



Adelaide Brighton Cement Ltd

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ENVIROMENT IMROVEMENT PROGRAMME (EIP) ANNUAL REPORT FOR BIRKENHEAD WORKS

COMPLIANCE DATE: 15/04/2024 - 2023 Annual Report **EPA Licence 1126: Environment Improvement Programme** **(U-583)**

Licensed site: Adelaide Brighton Cement, Birkenhead Works

62 Elder Road, Birkenhead, SA 5015

Date of Submission: 3 May 2024

Version Number: 1



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


Purpose	The purpose of the Environmental Improvement Programme (EIP) is to reduce noise and fugitive particulate emissions from the site.
Background Information	<p>In order to reduce its environmental impact, Adelaide Brighton Cement Ltd, has developed an EIP that contains projects to reduce noise and fugitive particulate emissions. These projects were identified from the following inputs:</p> <ul style="list-style-type: none"> • Adelaide Brighton Cement Limited Report, August 2018, “Assessment of Options Report” • Katestone Environmental Report, August 2018 “Birkenhead Cement Plant – Options Assessment Report” • Katestone Environmental Report 2017 “Air Quality Assessment of the Birkenhead Cement Plant” • Vipac Engineers and Scientists Report, August 2018 “Environmental Noise Model Update” • Vipac Engineers and Scientists Report, February 2019 “Noise model update and Abatement Options” <p>Thirteen fugitive particulate and three noise improvement projects were identified and incorporated into an EPA approved EIP.</p> <p>EIP project implementation is tracked through the completion of 52 compliance actions over the life of the EIP.</p> <p>The EIP approved by the EPA on 28 February 2019 is available on the ABC Birkenhead Community Website: http://www.birkenheadcommunity.com.au/</p>
Reporting Objective	<p>Annual EIP progress report providing:</p> <ul style="list-style-type: none"> • Summary of EIP actions completed during the calendar year • A summary of progress on EIP actions <p>To be submitted within 45 days of the anniversary of the EIP approval date, namely 15th April of each year</p>
Annual Report	<p>EIP Project 17 - Evaluation Report Fugitive Dust Projects completed 29/9/2023. Report attached in appendix A</p> <p>EPA has approved extensions to remaining EIP Projects 10 and 12, which were due to be completed by 31/12/2023. Rationale for requesting extensions for these projects to the 31 May 2024 are noted in the table below.</p>

EIP Project	Reason for revised compliance date	Revised compliance date
EIP Project 10 - Sealing of surface area south of 4A ESP	The intention was to seal the surface area south of 4A ESP with concrete using a trial low carbon footprint cement. The scheduled trail to produce the low carbon footprint at the Angaston plant has been deferred due to market requirements to 2025. ABC now intends to seal the surface with bitumen. Access to seal the surface, has to be rescheduled to occur after the 2024 plant shutdown, as the area is currently being used to store steel work for replacement of 4A stack during the 2024 shutdown.	31 May 2024
EIP Project 12 - Upgrade/maintain the cladding on the CM6 building	This project requires Cement Mill 6 (CM6) to be shut down for implementation. There has been no planned shutdown of CM6 to enable this project to be progressed.	31 May 2024

The following table summarises the progress and completion of all EIP projects and actions.

Appendix A	EIP Project 17 – Compliance action 52 - Evaluation Report Fugitive Dust Projects
Appendix B	ABC Birkenhead Noise Survey - May 2020
Appendix C	EIP Project 17 - Compliance action 51 – Summary Report



Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
1	Fugitive Dust - Stockpile emission reduction	Relocate Bauxite Stockpile and cover with Geofabric	1	By the 24/04/2019, ABC will select a suitable Geofabric, determine installation methodology and project costs to enable a business case to be developed for capital expenditure approval.	<p>ABC has researched several suitable Geofabrics, installation methodologies and obtained estimated project costs.</p> <p>In summary:</p> <ul style="list-style-type: none"> • A heavy duty shade cloth material to be used for the stockpile cover – (example photo below)  <ul style="list-style-type: none"> • Stockpile to be covered with six panels of heavy duty shade cloth (15 m x 65 m each) to provide flexibility and safety in covering and uncovering the stockpile • Covers will be applied using a combination of lifting equipment and manual labour • Covers will be anchored using water filled 200 litre drums appropriately spaced <p>A business case and a capital expenditure proposal will be submitted to obtain capital funding by the 23/08/2019.</p>

