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Air Particulate Management Plan

Adelaide Brighton Cement Limited

Licence number: 1126

Premises Address: Victoria & Elder Roads, Peterhead (Birkenhead Site)

October 2023

ENVIRONMENT PROTECTION AUTHORITY

THIS IS THE APPROVED Air Particulate Management Plan

REFERRED TO IN CONDITION U - 1549

OF EPA AUTHORISATION NUMBER 1126

DELEGATE K Williams DATE 16/10/2023

A/Principal Adviser

Contents

Glossary

Term	Definition
µg/m^3	micrograms per cubic metre
µm	micrometre
°C	degrees Celsius
m	metre
m^3	cubic metres
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
Abbreviations	**Definition**
ABC	Adelaide Brighton Cement
Air EPP	Environment Protection (Air Quality) Policy 2016
APMP	Air Particulate Management Plan
EPA	Environment Protection Authority
GLPMRP	Ground Level Particulate Monitoring and Reporting Plan
SPMP	Stack Particulate Management Plan
TARP	Trigger Action Response Plan

1.0 Purpose

The purpose of this Air Particulate Management Plan (APMP) is to facilitate the ongoing implementation of particulate control measures to minimise offsite particulate from the Birkenhead site (Facility).

2.0 Scope

The plan addresses

- Objectives of the plan
- Particulate management practices
- Development of trigger action response plans
- Reporting methodology
- Public access to reports and plan

3.0 Plan objectives

The objectives of this plan are to:

- Develop triggers based on ambient monitoring data, meteorological and visual observations
- Develop trigger action response plans to prevent or minimise off site particulate impacts and ensure compliance with Air EPP criteria of:
    - PM_{10} of 50 µg/m³ (24-hour average)
    - $PM_{2.5}$ of 25 µg/m³ (24-hour average)
- Facilitate on going implementation of particulate control measures
- Provide public access to quarterly, annual reports and this plan

4.0 Background

ABC has a network of onsite and offsite, ground level particulate monitors that continuously measure particulate size fractions (PM_{10}, $PM_{2.5}$ and TSP), wind speed and direction.

The Ground Level Particulate Monitoring and Reporting Plan (GLPMRP) provides the framework for the measurement, monitoring and reporting of ground level particulate concentrations from the monitors.

The monitors provide data that facilitate the ongoing implementation of particulate control measures, development of Trigger Action Response Plans (TARP's) and strategies to reduce fugitive particulate emissions from activities on the site.

4.1 Sources of particulate

Fugitive particulate emissions may occur from the following sources at the site:

- Unloading of limestone from ships
- Onsite transfers of limestone, gypsum, shale, black sand, mill scale, bauxite and slag
- Wind erosion of stockpiles
- Wind erosion of cleared areas
- Vehicle movements on paved and unpaved areas
- Combustion emissions from vehicles onsite
- Dust collectors that are vented to the environment.

4.2 Details of the receiving environment and particulate monitoring locations

- Plant is located adjacent to the Port River, Northern side of the Birkenhead Bridge
- Plant is adjacent to a residential area
- Proximity of sensitive receptors to the site is shown in figure 1

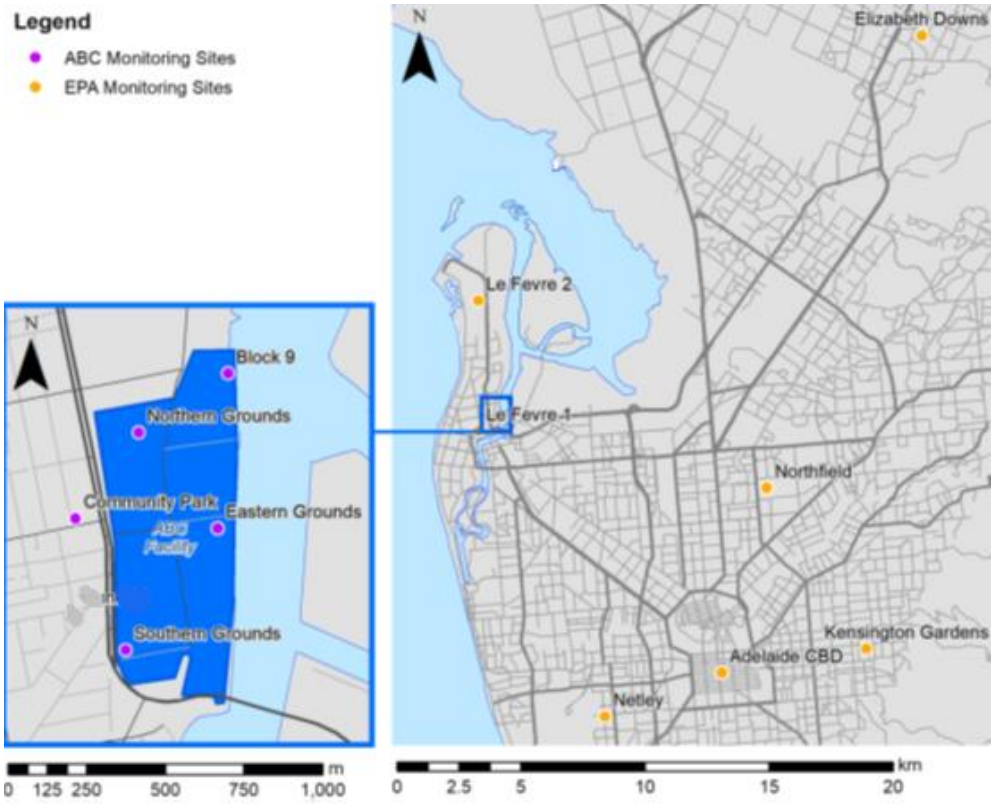


Figure 1:

- Particulate monitoring locations are indicated by colour coded points on the aerial photograph below

On-site particulate monitors are located strategically around the site to allow ABC to manage dust emissions from site operations.

An offsite particulate monitor is located at the Community Park, located on the corner of Alfred Street and Hargrave Street, Peterhead, 5016. ABC is currently seeking to find a suitable location for an air particulate monitor to replace the Gunn Street, Birkenhead 5015, monitor, following the sale and redevelopment of the site (not owned by ABC). Appendix A contains details of locations that are under consideration for a monitoring station and the process required for approval and implementation.

Location of fugitive particulate sources as well as the stacks and significant dust collectors are shown in Figure 2: Schematic of the facility showing locations of stacks, and fugitive particulate sources, and Figure 3: Location of significant dust collectors.

Figure 2: Schematic of the facility showing locations of stacks, and fugitive particulate sources

Figure 3: Location of significant dust collectors

4.3 Particulate controls

ABC has implemented a range of fixed measures to reduce or eliminate the potential sources of fugitive particulate across the Facility, including the following:

- Stockpiling and handling of material largely occurs inside sheds (limestone blend building, Wallaroo shed, clinker gantries)

- Rapid raise doors
- Miscellaneous Materials (MM) and slag stockpiles enclosed in 3-sided bunkers
- Transfer points are enclosed
- Conveyors are enclosed
- Water sprays on ship unloader
- Sprinklers on MM bunkers
- Shade cloth installed around most of the site to reduce wind speed and trap particulate
- Vegetation barriers to reduce wind speed and trap particulate
- Truck washes
- Wheel washes
- Dust collectors
- Sealing of exposed areas to eliminate particulate lift-off

4.4 Assessment of particulate emissions and controls

A comprehensive air quality assessment of the Adelaide Brighton Cement Birkenhead site was undertaken by Katestone Environmental Pty Ltd. (Katestone), based on 2022 activity data and documented in the Katestone report "Birkenhead Cement Plant Air Emissions Inventory and Dispersion Modelling" dated August 2023. The air quality assessment was undertaken in accordance with the EPA's guidance for air quality assessments, and in accordance with condition U-1566 (Air Pollutant Emissions Inventory) of licence 1126 for the ABC Birkenhead Cement Plant, issued by the South Australian Environment Protection Authority on 1/11/2022.

The report, submitted to the EPA, details, particulate sources, activities and control measures in place to mitigate particulate emissions and quantifies the off-site impacts of particulate emissions. Table 1 summarises the identified particulate emissions.

Table 1: Summary of particulate emissions

Activity	Emission rate (g/s)			Emission rate (kg/year)		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Handling – Transfer points	0.053	0.025	0.004	858	406	61
Handling – Stockpiles	0.025	0.012	0.002	489	231	35
Stockpile wind erosion	0.161	0.081	0.012	5,084	2,542	381
Exposed areas wind erosion	0.024	0.012	0.002	768	384	58
Dust collectors	0.996	0.807	0.540	31,410	25,458	17,031
Stacks	2.939	1.838	1.036	92,693	57,960	32,670
4A Stack	*2.218*	*1.338*	*0.743*	*69,935*	*42,183*	*23,419*
4B Stack	*0.330*	*0.300*	*0.208*	*10,407*	*9,470*	*6,544*
SPP Stack	*0.392*	*0.200*	*0.086*	*12,352*	*6,307*	*2,707*
Vehicle movements – unpaved	1.708	0.471	0.047	53,878	14,850	1,485
Vehicle movements – paved	0.669	0.128	0.031	21,098	4,050	980
Total	**6.577**	**3.374**	**1.674**	**206,277**	**105,881**	**52,701**

Of note the 2022 air emissions inventory shows an increase in PM_{10} emissions associated with vehicle movements, 18,900 kg/year (2022), compared with 4,309 kg/year in the 2017 assessment. The 2022 whole of site air quality assessment considers current activity levels, with greater quantities of materials used and increased material handling, vehicular movements, vehicular travel distance on paved and unpaved roads, than those used in the 2017 air quality assessment. In addition, the 2017 assessment used average vehicle weights, whereas the 2022 assessment calculates emissions for laden and unladen heavy vehicles separately, which results in higher particulate emissions as the relationship between gross vehicular weight and particulate emissions is not linear, with heavier vehicles producing proportionally higher particulate emissions.

Predicted contributions of each source group to PM_{10} concentrations at the Community Park were estimated in the air quality assessment and are reproduced in Figure 4.

The Community Park is located between the site and the residential area to the west and is representative of the maximum potential concentrations of fugitive particulates within the residential area.

Figure 4: Source contributions for the 25 highest predicted 24-hour average concentrations of PM_{10} at the Community Park, shows that the stack contribution to ground level concentrations of particulate is very low and contributions of sources during each of the 25 highest days are relatively consistent.

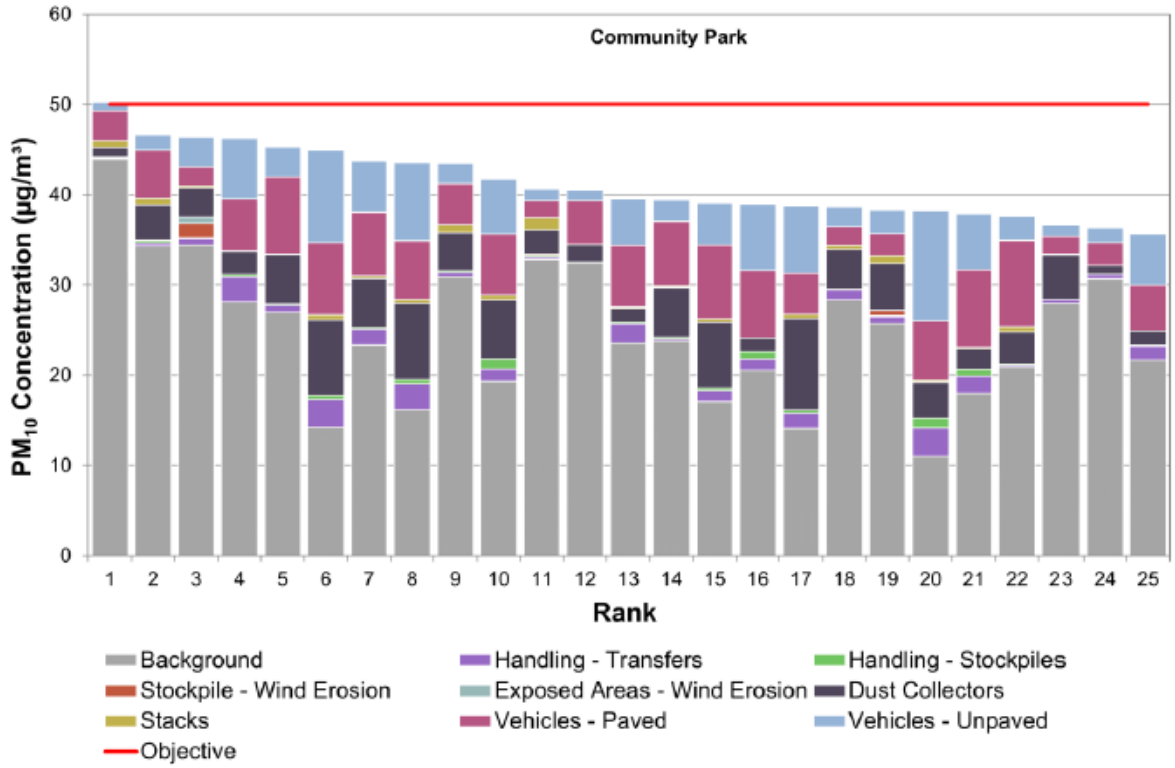


Figure 4: Source contributions for the highest 25 predicted 24-hour average concentrations of PM_{10} at the Community Park

The Facility adopts a range of controls to minimise dust emissions from the site. Controls that have been incorporated into the calculation of emissions from fugitive dust sources are listed in Table 2. Controls included in the assessment.

