triggers were recorded, including 342 low level triggers (54%), 224 medium level triggers (35%) and 73 high level triggers (11%)
- Low, medium and high level triggers occurred with decreasing frequency at all sites
- The sites that generated the most triggers were Northern Grounds (257), Eastern Grounds (175) and Southern Grounds (116), followed by Meteorology – forecast (57), Block 9 (32) and Meteorology – observations (2)
- No triggers were generated by on-site visual observations during the reporting period
- A total of 1,722 actions were taken, including 501 actions against low level triggers (29%), 767 actions against medium level triggers (45%) and 454 actions against high level triggers (26%)
- The most actions were generated by Northern Grounds (659) and Eastern Grounds (473), followed by Meteorology – forecast (268), Southern Grounds (227), Block 9 (70) and Meteorology – observations (25)
- On average, approximately 3 separate actions were performed for every trigger, the same as in the 2022 reporting period
- Although high trigger alerts regularly did not correspond with elevated PM_{10} concentrations at Community Park, the majority of actual elevated PM_{10} events at Community Park were also covered by a trigger of some level
- The highest PM_{10} levels recorded at Community Park 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
- 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.

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 during the reporting period was greater than 93% at all sites, meeting the 90% data capture limit prescribed in the GLPMRP
- The 24-hour average concentrations of PM_{10} and $PM_{2.5}$ did not exceed the EPA criteria at the Community Park monitoring site during the reporting period
- This is the same as the previous reporting period (January 2022 to December 2022)
- The highest on-site 24-hour average concentration of PM_{10} was 75.4 µg/m^3 and was recorded at Block 9 on 14 January 2023
- The highest on-site 24-hour average concentration of $PM_{2.5}$ was 66.6 µg/m^3 and was recorded at Eastern Grounds on 27 April 2023
- It does not appear that on-site operations are significantly contributing to off-site particulate monitoring concentrations at Community Park.

Analysis of concentrations at Community Park in the hours before and after trigger alerts have been generated suggests that effective response actions are being taken to prevent unacceptable fugitive dust emissions from the Facility in almost all circumstances. However, in the case of high meteorological triggers, it would appear that the actions taken in 2023 were not entirely effective in preventing an increase in PM_{10} concentrations at Community Park. It is possible that this apparent trend was a result of a few exceptional events and/or outside factors (e.g. regional events), thus it is recommended that this outcome is reviewed again in next year's review of the 2024 TARP effectiveness, to see if it persists or if it was an anomaly. If it persists then consideration will be given to what additional measures could be taken to prevent offsite impacts following high meteorological triggers. Nevertheless, ABC should be especially diligent in its responses to high meteorological triggers in 2024 to prevent offsite impacts.

The analysis carried out has otherwise 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. Table 15 presents the frequency of various measures of dust impact over the 2019 to 2023 reporting periods. While there were more dust-related complaints in the 2023 reporting period than in 2022, the total was less than in the 2019, 2020 and 2021 reporting periods. The number of exceedances of the 24-hour average criteria for PM_{10} and $PM_{2.5}$ at Community Park in 2023 was equal lowest over the five years, and significantly less than in the 2019 and 2020 reporting periods.

It is recommended to maintain the current trigger levels considering the lack of off-site exceedances observed throughout this reporting period.

Table 15 Comparison of community impacts between the 2019-2023 reporting periods

Dust Impact	Frequency of dust impact over each reporting period				
	Calendar year 2019	Calendar year 2020	Calendar year 2021	Calendar year 2022	Calendar year 2023
Dust-related complaints	47	22	37	11	18
PM_{10} exceedances at Community Park	2	4	0	0	0
$PM_{2.5}$ exceedances at Community Park	6	22	1	0	0