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
1	Fugitive Dust - Stockpile emission reduction	Relocate Bauxite Stockpile and cover with Geofabric	2	By the 23/08/2019, ABC will obtain capital expenditure approval for the purchase and installation of Geofabric on the Bauxite stockpile to be located at the Southern end of the site.	<p>Capital expenditure approval has been obtained for purchase and installation of Geofabric on the Bauxite stockpile.</p> <p>In summary:</p> <ul style="list-style-type: none"> Relocated Bauxite Stockpile applied with environmentally friendly dust suppression (green) Reduced vehicle movements and dust emissions as stockpile closer to materials handling system <div> </div> <ul style="list-style-type: none"> A heavy duty shade cloth material to be used for the stockpile cover – (example photo below) <div> </div> <ul style="list-style-type: none"> Stockpile to be covered with six panels of heavy duty shade cloth (15 m x 65 m each) to provide flexibility and safety in covering and uncovering the stockpile Covers will be applied using a combination of lifting equipment and manual labour Covers will be appropriately anchored

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
1	Fugitive Dust - Stockpile emission reduction	Relocate Bauxite Stockpile and cover with Geofabric	3	<p>Subject to obtaining capital approval by 23/08/2019, ABC will complete implementation of Geofabric on the Bauxite Stockpile at the Southern end of the plant by 18/10/2019</p> <p>Variation: <i>At the time of developing the EIP, ABC was not cognisant of the long lead times associated with the delivery of the material which is sourced from overseas manufacturers and the production timing coinciding with a seasonally related busy period.</i></p> <p><i>A revised completion date of 28/02/2020, and application of chemical dust suppressant to the stockpile as an interim fugitive dust control measure, was approved by the SA EPA.</i></p> <p>Project completed</p>	<p>ABC completed installation of the covers on the relocated Bauxite Stockpile at the Southern end of the plant on 13/02/2020.</p> <ul style="list-style-type: none"> Relocated Bauxite stockpile close to the material handling system reduces vehicle movements and associated fugitive dust. Covering inactive areas of stockpile with heavy duty shade cloth prevents wind erosion and fugitive dust from surface of stockpile. Predicted to reduce maximum 24-hr average concentrations of PM₁₀ at the Community Park by 0.2 µg/m³.  <ul style="list-style-type: none"> Dust suppression (green) applied to stockpile before covers added  <ul style="list-style-type: none"> Bauxite Stockpile with heavy duty shade cloth covers applied


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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
2	Fugitive Dust - Stockpile emission reduction	Wind curtain - Limestone stockpile	4	By 27/02/2020, ABC will complete a detailed cost-benefit analysis and technical assessment to enable capital approval to be obtained for the installation of a wind curtain for the limestone stockpile on shell block. The project will proceed if the front-end engineering costs are in line with the project selection criteria.	<ul style="list-style-type: none"> • In line with the EIP – Project 2 scope, ABC obtained budget quotations for a 15 metre high wind fence along the Western perimeter of the limestone stockpile, from two companies that specialise in wind fence technology. • Design, supply and install quotations for wind fences were obtained from the Australian agents for Weather Solve Structures and Dust Solutions Incorporated, “Dust Tamer Wind Fences”. • Proposals received, provided estimated costs for foundations, but noted geotechnical assessments were required to enable final foundation designs for the wind fence to be determined. In addition, the proposals excluded the costs to determine and manage potential impacts of the wind fence on a legacy hydrocarbon plume and High Density Polyethylene (HDPE) barrier on the limestone stockpile site. • ABC’s engineering study has determined that it fails to meet the criteria specified in the EIP for the project to proceed. <p>ABC is currently discussing with the EPA an alternative proposal to use a combination of control measures as follows:</p> <ul style="list-style-type: none"> • Portable wind fencing with a height of 6m and length of 50 m placed near the working face of the stockpile • A sand tarp/mesh fabric placed on 11,500 m² of inactive non working exposed surface areas of the limestone stockpile • Chemical dust suppressant polymers on all stockpile wall surfaces • Increased haul road surface to cover 35% of unsealed exposed areas around the stockpile including unsealed exposed traffic flow/movement areas around the stockpile • Air Quality Consultants (Katestone) have assessed the alternative proposal and found it will provide the same level of reduction of PM₁₀ emissions as the original EIP wind fence proposal