Table 2: Controls included in the assessment

Control	Activities	Control efficiency
4-sided enclosure	Ship unloading	90%
Enclosure	Transfers between conveyors/telestacker	90%
3-sided enclosure	Transfers into hoppers	90%
Enclosure	Transfers into MM Pit bin	90%
Chemical suppressant	Wind erosion of open stockpiles (limestone, HGL, bauxite and gypsum) and exposed areas (where applied)	80%
3-sided bunkers with wind canopies and water suppression	Wind erosion of bunkered stockpiles (slag, bauxite, mill scale, black sand and moculta shale)	90%
Chemical suppressant	Unpaved roads	80%
Water cart/Street sweeper	Paved roads	75%

Not all control measures are able to be quantified. The following controls measures have been put in place by ABC but have not been accounted for in the model:

- Shade cloth – reduce wind speed and collect particulate
- Truck wash

5.0 Applicable legislative requirements and guidance

- South Australian Environment Protection Act 1993
- South Australian Environment Protection Regulations 2009
- South Australian Environment Protection (Air Quality) Policy 2016 (Air EPP)

The air quality criteria that are relevant to particulate emissions from the site are reproduced in Table 3.

Table 3: Relevant criteria from the Air EPP Schedule 2 (unless noted otherwise)

Pollutant	Classification	Averaging time	Maximum concentration (µg/m³)
Particles as PM_{10}	Toxicity	24 hours	50
Particles as $PM_{2.5}$	Toxicity	24 hours	25
		12 months	8

Adelaide Brighton Cement's EPA Licence No1126, 1/11/2022, conditions U1549

1.1 AIR PARTICULATE MANAGEMENT PLAN (U - 1549)
The Licensee must:

1.1.1 develop and submit to the satisfaction of the EPA an Air Particulate Management Plan by the compliance date listed below;

1.1.2 ensure that the Air Particulate Management Plan includes, but need not be limited to:

a) specification of trigger values to prevent and minimise particulate emissions;

b) specification of trigger values required by sub paragraph 2(a) of this condition should have regard to the following items:

i. existing monitoring data;

ii. data collected as part of conditions U-1555, U-1556;

iii. meteorological conditions; and

iv. visual observations, including the use of electronic and/or remote visual methods;

c) detailed action and response strategies that will be taken when the trigger values, identified under sub paragraph 2(a) of this condition are reached, to prevent and minimise particulate emissions;

d) a methodology and framework for providing public access to the Air Particulate Management Plan (or any revised plan approved by the EPA) and to quarterly and annual reporting;

1.1.3 submit a quarterly report to the EPA by the last day of January, April, July and October of each year that includes but need not be limited to:

a) the date, time and trigger value exceeded;

b) action and response strategies implemented;

c) summary of events notified under condition U-765;

d) a summary of air particulate related complaints received and recorded pursuant to condition U-1553;

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 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;

1.1.5 implement the Air Particulate Management Plan approved in writing by the EPA (or any revised plan approved in writing by the EPA).

Compliance Date: 30-May-2023

6.0 Responsibilities

The organisation chart presented in Figure 5 shows personnel with roles that have been assigned under the Air Particulate Management Plan (APMP).

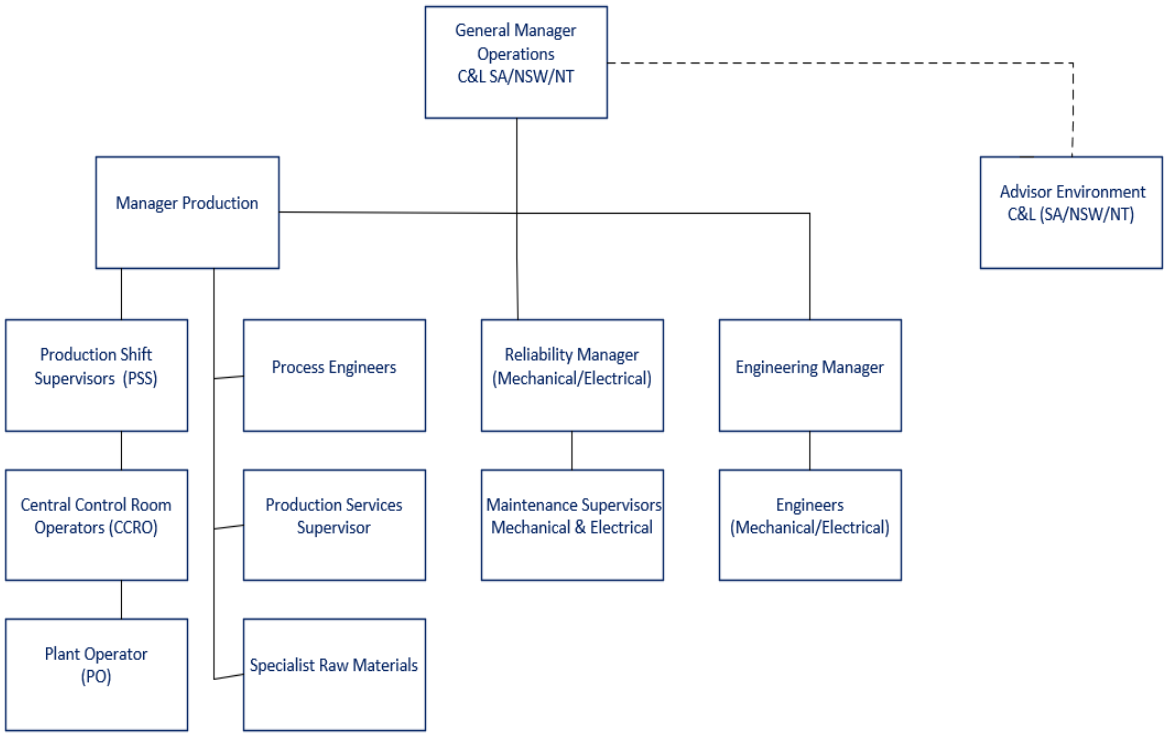


Figure 5: Organisation chart

All employees are responsible for complying with this plan, which includes:

- Taking action to minimise or prevent particulate (dust) incidents
- Identifying and reporting particulate (dust) incidents.

Responsibilities for key roles assigned in the APMP have been detailed in Table 4: General responsibilities

Table 4: General responsibilities

Role	Responsibility & Authority
Reliability Manager Engineering staff Maintenance Supervisors (Electrical / Mechanical)	Responsibility and authority to ensure • Timely plant and equipment maintenance to minimise dust emissions • Maintenance and calibration of particulate monitors (refer to GLPMRP)
Central Control Room Operators (CCRO) Plant Operators (PO)	Responsible for minimisation of fugitive particulate emissions this includes: • Responding to and investigating TARP trigger threshold alerts • Initiating action to minimise particulate emissions • TARP reporting and recording
Production Shift Supervisor (PSS)	Responsible for minimisation of fugitive particulate emissions this includes: • Responding to, investigating and recording dust complaints • Responding to and investigating TARP trigger alerts • Initiating action to minimise particulate emissions • TARP reporting and recording
Production Services Supervisor	Responsible for: • Responding to and investigating TARP trigger alerts • Water cart and street sweeper operations • Application and maintenance of chemical dust suppressant • Application of water • Clean up of spilled materials to reduce dust emissions
Specialist Raw Materials	Responsible for: • Responding to and investigating TARP trigger alerts • Ensuring availability of water cart and street sweeper for campaign movement of materials • Ensuring employees and contractors involved in material transfers and movements are trained with respect to dust awareness, responsibilities, instructions, procedures
Manager Production	Responsible for: Implementation of APMP and TARP • Ensuring employees and contractors are trained with respect to dust awareness, responsibilities, instructions, procedures • Ensuring timely maintenance of plant and equipment to reduce dust emissions
Advisor Environment C&L (SA/NSW/NT)	Responsible for: • Annual and quarterly reporting requirements of this plan • Annual Review and effectiveness of APMP and TARP • Reporting requirements under the GLPMRP • Review of TARP trigger thresholds • Management of dust complaints (response, investigation, recording) • Identifying opportunities for improvement

Role	Responsibility & Authority
General Manager Operations C&L (SA/NSW/NT)	Responsible for: • Ensuring compliance with this APMP and TARP • Ensuring employees are aware of the site EPA licence conditions and reporting requirements relating to this APMP and TARP • Provision of resources to reasonably and practically implement this Dust Management Plan and TARP

7.0 General particulate (dust) management practices

The following dust mitigation practices outlined in Table 5 General particulate management practices, shall be implemented on an ongoing basis at the site. Additional particulate (dust) mitigation practices may be required in response to trigger levels being reached and these are outlined in Section 8.

Table 5: General particulate (dust) management practices

Parameter	Action	Frequency	Responsibility
Administrative actions			
Induction	Inductions for all employees and contractors shall include information on: • Potential sources of dust • Monitoring program and licence conditions • Minimising or eliminating dust impacts • Environmental incident reporting • Individual staff/contractor responsibilities	At beginning of employment and renewed annually (contractors) or biennially (employees)	Manager - Production
Reassignment of responsibility	When staff that are normally responsible for dust management are unavailable (e.g., on leave), reassign responsibilities to another staff member	Prior to staff unavailability	General Manager Operations / Manager - Production
Maintenance – plant and equipment	All plant and equipment shall be maintained in a proper and efficient manner, to ensure that dust emissions are minimised.	Maintenance schedule or when identified	Reliability Manager Maintenance Supervisors Engineers

Parameter	Action	Frequency	Responsibility
Maintenance – ambient and meteorological monitors	Maintained as recommended by manufacturer to ensure reliable data collection.	3 monthly routine inspection and maintenance Yearly service performed by supplier	Maintenance Supervisor - Electrical
Routine (baseline) dust mitigation practices			
Sealed roads	Watercart and/or street sweeper	Dayshift - Monday to Friday & during any other periods of high traffic activity)	Production Services Supervisor
Unsealed roads	Watercart	During transfer of materials	Production Services Supervisor
	Apply chemical dust suppressant	Weekly checks & apply to unsealed areas*	
Stockpiles and exposed areas	Apply water	During transfer of materials	Production Services Supervisor
	Apply chemical dust suppressant	Weekly checks & apply to unsealed areas**	
Spillages	Spilled materials to be cleaned immediately after they occur	Clean up immediately after spill occurs	Production Services supervisor
Ship unloading of limestone	Apply water sprays	During unloading to limestone stockpile holding pad	Specialist - Raw Materials /Shift Supervisor
Bulk material import / export in pneumatic tankers	Ensure all ‘bulk’ pneumatic tankers use truck wash	All pneumatic tankers on exit	Manager Production
Shade cloth	Ensure shade cloth is in place and in good condition	At all times, review annually	Production Services supervisor
Campaign movement of materials	Ensure watercart availability Ensure road sweeper availability	Prior to & during entire campaign	Specialist - Raw Materials
Buildings	Ensure all doors are closed Ensure all buildings are sealed	At all times	Manager Production
Routine practices to ensure implementation of TARP			
Continuous observations	Assess whether any visible dust or build-up of deposited dust is present	At all times	All staff

Parameter	Action	Frequency	Responsibility
Routine review of dust management and TARP	Annual review of • Dust management activities • Trigger levels • Compliance • Opportunities for improvement	Review annually	Advisor Environment C&L (SA/NSW/NT)
Dust Dashboard	Monitoring & TARP recording	At all times	Manager Production

* Chemical suppressant applied in accordance with manufacturers recommendations; not to be applied during rain events, surfaces not to be watered during curing of polymer, application dependant on vehicular activity and weather conditions – high activity in hot dry windy conditions typically requires application twice /week

** Applied to non-working surface areas of stockpiles – long lasting coating – reapply as surfaces are disturbed

8.0 Trigger Action Response Plans (TARP's)

Triggers have been defined to assist ABC to meet its particulate management obligations by identifying circumstances when:

- Ground-level concentrations at offsite receptors are likely to be elevated due to activities onsite
- Activities onsite are generating particulate (dust) outside of the normal range

The following three levels of trigger/response have been defined:

1. Low trigger (Watch and wait). This is an early warning level put in place to increase awareness of potential particulate (dust) issues before they arise.
2. Medium trigger (Investigate). A medium trigger indicates that there may be a potential particulate (dust) issue and specific investigation is warranted.
3. High trigger (Escalate). A high trigger indicates that particulate (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 particulate (dust) impact.
Triggers and responses have been defined for the following data sources:

- Ambient Particulate (dust) monitoring data
- Meteorological parameters
- Visual observations

Triggers and responses based on stack monitoring are included as part of the separate Stack Particulate Management Plan (SPMP).

8.1 Trigger values and responses for ambient particulate monitoring data

The trigger values presented in table 6 are based on an analysis of monitor-specific real-time ambient monitoring data. The analysis considered the range of typical concentrations of PM_{10} at each monitor between 1 January 2015 to 30 November 2017. Trigger values have been set at the 90th, 95th and 99th percentile values for low, medium and high respectively. The trigger values have been set to achieve compliance with Air EPP criteria in the community.

To ensure that the triggers are relevant to the site, the trigger levels include a reference to measured wind direction. If the wind direction is not blowing from the general direction of the site, that is the wind direction is between 180° and 360°, the trigger level will be downgraded by one, i.e., Medium to Low.

To ensure ongoing effectiveness of triggers and response strategies, an annual review of the TARP is undertaken and submitted to the EPA.

The 2022 annual TARP review, included a complete review of trigger action response data, undertaken by air quality specialists Katestone Environmental Pty Ltd. (Appendix B). The review concluded that the TARP is working effectively to reduce off-site particulate concentrations and prevent exceedances and recommended maintaining the current trigger levels and actions.

The EPA provided the following feedback on trigger levels and internal monitor locations:

- Change DT3 trigger values to (from): Low-18 (35), Medium-25 (41), High-45 (66)
- Review locations for internal monitors to address wind restrictions:
    - DT1 (polar plots show wind restricted from East-West direction)
    - DT5 (wind restricted from North-South direction)

On-site particulate monitors are located strategically around the site to allow ABC to proactively manage dust emissions from site operations. Large buildings and infrastructure on the Birkenhead site, affect wind flow resulting in wind channeling effects which can result in preferential wind flow patterns, which is indicated in polar wind plots over extended periods of time. This often requires a compromise to be made between ideal placement of the monitor from a wind perspective and placement of the monitor to capture potential fugitive dusts from onsite sources, to enable potential off-site impacts to be minimised. This compromise is most apparent for the Southern Grounds (DT1) and Northern Grounds (DT5) monitors as indicated by the EPA.

The Northern Grounds (DT5) monitor is located to the East of the external limestone stockpile locations, primarily to provide an early warning of increased fugitive dust emissions from this area to facilitate proactive response in managing these emissions to minimise offsite impacts on the local community to the western side of the site. The existing building and plant infrastructure facilitates channeling of wind flow in an East /West direction. ABC is of the opinion that this East/West air flow direction, whilst not ideal, is preferable as it is more likely to facilitate proactive management of fugitive dust from the stockpile storage area, than relocating the monitor to another location to produce a more favourable polar wind plot.

Similarly, the Southern Grounds (DT1) monitor, is located downwind of an external materials stockpile area, but location of building infrastructure channels air flow in a North /South direction.

Finding an alternative position is problematic because of the location of the potential fugitive dust source, and downwind shielding effects of buildings, vegetation etc.

The triggers in ABC's TARP are based on historical monitoring data for each monitor, which due to surrounding dust sources provides a data set unique to that monitor. The analysis undertaken as part of the 2022 annual TARP review by air quality specialists Katestone Environmental Pty Ltd. (Appendix B) including a review of the frequency of dust impacts from 1 January 2022 - 31 December 2022 concluded that the TARP is working effectively to reduce off-site particulate concentrations and prevent exceedances and recommended maintaining the existing trigger levels and actions. ABC is of the opinion that the trigger levels for Block 9 monitor therefore don't need to be adjusted simply to provide similar numbers of low, medium and high-level triggers to the other onsite monitors.

ABC will continue to review the performance of the TARP, including feedback from the EPA on an annual calendar year basis to ensure it is working effectively to reduce off-site particulate concentrations and prevent exceedances.

The trigger values presented in table 6 are those assessed in the 2022 annual TARP review.

The responses that are triggered by ambient monitoring concentrations exceeding the trigger values in table 6 are presented in table 7.

Table 6: Trigger values for 1-hour average concentrations of PM10 µg/m3

Trigger Level	Block 9	Northern Grounds	Eastern Grounds	Southern Grounds
Low	35	20	22	19
Medium	41	27	28	26
High	66	47	48	44

Table 7: Actions and responses for ambient monitoring data triggers – onsite, 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, as per Table 5 • 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 is required • Ensure all routine dust management practices have been implemented as per Table 5 • 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

8.2 Trigger values and responses for meteorological parameters

The trigger values in Table 8 are based on meteorological conditions that are known to have the potential to generate dust. The responses that are triggered by exceeding the values in Table 8 are presented in Table 9 and are proactive based on forecast meteorological conditions.

Table 8: Trigger values for meteorological parameters

Trigger level	Trigger
Low	Forecast of high temperatures (>30 ºC) and north-easterly winds (0° – 90°) Or 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°) Or 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 9: 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, as per Table 5 • 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, as per Table 5 • Visual observations of site every 3 hours • Review ambient monitoring PM_{10} levels & implement the action response if the high level trigger is activated	Shift supervisor

8.3 Trigger values and responses for visual observations

Table 10 presents visual observation triggers and table 11 the corresponding trigger action.

Table 10: Trigger values for visual observations

Trigger level	Trigger
Low	General build-up of deposited 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 11: Actions and responses for visual observations triggers

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 as specified in Table 5	Shift supervisor
Medium	• Inspect site to determine source of dust • Check routine (baseline) dust management practices have been applied to that source as specified in Table 5 • 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 / plant	Shift supervisor
High	• Inspect site to determine source of dust • Check routine (baseline) dust management practices have been applied to that source as specified in Table 5 • 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/plant • Minimise activity rate of dust producing activity	Shift supervisor

8.4 Dust management dashboard and control system

Management of the TARPs shall be performed through an internal Dust Management Dashboard, to ensure that all triggers and associated responses are recorded for subsequent reporting and analysis.

The Dust Management Dashboard displays the following information:

- Real time ambient monitoring data collected at all ABC monitoring sites
- Trigger status of all ABC monitoring sites
- Meteorological data.

A trigger can be activated automatically, in response to monitoring data, or manually, by an operator in response to visual observations. Once a trigger has been activated, the dashboard will display a list of recommended responses. The trigger will remain active until the operator has recorded the action(s) taken and optionally, any additional comments regarding the trigger/response.

9.0 Reporting methodology

All reports will clearly identify the EPA licence number, name and address where the licence activity is conducted, name and contact details of the person submitting the report.

Quarterly reporting

The following information will be included in quarterly reports submitted to the EPA within one month of the end of the calendar quarter:

- the date, time and trigger value exceeded
- action and response strategies implemented
- summary of 24-hour exceedance of PM_{10} and $PM_{2.5}$ Air (EPP) criteria on ambient monitors in the community (licence condition U-765)
- a summary of air particulate related complaints received and recorded pursuant to condition U-1553

Annual reporting

The following information will be included in annual reports submitted to the EPA within 45 days of the end of the calendar year:

- a review of all trigger values
- a review of the effectiveness of all action and response strategies
- a trend analysis of data collected
- 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 the SPMP and GLPMRP
- opportunities for improvement in dust management

Public access

Following acceptance of the quarterly and annual reports by the EPA, the reports will be made available within 7 days on the ABC Community web site.

The current version of this Plan, as approved by the EPA will be made available within 7 days on the ABC Community web site.

A copy of the current version of this Plan, as approved by the EPA, will be made available on the ABC Birkenhead Community Web Site https://adelaidebrightoncommunity.com.au/

10.0 Plan review

The TARP will be reviewed to ensure ongoing effectiveness when:

a) An analysis of monitoring data from off-site particulate monitors demonstrates that ABC operations are resulting in non-compliance with Air EPP criteria of:
    - PM_{10} of 50 µg/m³ (24-hour average)
    - $PM_{2.5}$ of 25 µg/m³ (24-hour average)
b) On an annual basis

The TARP review may include the following analysis:

- Frequency of trigger occurrence
- Correlation between triggers and measured onsite and offsite dust levels, including an analysis of false positives and misses (false negatives)
- Correlation between triggers and complaints
- Revision of trigger level values as a result of improvements made in dust controls and practices.
- Improvement in dust management controls and practices considering site experience and innovations
- A review and analysis of data collected from conditions SPMP and GLPMRP

The APMP will be reviewed and updated to reflect changes in the TARP and incorporate improvement in dust management practices.

11.0 Plan submission

Submitted by:

Name Craig Mackenzie

Advisor Environment C&L (SA/NSW/NT)

on behalf of

ADELAIDE BRIGHTON CEMENT LTD.

Dated: 9/10/2023

12.0 Plan approval

Approved by:

……

DELEGATE OF THE ENVIRONMENT PROTECTION AUTHORITY

Signed: ……..

Dated: ……/……../……...

Appendix A

Potential community locations for an ambient particulate monitor and required approval process

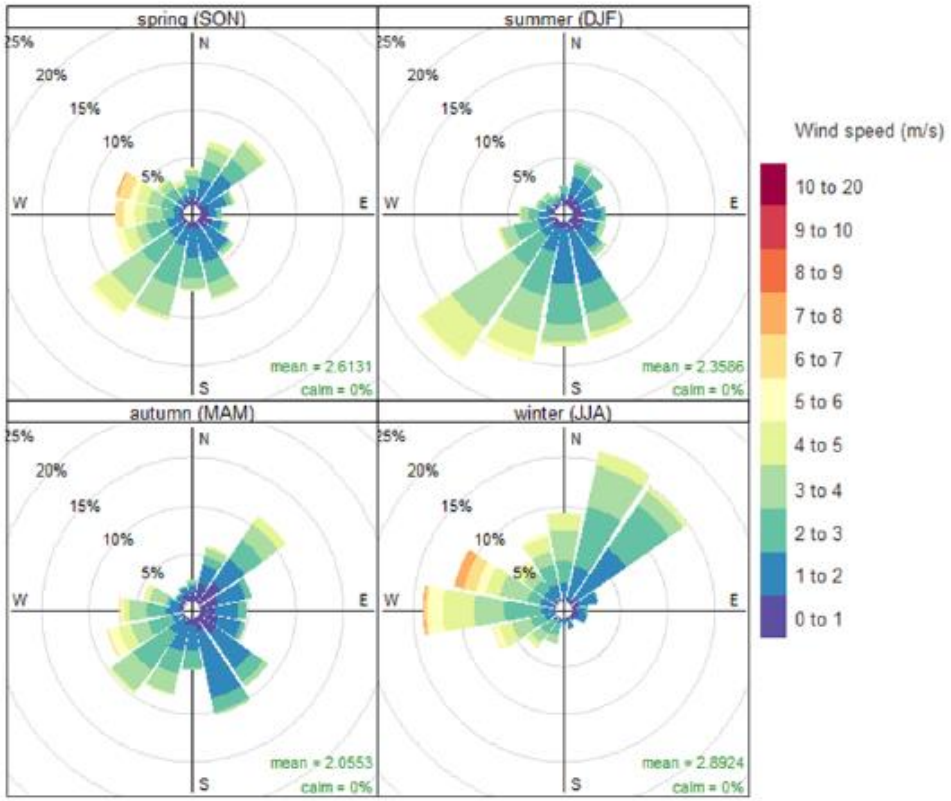
Monitoring locations need to meet a number of siting requirements in order to be suitable. The Australian standard AS/NZS 3580.1.1: 2016 Methods for sampling and analysis of ambient air Part 1.1: Guide to siting air monitoring equipment provides guidance for selection of suitable sites for locating monitors to measure ambient levels of PM10, PM2.5 and TSP particulates.

In summary a suitable monitoring location will also need to meet the following requirements:

- Located downwind of ABC operations (predominant wind directions in the area are N/E and SW - Wind roses for the Birkenhead area are shown in Figure A1 Seasonal distribution of winds at the Facility
- Close to the ABC site
- Located in compliance with Australian Standards for ambient particulate monitoring.
    - In free space, without interference from trees, buildings, and significant road traffic
- Preferably mains power availability or alternatively suitable space /orientation for solar panels
- Secure site (publicly safe installation and protection of equipment from vandalism etc.)
- Able to be accessed 24/7 for maintenance and service in a safe and secure environment in accordance with occupational health and safety regulatory requirements.
- Noise from monitoring equipment and maintenance activities does not impact on residents.
- The location of the monitoring station should minimise impact on the general activities of the local population and should not be restrictive on the intended use of the location area.
- Ideally located on public property

In an urban environment it is likely that there will have to be some compromises in the ideal siting location.