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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
2	Fugitive Dust - Stockpile emission reduction	Wind curtain - Limestone stockpile	5	By 29/09/2020, ABC will obtain capital and necessary expenditure for implementing the portable wind curtain.	<p>ABC has obtained approval for the expenditure necessary to implement the portable wind curtain.</p> <p>The implementation of the portable wind curtain is planned to be completed 1/02/2021.</p>

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
2	Fugitive Dust - Stockpile emission reduction	Wind curtain - Limestone stockpile	6	<p>Subject to obtaining capital approval by 29/09/2020, ABC will complete the installation of the wind curtain by 1/02/2021.</p> <p>Variation: ABC agreed with the EPA to complete the installation of the wind curtain before commencement of the limestone stockpile reclamation in early April 2021</p> <p>Project completed</p>	<p>Arrival of wind curtain parts from overseas was late due to COVID-19 shipping delays. ABC informed the EPA of the delay and it was agreed that installation of the portable wind curtain could be achieved before commencement of the limestone stockpile reclamation in early April 2021.</p> <p>ABC completed installation of 5 portable wind fences on the 22/3/2021, before commencement of the limestone stockpile reclamation in early April 2021.</p> <ul style="list-style-type: none"> • 5 portable wind fences (6m high x10m length each) installed at the working face of the limestone stockpile • A porous windbreak fence can reduce wind speed minimising dust lift-off and transport • A portable wind fence provides flexibility to manage changing dynamics of the stockpile size, providing an effective means of reducing dust emissions from materials handling activities at the working face of the stockpile  <p>Outcome: Independent air quality modelling and analysis indicates that a portable wind curtain located at the working face of the stockpile when used in conjunction with chemical polymers applied to stockpile sides and exposed surface areas, and use of stockpile covers applied to 11,500m² of inactive non-working exposed surface areas of the limestone stockpile may reduce maximum 24-hr average concentrations of PM₁₀ at the Community Park by 2.3 µg/m³.</p>













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3	Fugitive Dust - Stockpile emission reduction	Geofabric – Limestone stockpile	9	By the 30/05/2019, ABC will select a suitable Geofabric, determine installation methodology and project costs to enable a business case to be developed for capital expenditure approval.	<p>ABC has researched several suitable Geofabrics, installation methodologies and obtained estimated project costs.</p> <p>In summary:</p> <ul style="list-style-type: none"> • A heavy duty shade cloth material to be used for the stockpile cover – (example photo below)  <ul style="list-style-type: none"> • In active areas of the stockpile to be covered with panels of heavy-duty shade cloth to provide flexibility and safety in covering and uncovering the stockpile • Covers will be applied using a combination of lifting equipment and manual labour • Covers will be anchored using water filled 200 litre drums appropriately spaced <p>A business case and a capital expenditure proposal will be submitted to obtain capital funding by the 27/09/2019.</p>

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
3	Fugitive Dust - Stockpile emission reduction	Geofabric – Limestone stockpile	10	By 27/09/2019, ABC will obtain capital expenditure for purchase and installation of Geo fabric on the limestone stockpile on the shell block.	<p>ABC has obtained capital expenditure approval for the purchase and installation of geo fabric on the limestone stockpile on the shell block.</p> <p>It is envisaged that the stockpile will have adequate non-working surfaces to complete the installation of Geo fabric on 11,500 m² of inactive stockpile areas by 13/03/2020.</p>