Figure A1



Frequency of counts by wind direction (%)

Seasonal distribution of winds at the Facility (from CALMET)

For reference a typical ambient particulate monitoring station is shown in the photograph below.

The assessment of identified potential monitoring locations in the community is summarised in Table A1 Assessment of potential ambient particulate monitoring locations.

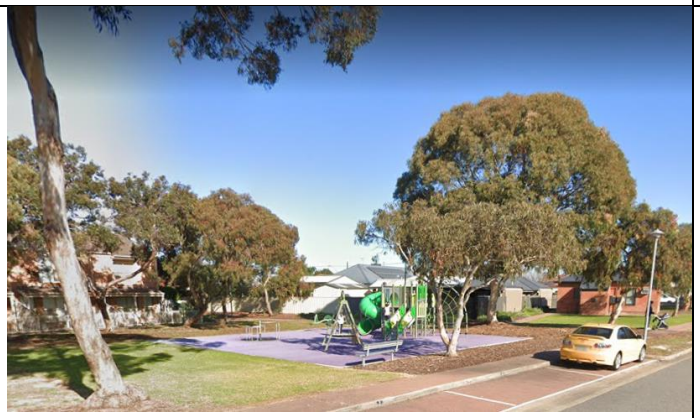
ABC's preferred location is the Naval Reserve in Birkenhead

Table A1: Assessment of potential ambient particulate monitoring locations

Location Description	Photograph of location	Suitability Comments
Birkenhead Naval Reserve (near the toilet facility) Corner Fletcher Rd & Heath St. Birkenhead 5015 **Preferred Site location**		• Downwind impact from Birkenhead site operations • Mains power likely to be available • Could be mounted on roof or to building – minimising impact on intended use • Minimal impact on nearby residents • 24/7 Accessibility • Minimal interference from trees/buildings • Minimal impact on intended area use • A bit close to major roads <50 m) • Potential impact from significant redevelopment of Fletcher Slip area

Location Description	Photograph of location	Suitability Comments
Birkenhead Naval Reserve Alternative location in this reserve under consideration is near the corner Wells Street & Craigie Street Birkenhead 5015 Possible location		• Downwind impact from Birkenhead site operations • Mains power likely to be available • 24/7 Accessibility • Interference from trees (may require removal of tree plantings) • Monitor will need to be at height to avoid interference of adjacent residential buildings • Impact on nearby residents • Impact on intended area use - adjacent children's playground equipment • Community consultation

Location Description	Photograph of location	Suitability Comments
Location in area that incorporates the stormwater retention basin, that lies between Victoria Road, Nelson Street and Semaphore Road, Birkenhead, 5015 Possible location	 	• Downwind impact from Birkenhead site operations • Mains power – would need to connect to street power supply • Minimal impact on nearby residents • 24/7 Accessibility • Minimal interference from trees/buildings • Minimal impact on intended area use • A bit close to significant traffic volumes on major roads <50 m • Potential impact from significant redevelopment of Fletcher slip area

Location Description	Photograph of location	Suitability Comments
Peter Nicholls Reserve Corner of Fletcher Road & Hargrave Street Birkenhead 5015		• Downwind impact from Birkenhead site operations • Mains power – would need to connect to street power supply • Minimal impact on nearby residents • 24/7 Accessibility • Minimal interference from trees/buildings • Impact on intended area use • A bit close to major suburban roads <50 m) • Directly in line (west) with existing Adelaide Brighton Cement Community Dog Park monitor may be of little benefit
Reserve on Tim Hunt Way Peterhead, 5015		• Limited downwind impact from Birkenhead site operations • Mains power – would need to connect to street power supply – difficult (underground) • Minimal impact on nearby residents • 24/7 Accessibility • Impact on intended area use • Interference from trees/buildings • A bit close to major suburban roads <50 m)

Location Description	Photograph of location	Suitability Comments
Stormwater retention basin between Alfred Street and May Street Peterhead 5015		• Limited downwind impact from Birkenhead site operations • Mains power – would need to connect to street power supply • Minimal impact on nearby residents • Minimal Interference from trees/buildings • Minimal impact on intended area use • 24/7 Accessibility • Interference from trees/buildings • 100 - 150 m from major traffic (Victoria Road)
115 Victoria Road Peterhead 5015		• Limited downwind impact from Birkenhead site operations • Mains power – would need to connect to available power supply • Minimal impact on nearby residents • Minimal impact on intended area use • 24/7 Accessibility • Interference from trees/buildings • Very close to major traffic (Victoria Road) <30 m

The EPA has requested ABC investigate with the City of Port Adelaide Enfield the possibility of locating the monitor on the Northern side of Naval Reserve in preference to the current preferred location at the Southern end of the reserve. Table A2 summarises the approval process for installation of an ambient air particulate monitor in the community.

Table A2 Approval process for installation of an ambient particulate monitor

Step	Responsibility	Indicative timing to complete
ABC to investigate the possibility of locating the monitor on the Northern side of Naval Reserve, Birkenhead	ABC/EPA/ City of Port Adelaide Enfield	31/10/2023
Council property staff prepare a report detailing the ambient air monitoring station for Council consideration	Council property staff	15/12/2023
Subject to completion of the report, Council consider the report.	Council meeting	16/01/2024
Subject to Council approval, Council will undertake community consultation	Council staff	16/02/2024
Council review Community consultation outcome	Council meeting	5/03/2024
Subject to successful community consultation ABC will submit a Development Application (DA)	ABC	30/03/2024
Subject to DA approval, ABC will install monitor	ABC	31/07/2024

Trigger Action Response Plan Annual Review

Prepared for:

Adelaide Brighton Cement Ltd

February 2023

Final

Prepared by:

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Reviewed by:	Ricky Gellatly
Approved by:	 Ricky Gellatly 6 February 2023

Contents

Tables

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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%

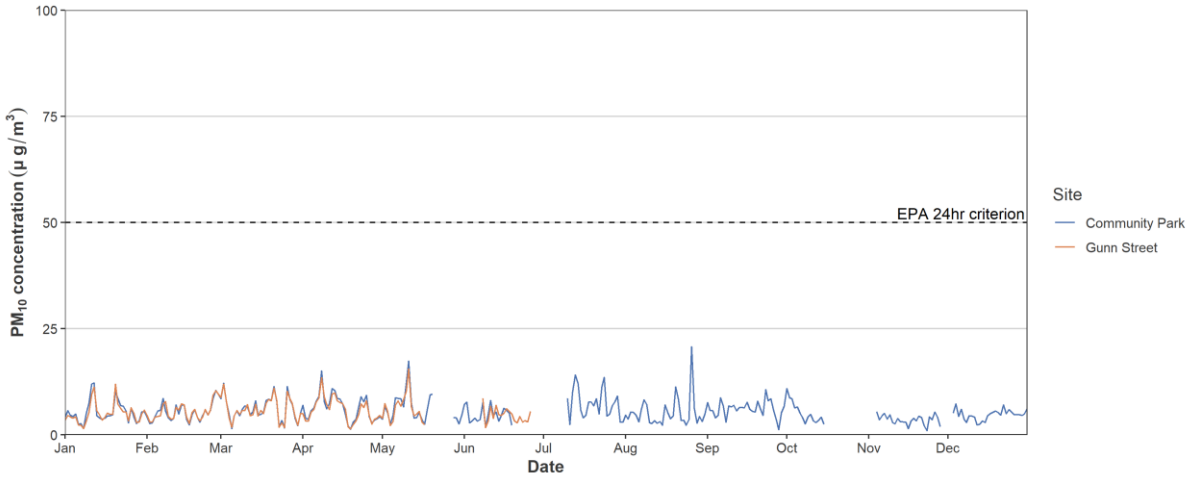

Figure 2 24-hour average concentrations of PM_{10} measured off-site during the reporting period

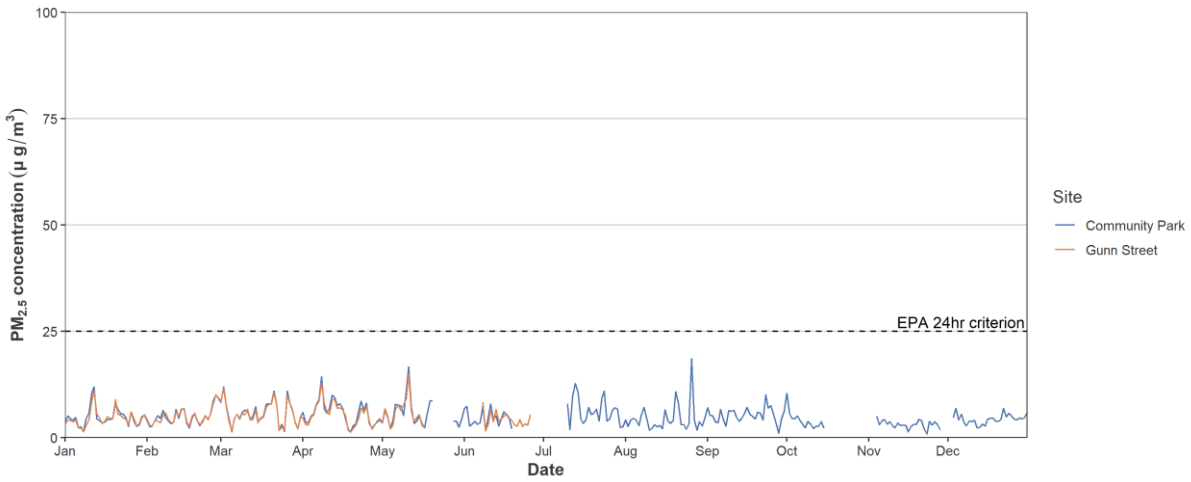

Figure 3 24-hour average concentrations of $PM_{2.5}$ measured off-site during the reporting period

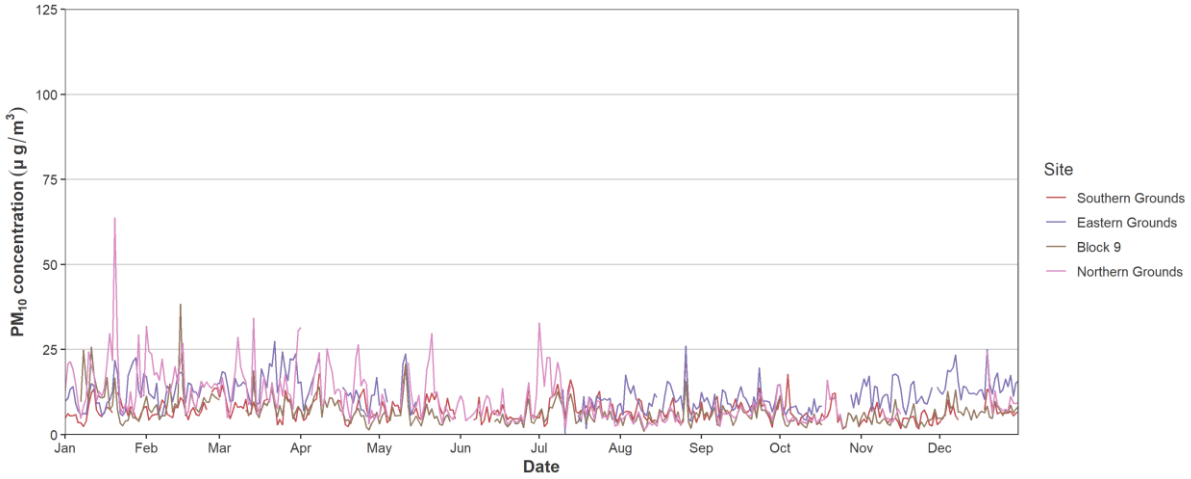

Figure 4 24-hour average concentrations of PM_{10} measured on-site during the reporting period

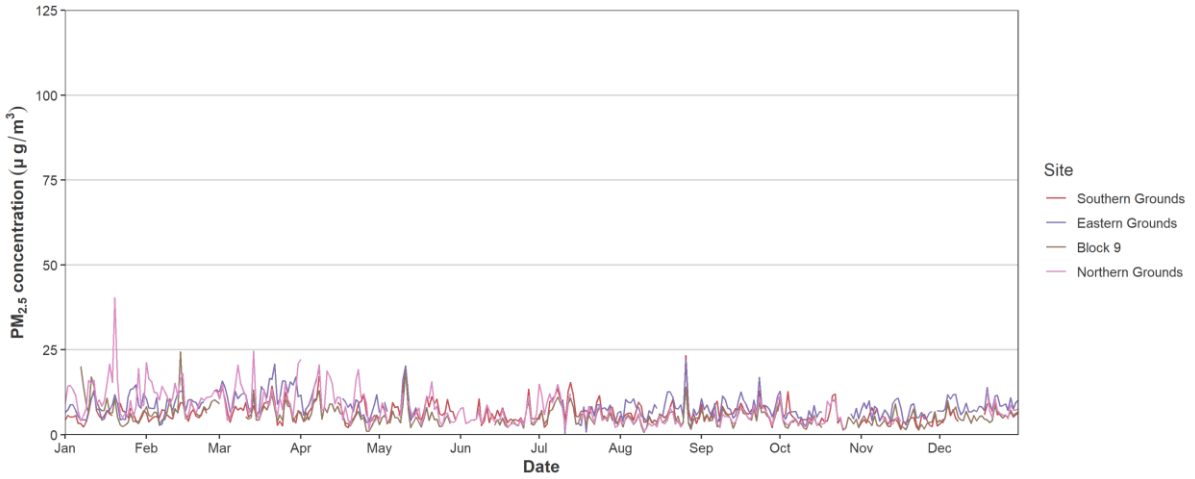

Figure 5 24-hour average concentrations of $PM_{2.5}$ measured on-site during the reporting period

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%

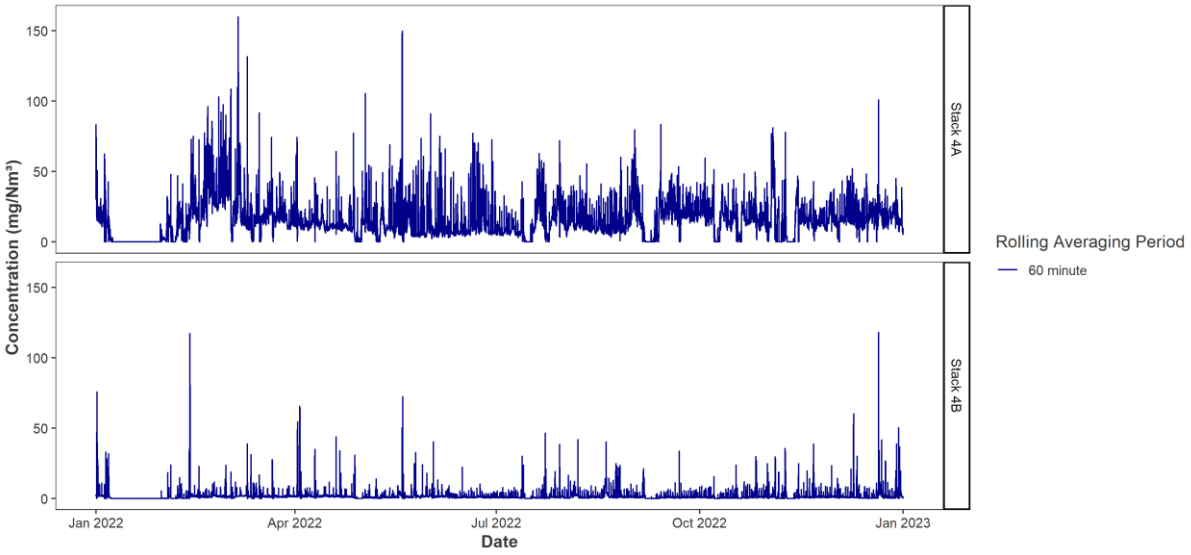

Figure 6 **Rolling 1-hour average in-stack TSP concentrations (mg/Nm^3) measured at Stacks 4A and 4B during the reporting period**

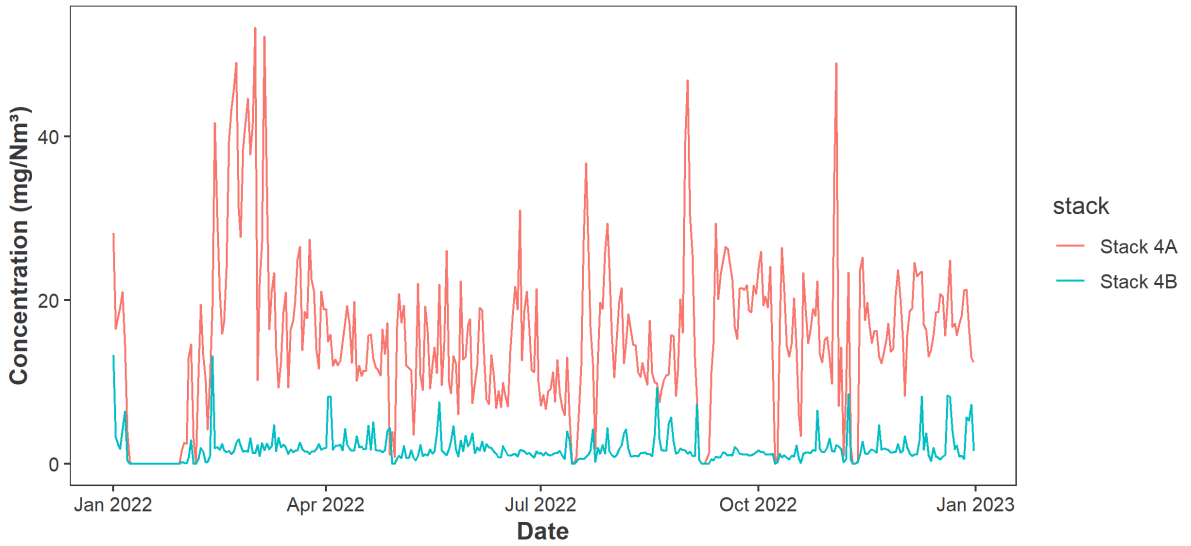

Figure 7 **24-hour average in-stack TSP concentrations (mg/Nm^3) measured at Stacks 4A and 4B during the reporting period**

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.

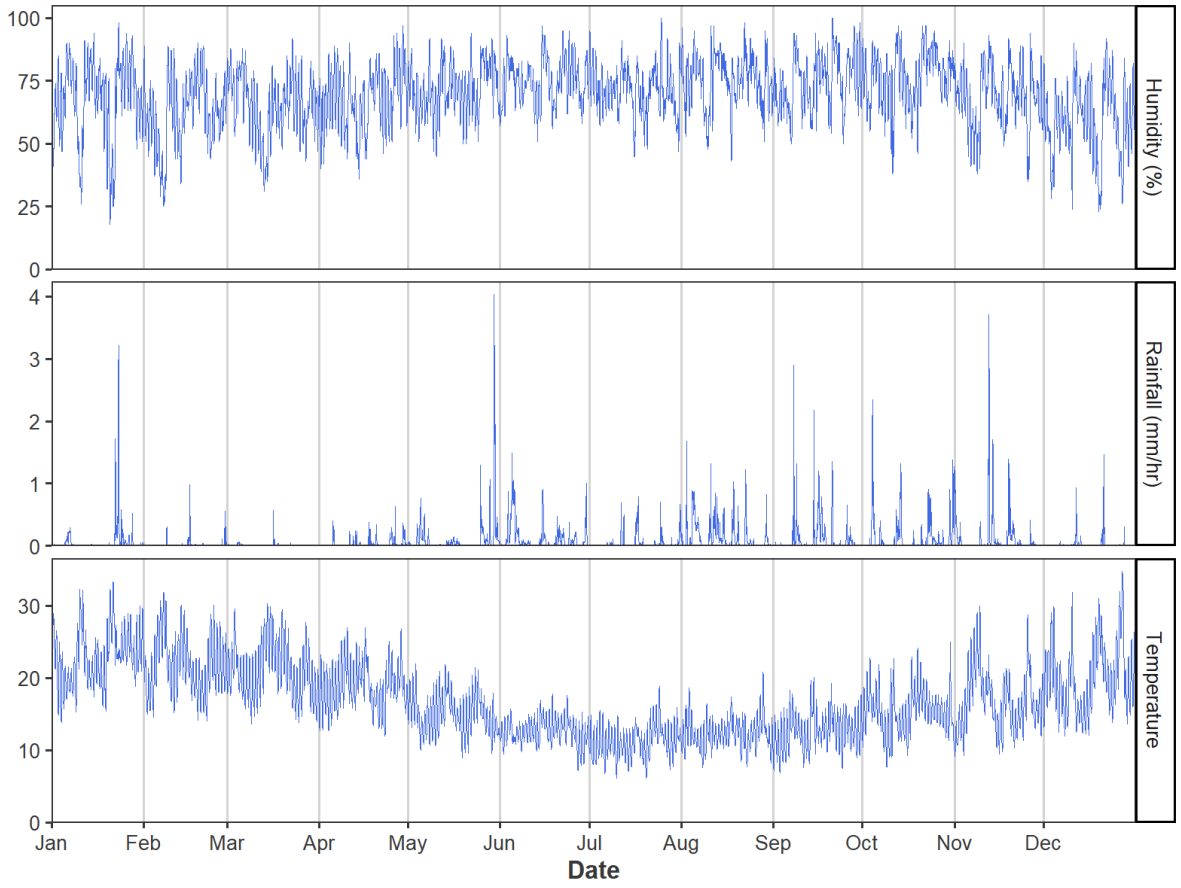

Figure 8 **Meteorological observations for Birkenhead during the reporting period**

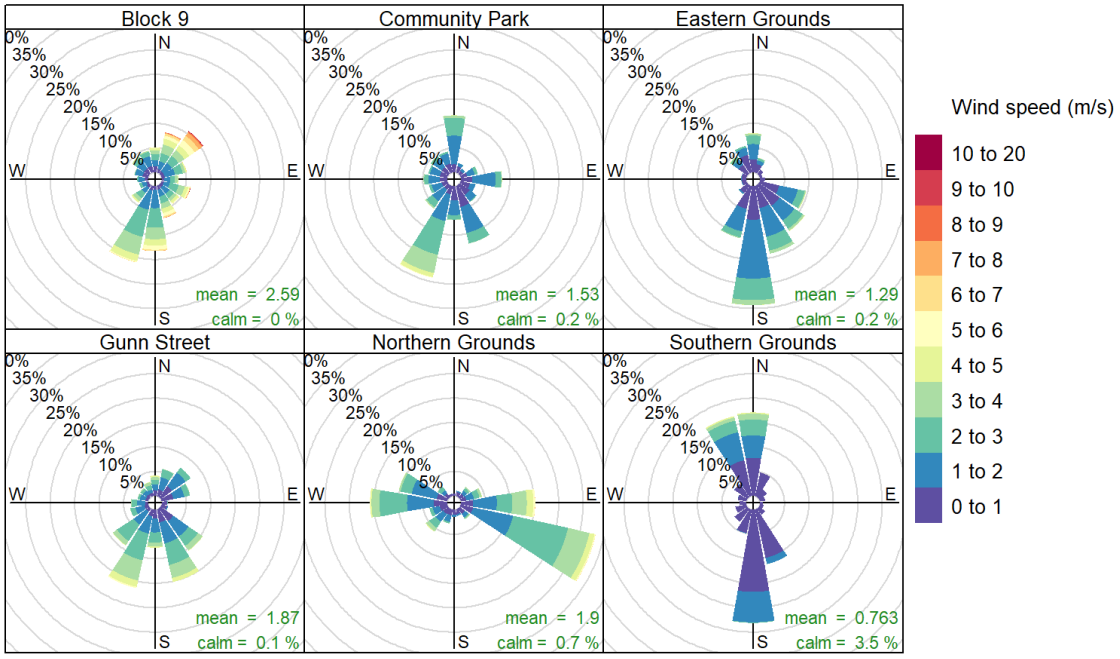

Figure 9 **Distribution of wind speed and direction measured at ABC monitoring sites during the reporting period**

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.