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3	Fugitive Dust - Stockpile emission reduction	Geofabric – Limestone stockpile	11	<p>Subject to obtaining capital approval by 27/09/2019, ABC will complete the installation of Geo fabric on the 11,500 m² Of inactive stockpile areas by 13/03/2020</p> <p>Variation: Subject to obtaining capital approval by 27/09/2019, ABC will complete the installation of Geo fabric to 77% of 11,500 m² of inactive stockpile areas by 30/09/2020, with the balance completed by 17/01/2021.</p> <p><i>This variation has been accepted by the EPA</i></p> <p>Project completed</p>	<p>ABC completed the installation of “Sand Tarps” (Geofabric) on inactive surface areas of the limestone stockpile on 11/01/2021.</p> <p>At the time of preparing the EIP, ABC anticipated 11,500 m² of inactive surface area would be available by the 13/03/2020, to which a cover could be applied. Due to the dynamic nature of the stockpile build, this was not possible and variations to the project milestone was agreed with the EPA, allowing for progressive application of covers as the stockpile build enabled this to occur. Progress is summarised in the table below:</p> <table border="1"> <thead> <tr> <th>Date</th> <th></th> <th>Photos</th> </tr> </thead> <tbody> <tr> <td>18/3/2020</td> <td>Ariel view</td> <td></td> </tr> <tr> <td>30/09/2020</td> <td>Top of stockpile</td> <td></td> </tr> <tr> <td rowspan="2">11/01/2021</td> <td>Ariel view</td> <td></td> </tr> <tr> <td>Port River Side</td> <td></td> </tr> </tbody> </table> <p>Outcomes:</p> <ul style="list-style-type: none"> Covering inactive areas of the stockpile with Sand Tarps prevents wind erosion and fugitive dust from these areas of the stockpile. This project is predicted to reduce maximum 24-hr average concentrations of PM10 at the Community Park by 0.9 µg/m³. 	Date		Photos	18/3/2020	Ariel view		30/09/2020	Top of stockpile		11/01/2021	Ariel view		Port River Side	
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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
4	Fugitive Dust - Transfer operation	MM Wheel wash system	12	<p>By the 23/10/2020, ABC will complete an engineering study, including selection and installation of truck wheel wash to enable approval for capital expenditure.</p> <p><i>Variation proposed:</i></p> <p><i>By the 01/06/2021, ABC will complete an engineering study, including selection and installation of truck wheel wash to enable approval for capital expenditure.</i></p>	<p>Unplanned operational activity related to COVID-19 pandemic restrictions and critical plant equipment maintenance requirements have delayed progress on this project.</p> <p>Significant additional resource has been devoted to both the Annual Shutdown and the dry-docking arrangements for seaworthy recertification of the Accolade vessel. COVID 19 has required additional planning and the sourcing of alternative dry-docking facilities and maintenance providers, that align with the Annual Plant shutdown period in January.</p> <p>Rescheduling compliance actions, 12, 13 and 14 will still enable the project to be completed by the current due date as required by the EIP and compliance action 15.</p> <p>ABC requested that the EIP be changed to reflect the following: Compliance action 12 completion date of 1/6/2021</p>

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
4	Fugitive Dust - Transfer operation	MM Wheel wash system	13	By 01/06/2021, ABC will submit development application to the relevant regulatory authority for construction of a wheel wash.	<p>Installation of a portable wheel wash unit will not require council development approval.</p> <p>ABC will now proceed to obtain expenditure approval for the hire of a portable wheel wash for the MM system by 21/11/2001 as required by compliance action 14</p>

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
4	Fugitive Dust - Transfer operation	MM Wheel wash system	14	Subject to development approval by 1/9/2021 ABC will obtain capital expenditure for purchase and installation of a wheel wash facility for the MM System by 21/11/2021	<p>Installation of a portable wheel wash unit will not require council development approval.</p> <p>ABC has expenditure approval for a wheel wash system</p>

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
4	Fugitive Dust - Transfer operation	MM Wheel wash system	15	<p>Subject to capital approval by 21/11/2021 and annual kiln shutdown commencing on 10/01/2022, ABC will complete installation and commissioning of the wheel wash by 01/04/2022.</p> <p>Project cancelled</p>	<p>ABC will hire a portable wheel wash unit to assess effectiveness and suitability.</p> <p>The typical duty of the hire unit is as follows:</p> <ul style="list-style-type: none"> • Road-based truck / trailer configurations: 2900mm internal tire width • Capacity 50 trucks/day • Expected wash time ~30 seconds (depends vehicle length/speed) • Automatic operation • To be situated on concrete hard stand roadway/surface • Reclaim and reuse of cleaning water as much as possible – system top up with mains water • Materials expected to be handled, Limestone, Bauxite, Clay, Sands <p>ABC had difficulty in getting vendors to respond to supply a suitable hire unit.</p> <p>ABC considered redesign of the existing wheel wash unit to accommodate wheel washing for front end loaders.</p> <p>Further investigations identified safety concerns with installation of a new wheel wash at the proposed location, due to the size/mass, breaking force and exit angle of the location. On-site traffic movement has been modified and double road trains, which used to deliver to site and could not fit the current wheel wash, are no longer used.</p> <p>Therefore, this EIP is no longer required.</p> <p>PROJECT CANCELLED:</p>