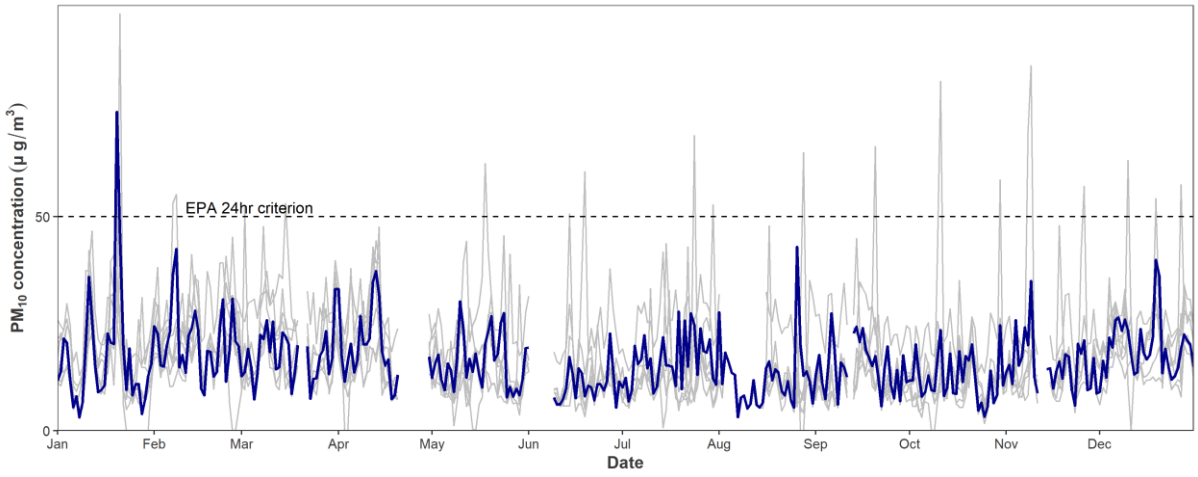

Figure 10 24-hour average concentrations of PM_{10} recorded at Le Fevre 1 (blue) and other EPA monitoring sites (grey) during the reporting period

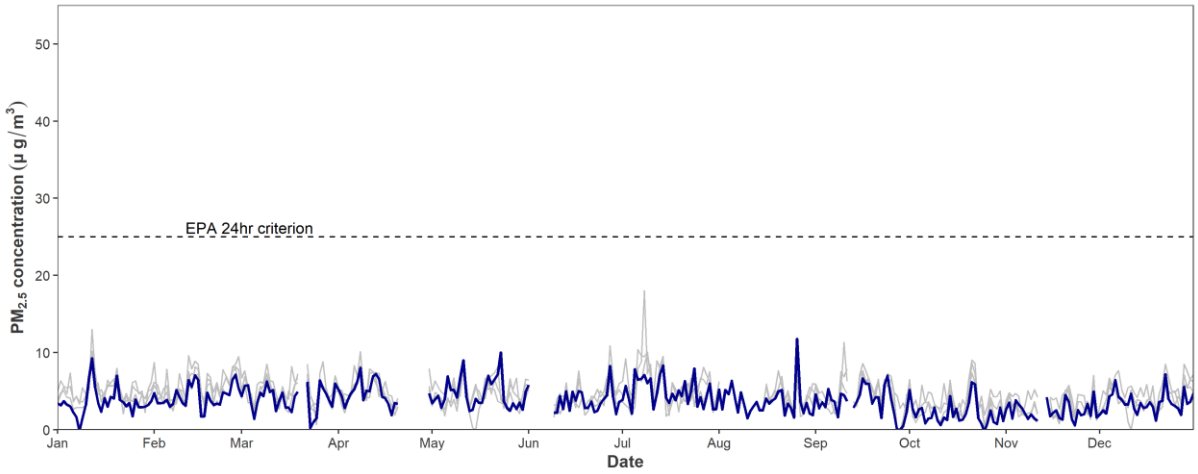

Figure 11 24-hour average concentrations of $PM_{2.5}$ recorded at Le Fevre 1 (blue) and other EPA monitoring sites (grey) during the reporting period

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.

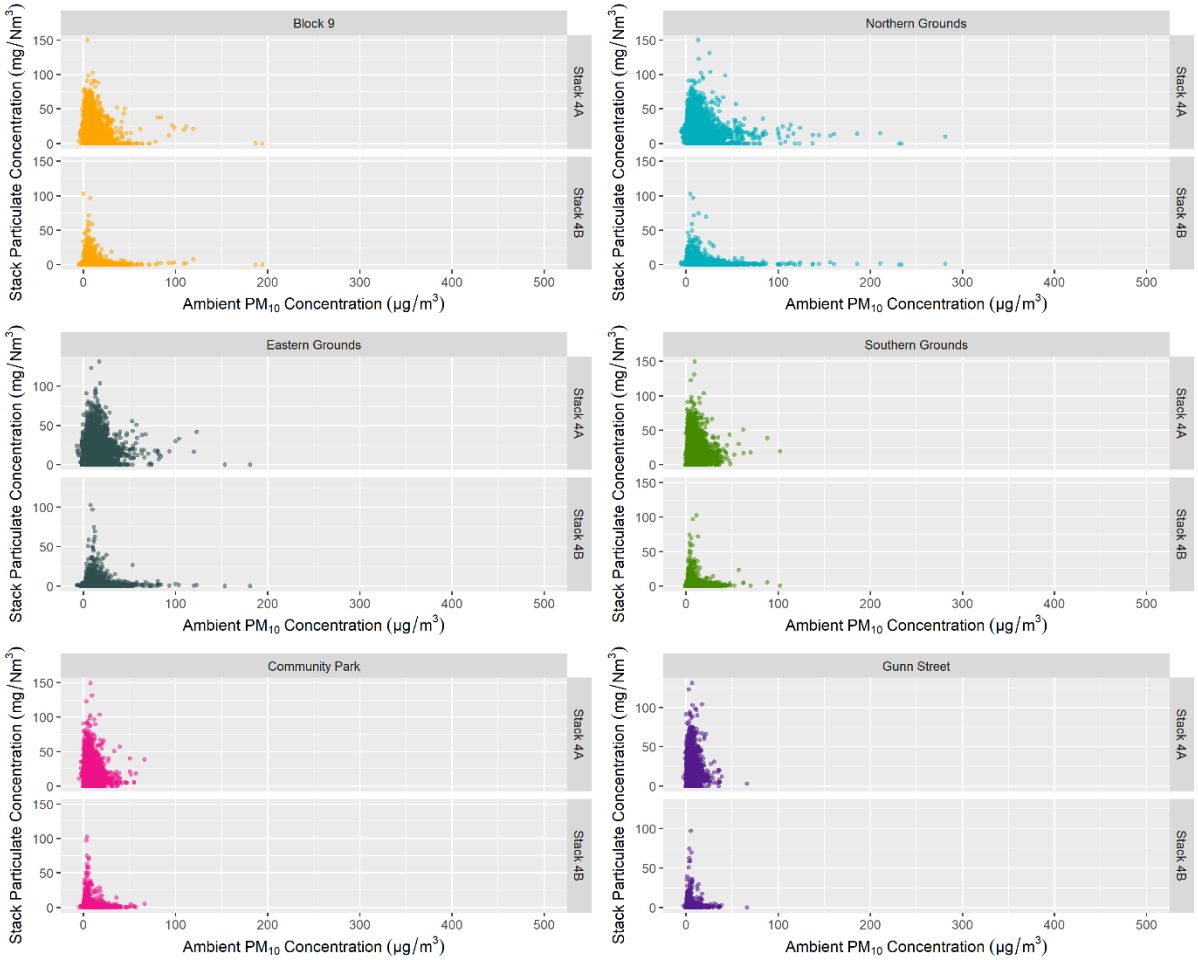

Figure 12 Scatter plot of 1-hour average in-stack TSP concentrations (mg/Nm^3) measured at Stacks 4A and 4B compared to 1-hour average ambient measurements at all on-site and off-site monitors for the reporting period

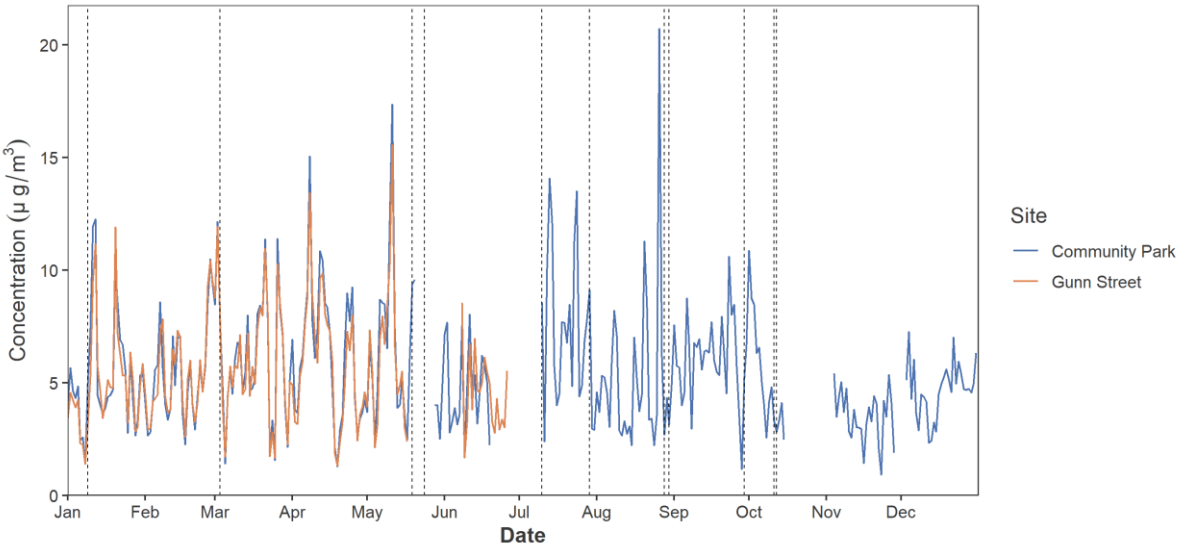

Figure 13 Dust complaints reported (vertical dashed lines) and corresponding 24-hour average concentration of PM_{10} (µg/m³) at the off-site monitoring stations

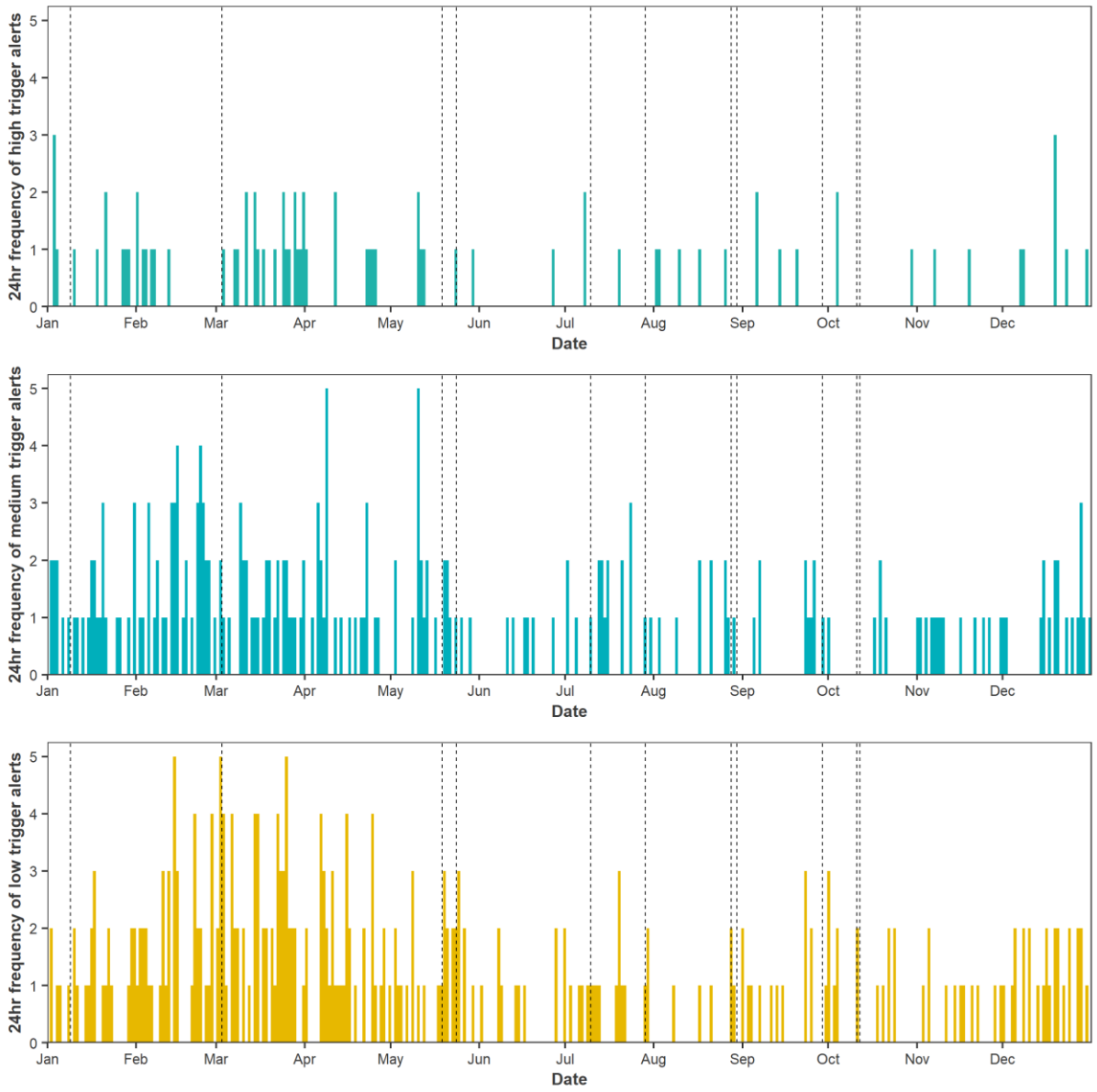

Figure 14 Trigger alerts and complaints during the reporting period

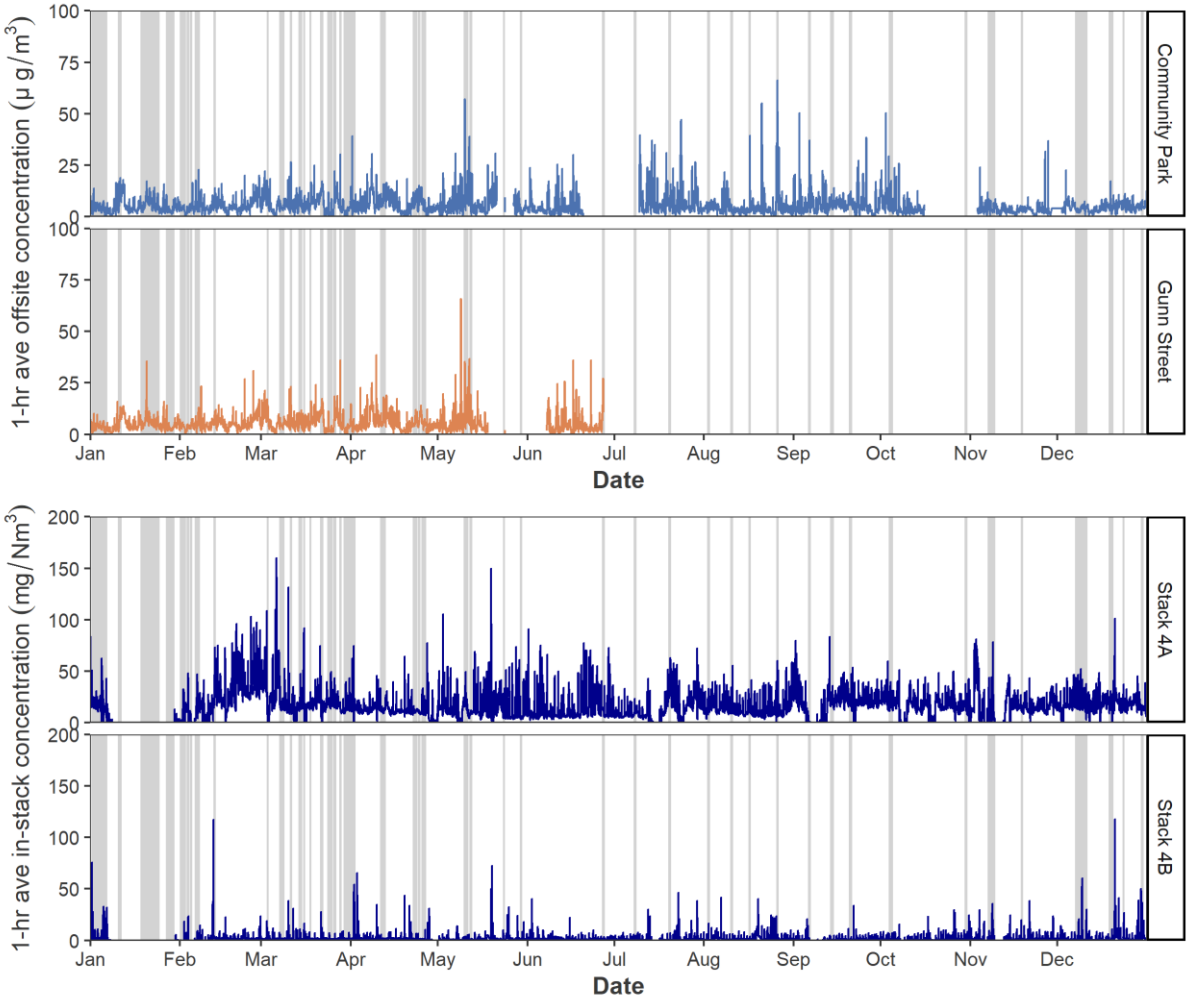

Figure 15 **1-hour average concentration of PM_{10} (µg/m^3) at off-site monitoring sites and rolling 1-hour average in-stack TSP concentrations (mg/Nm^3) from Stacks 4A and 4B with period of 'high' triggers marked in grey**

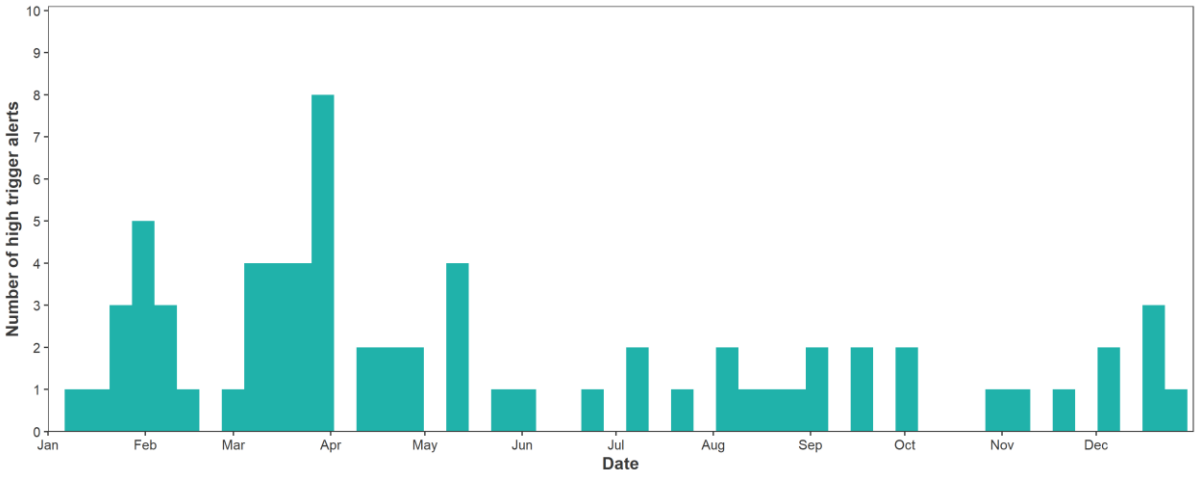

Figure 16 **Frequency of high trigger alerts during the reporting period**

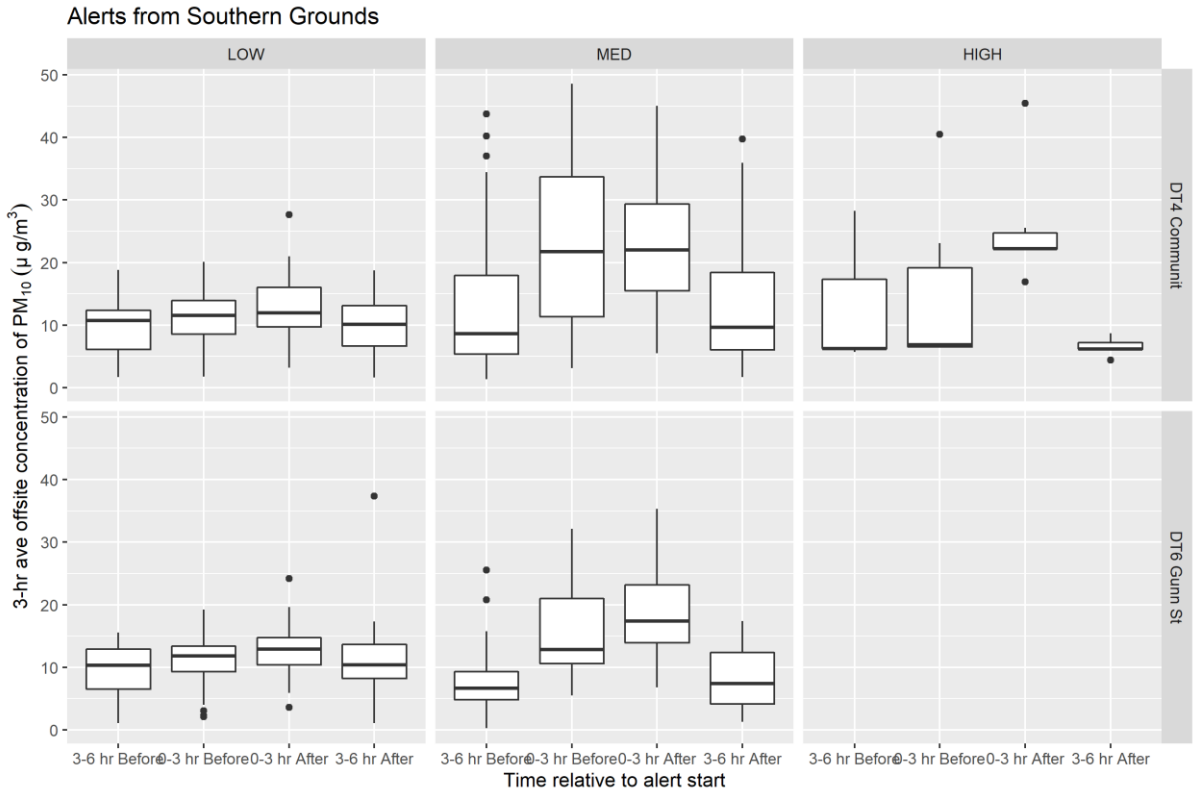

Figure 17 **Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a trigger alert from the Southern Grounds monitor**

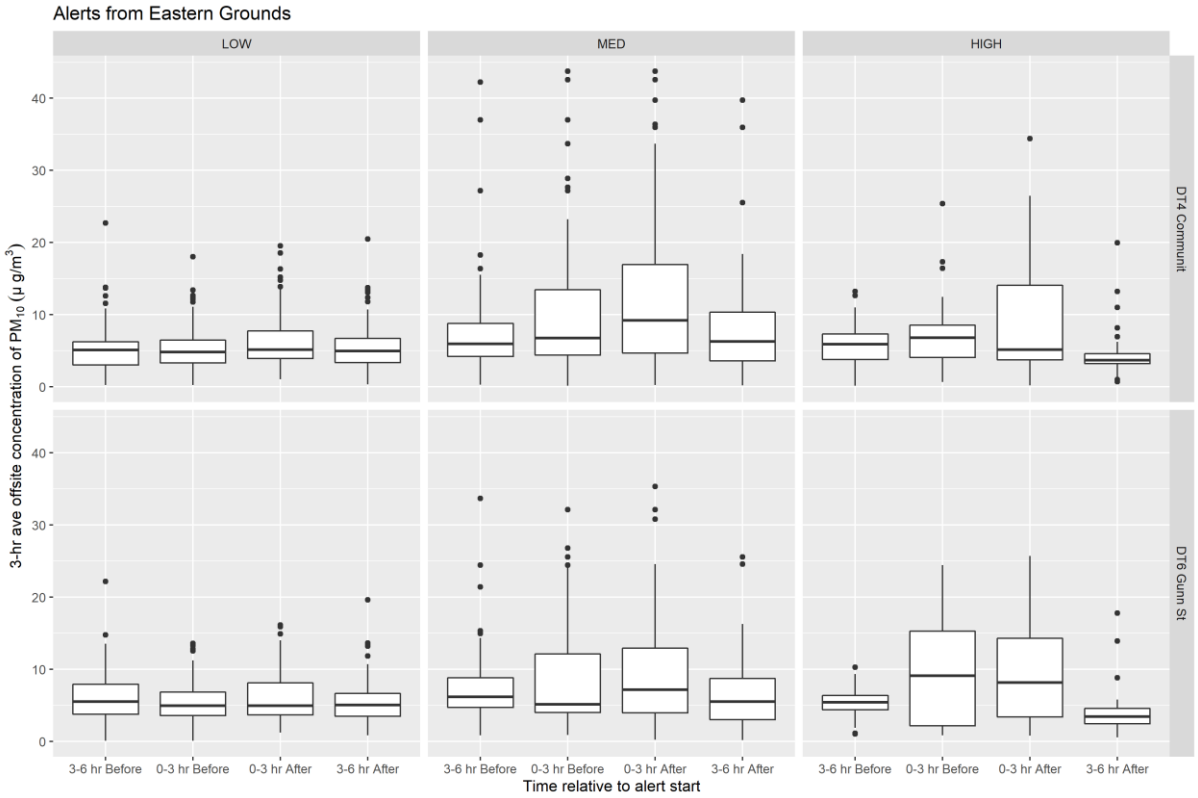

Figure 18 **Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a trigger alert from the Eastern Grounds monitor**