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
5	Fugitive Dust - Conveyors	CS2 CR2 CR3 wind shielding	16	By the 11/05/2020, ABC will complete an engineering study to enable capital expenditure approval for wind shielding on one side of CS2 CR2/CR3 conveyors.	<p>ABC has developed an engineering scope of work and obtained estimated project costs.</p> <p>In summary ABC will:</p> <ul style="list-style-type: none"> • Refurbish the conveyor gantry purlins • Reinstate cladding along the sides of CS2 CR2 CR3 clinker conveyor gantry • Install floor cladding over the existing perforated floor


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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
5	Fugitive Dust - Conveyors	CS2 CR2 CR3 wind shielding	17	By 12/05/2020, ABC will submit a development application to the relevant regulatory authority for construction of a CS2 CR2/CR3 conveyor wind shielding.	<p>ABC understands building consent approval will not be required as the proposed works are within the existing design parameters of the conveyor gantry structure.</p> <p>An expenditure proposal will be submitted to obtain funding for construction of CS2 CR2 CR3 conveyor wind shielding by the 9/11/2020.</p>

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
5	Fugitive Dust - Conveyors	CS2 CR2 CR3 wind shielding	18	Subject to development approval by 10/08/2020, ABC will obtain capital expenditure for the construction of a CS2 CR2 CR3 conveyor wind shielding by 9/11/2020.	<p>ABC has obtained approval for the expenditure required to construct the CS2 CR2 CR3 conveyor wind shielding</p> <p>In summary ABC will:</p> <ul style="list-style-type: none"> • Refurbish the conveyor gantry purlins • Reinstate cladding along the sides of CS2 CR2 CR3 clinker conveyor gantry • Install floor cladding over the existing perforated floor

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
5	Fugitive Dust - Conveyors	CS2 CR2 CR3 wind shielding	19	<p>Subject to capital approval by 9/11/2020 and the annual kiln shutdown commencing on 4/1/2021, ABC will complete installation of the CS2 CR2 CR3 wind shielding by 01/02/2021.</p> <p>ABC has requested a variation due to COVID -19 impacts, delayed resources and annual plant outage as follows:</p> <p>Variation:</p> <p>Subject to capital approval by 9/11/2020 and the annual kiln shutdown commencing on 24/2/2021, ABC will complete installation of the CS2 CR2 CR3 wind shielding by 30/04/2021.</p> <p>Project completed</p>	<p>ABC Advised the EPA, that the project was progressing well but would not be completed as expected by 30/4/2021. The necessary work to prepare the CS2 conveyor structure before cladding could be applied had taken longer than anticipated.</p> <p>The roofing and cladding installation was completed on the 7/5/2021, and roof vents installed the following week.</p> <p>The photograph below shows the completed project.</p> 

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6	Fugitive Dust – Storage/processing buildings	CM6 CF6 Clinker Transfer Point Dust Collector	20	By 29/08/2019, ABC will complete an engineering design to enable capital approval for selection and installation of a suitable dust collector	<p>ABC has developed an engineering scope of work to reduce dust emissions at the clinker transfer onto Cement Mill 6 (CM6) Clinker Feed conveyor (CF6)</p> <p>Engineering analysis determined the existing dust collector is correctly sized, but dust capture and handling need improvement.</p> <p>The scope of work includes;</p> <ul style="list-style-type: none"> • Redesigned ductwork to provide effective capture of dust at the clinker transfer point • Improved dust collector discharge arrangements <p>These improvements will reduce dust loadings within CM6 building and will lead to lower overall fugitive dust emissions from the building.</p>


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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
6	Fugitive Dust – Storage/processing buildings	CM6 CF6 Clinker Transfer Point Dust Collector	21	By 28/11/2019, ABC will obtain the capital expenditure for the installation of a CM6 CF6 Clinker transfer point dust collector.	ABC has obtained approval for the expenditure necessary to reduce dust emissions at the CM6 CF6 Clinker transfer point.

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
6	Fugitive Dust – Storage/processing buildings	CM6 CF6 Clinker Transfer Point Dust Collector	22	<p>Subject to capital approval by 28/11/2019 and CM6 mill shutdown commencing 14/04/2020, ABC will complete commissioning of dust collection system by 6/07/2020.</p> <p>Variation: Subject to capital approval by 28/11/2019 and CM6 mill shutdown commencing in January 2021, ABC will complete commissioning of the dust collection system by 8/3/2021</p> <p>EPA has accepted the variation.</p> <p>As CM6 shutdown has been rescheduled due to Covid -19 impact, ABC has applied for a variation as follows:</p> <p>Variation: Subject to capital approval by 28/11/2019 and CM6 mill shutdown in April 2021, ABC will complete commissioning of dust collection system by 30/06/2021.</p>	<p>Due to the COVID-19 pandemic and the need to minimise health risks, the scope of work for CM6 shutdown has been significantly restricted to only those activities critical to ensure ongoing and safe operation of the mill.</p> <p>ABC advises that it is unable to install the dust collection system within the timeframes required by EIP Project 6 (during the CM6 shutdown) and seeks a variation in the completion date for the EIP Project.</p> <p>ABC proposes to install the dust collection system on the next CM6 shutdown which is expected to be during the annual shutdown planned for January 2021.</p> <p>ABC therefore requested a revised completion date of 8/3/2021:</p> <p>EPA has accepted the proposed variation.</p>

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
6	Fugitive Dust – Storage/processing buildings	CM6 CF6 Clinker Transfer Point Dust Collector	22	<p>Subject to capital approval by 28/11/2019 and CM6 mill shutdown in April 2021, ABC will complete commissioning of dust collection system by 30/06/2021.</p> <p align="center">Project completed</p>	<p>Engineering analysis determined the existing dust collector is correctly sized, but dust capture at the transfer point needed improvement.</p> <p>ABC has completed the installation of the redesigned duct work to provide effective capture of dust at the transfer point. This work was completed on 24 June 2021</p>  <p>These improvements will reduce dust loadings within CM6 building and will lead to lower overall fugitive dust emissions from the building.</p>



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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
7	Fugitive Dust - Storage/processing buildings	CM6 Clinker Gantry entry air knives	23	By the 28/08/2020, ABC will complete the engineering design to enable capital expenditure approval for installation for CM6 Gantry air knives.	<p>ABC has developed an engineering scope of work to reduce dust emissions from the CM6 clinker gantry doors when vehicles pass through.</p> <p>The system consists of a blower and ducting directing a stream of air around the CM6 gantry door, to minimise fugitive dust emissions from the shed when the door is open.</p> <p>By 30/10/2020, ABC will obtain the capital expenditure for installation for CM6 Gantry air knives.</p>

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7	Fugitive Dust - Storage/processing buildings	CM6 Clinker Gantry entry air knives	24	By 30/10/2020, ABC will obtain the capital expenditure for installation for CM6 Gantry air knives.	ABC has approval for the necessary expenditure for installation for CM6 Gantry air knives.

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EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
7	Fugitive Dust – Storage/processing buildings	CM6 Clinker Gantry entry air knives	25	<p>Subject to capital approval by 30/10/2020, ABC will complete the installation of air knives on the truck entry to the CM6 Clinker Gantry by 17/05/2021.</p> <p>Variation: <i>ABC advised the EPA that the supplier had informed ABC of delays in the delivery of the fans which were not expected to arrive until the end of June, delaying completion of the project. The air knife system design and onsite electrical work in preparation for arrival of the fans had been completed.</i></p> <p>Project completed</p>	<p>ABC has completed the installation of the air knives and the system was operational from the 10/8/2021. The photos below show the installed air knife duct work and one of the two identical air fans that have been installed.</p>   <p>This project improves fugitive dust emissions from the CM6 Clinker Gantry door when vehicles pass through.</p>

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1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
8	Fugitive Dust - Dust Collectors	CM1 Dust Collector - redirect outlet	26	By 30/07/2019, ABC will complete an engineering design to enable capital approval for changing the CM1 Dust collector outlet to a vertical discharge.	<p>ABC has developed an engineering scope of work to change the CM1 Dust collector out let to a vertical discharge.</p> <p>The design includes:</p> <ul style="list-style-type: none"> • Installing new ducting within the existing mill room building with a smooth radius turn to minimise turbulence • The existing duct attenuator will be overhauled to further mitigate noise emissions




Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
8	Fugitive Dust - Dust Collectors	CM1 Dust Collector - redirect outlet	27	By 31/07/2019, ABC will submit an application to the relevant regulatory authority for redirection of the CM1 Dust Collector outlet.	As the scope of work does not affect the structure or use of the building and considering all the work is being completed internally, building approval is not required.