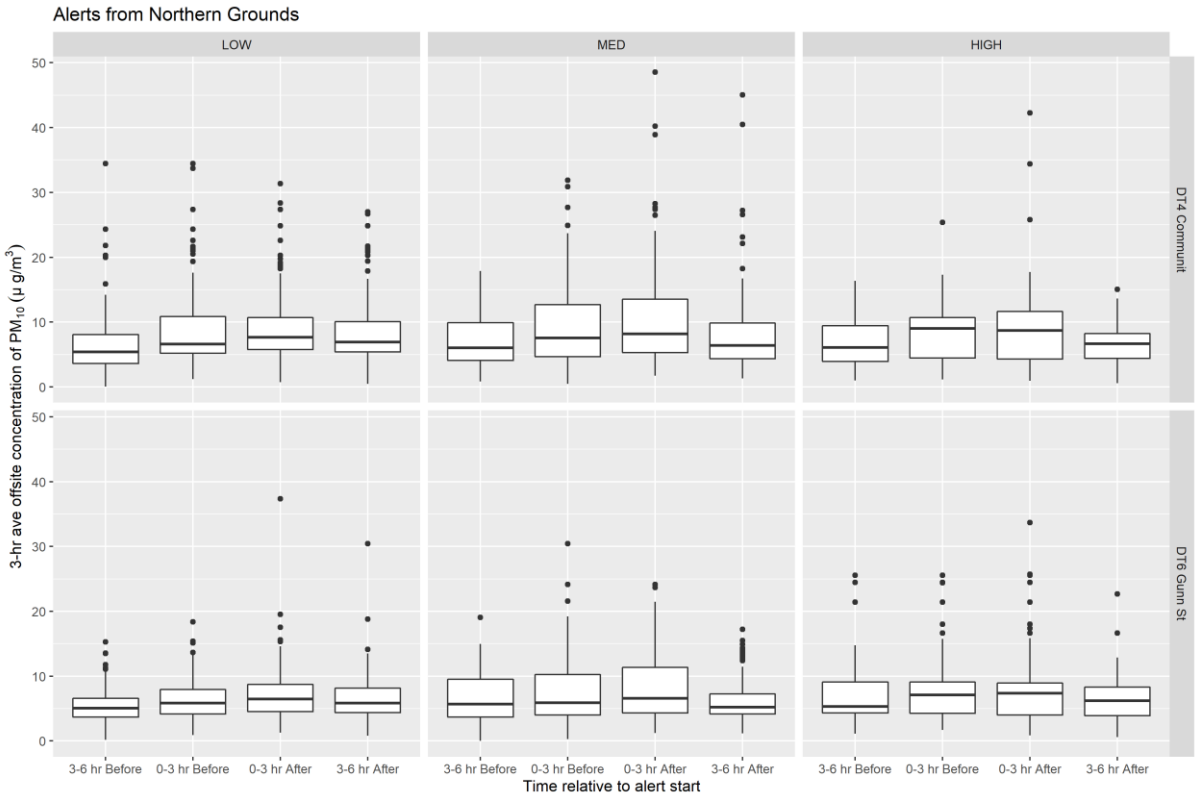

Figure 19 **Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a trigger alert from the Northern Grounds monitor**

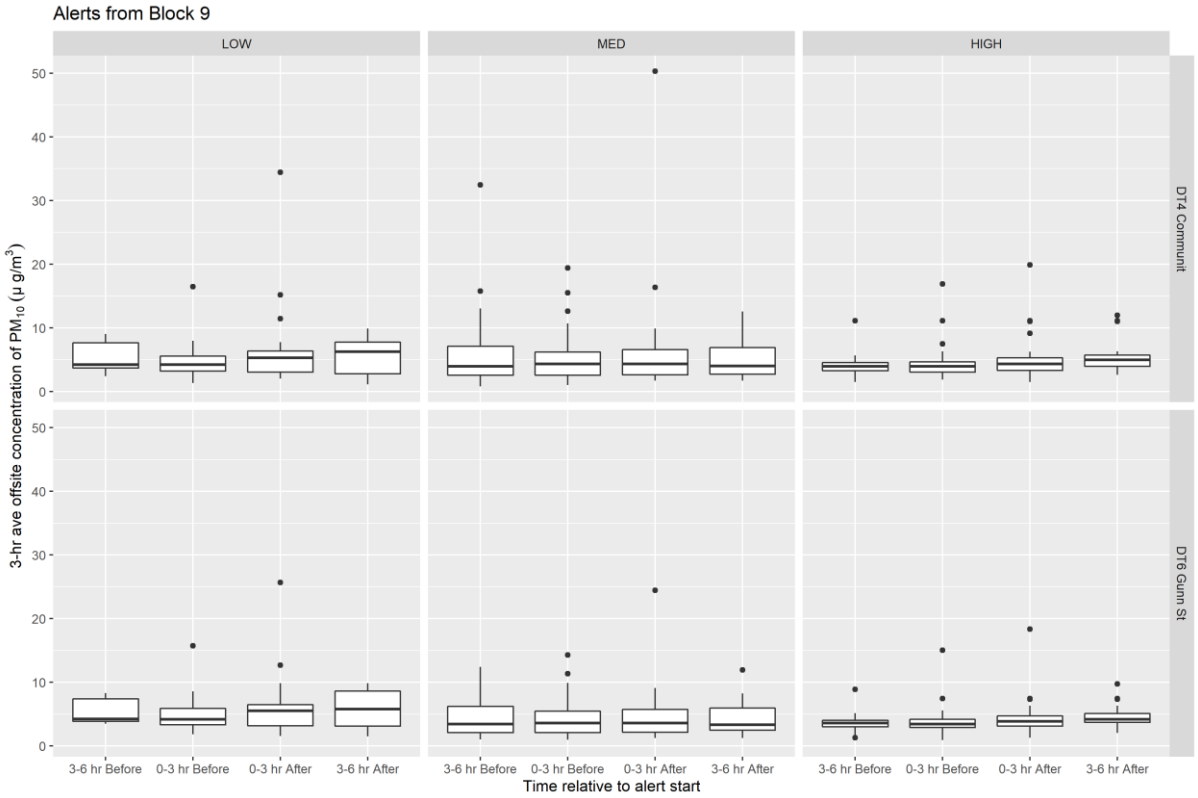

Figure 20 **Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a trigger alert from the Block 9 monitor**

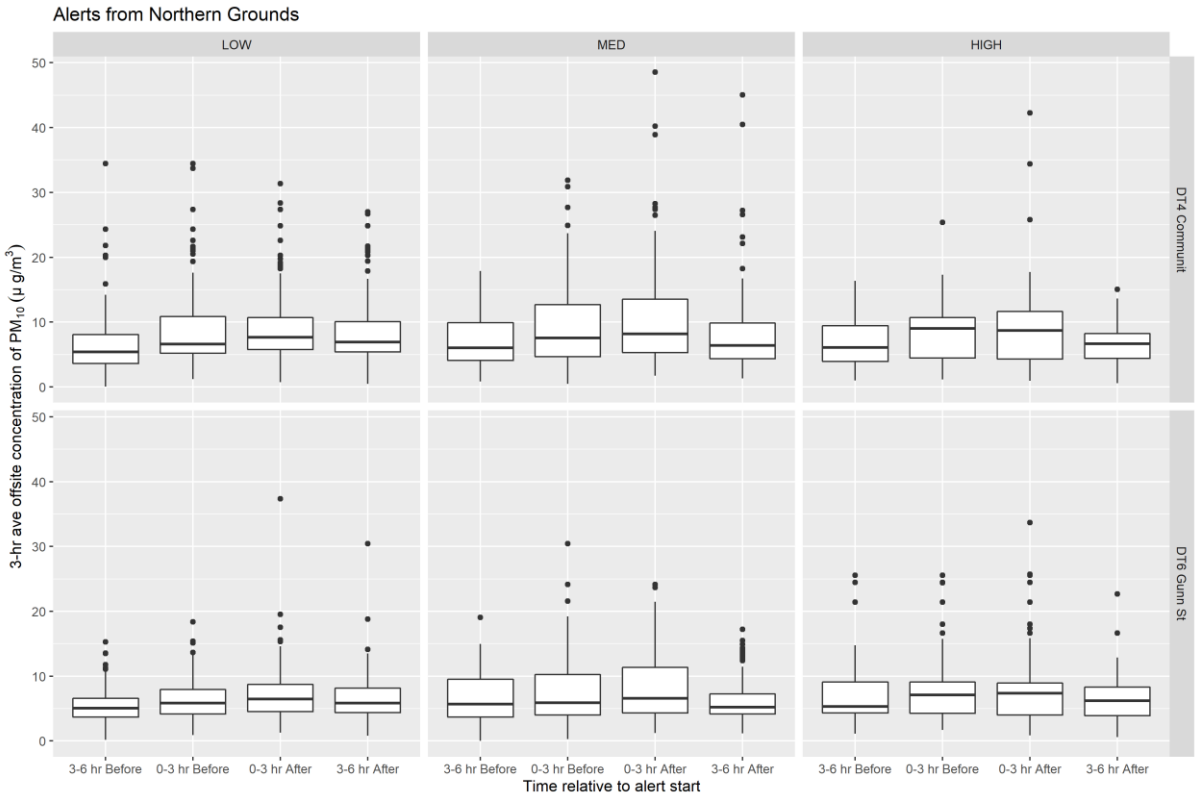

Figure 21 Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a trigger alert from the Northern Grounds monitor

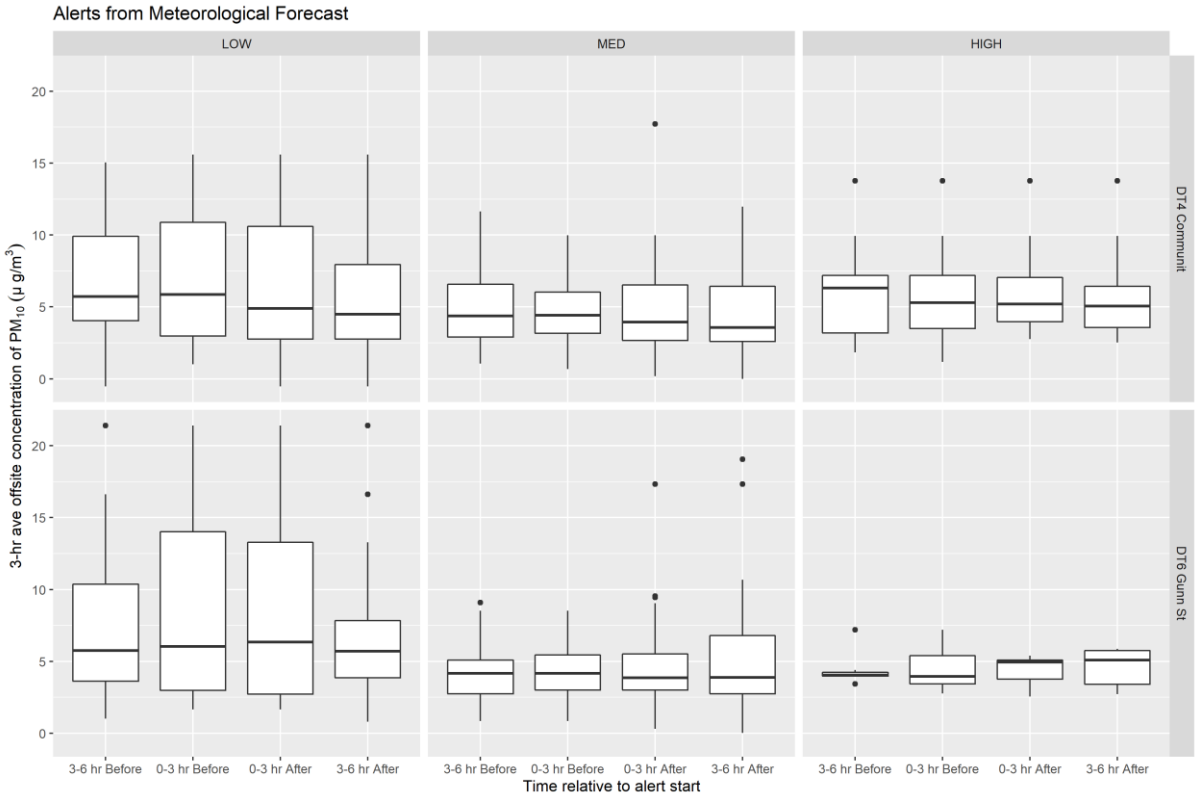

Figure 22 Boxplots of 3-hr average offsite concentrations of PM_{10} within 6 hours of a Meteorology Forecast trigger alert

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