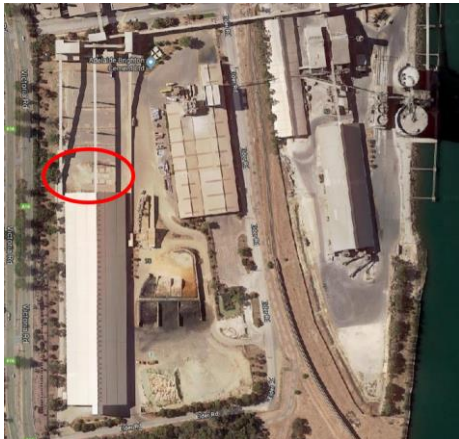
Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
8	Fugitive Dust – Dust Collectors	CM1Dust Collector – Redirect outlet	28	Subject to development approval by 29/10/2019, ABC will obtain the capital expenditure for changing the CM1 dust collector outlet to a vertical discharge by 28/01/2020	<p>ABC has obtained the funding to change the CM1 dust collector outlet to a vertical discharge.</p> <p>ABC plans to complete the installation of the redirected CM1 dust collector outlet in February 2020, as the planned CM1 shutdown has been brought forward from April 2020.</p>

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
8	Fugitive Dust – Dust Collectors	CM1Dust Collector – Redirect outlet	29	<p>Subject to capital approval by 28/01/2020 and cement mill 1 shut down for maintenance commencing on the 14/04/2020, ABC will complete the installation of the redirected CM1 dust collector outlet by 20/04/2020.</p> <p align="center">Project completed</p>	<ul style="list-style-type: none"> Funding obtained and changes completed on 04/02/2020, as CM1 shutdown was brought forward from April 2020. A vertical outlet on the dust collector improves dispersion and is predicted to reduce maximum 24-hr average concentrations of PM₁₀ at the Community Park by 0.45 µg/m³ Project has also reduced ground level noise on eastern side of CM1 building by 25 dBA <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;">  <p>Horizontal outlet</p> </div> <div style="text-align: center;">  <p>Vertical outlet</p> </div> <div style="text-align: center;">  <p>Vertical outlet through roof</p> </div> </div>


Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
9	Fugitive Dust – Sealing exposed unsealed surfaces	Seal area – north of reclaimer shed	30	By the 25/06/2019, ABC will complete the engineering design to enable capital approval for sealing 1200m ² of unsealed surface area on the northern side of the reclaimer shed.	<p>ABC has developed an engineering scope of work and obtained estimated project costs. In summary:</p> <ul style="list-style-type: none"> • 1375 m² of unsealed surface is to be bituminised • Sealed surface to blend in with existing paved areas • Additional car parking spaces to be provided • Surface drainage into existing arrangements • Draft plan below  <ul style="list-style-type: none"> • Site Location below  <p>A business case and a capital expenditure proposal will be submitted to obtain capital funding by the 24/09/2019.</p>

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
9	Fugitive Dust – Sealing exposed unsealed surfaces	Seal area – north of reclaimer shed	31	By 24/09/2019, ABC will obtain capital expenditure for sealing 1200m ² of unsealed surfaces on the northern side of the reclaimer shed with bitumen	<p>ABC has obtained capital expenditure approval to seal 1200m² of unsealed surfaces on the northern side of the reclaimer shed with bitumen.</p> <p>Implementation of this project has now commenced to enable the area to be sealed by 26/11/2019.</p>

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
9	Fugitive Dust – Sealing exposed unsealed surfaces	Seal area – north of reclaimer shed	32	<p>Subject to capital approval by the 24/09/2019, ABC will seal 1200 m² of unsealed surface area on the northern side of the limestone reclaimer by 26/11/2019.</p> <p>Project completed</p>	<p>ABC has sealed 1200m² of unsealed surfaces on the northern side of the reclaimer shed with bitumen.</p> <p>The bituminised area is now being utilised to provide additional car parking spaces – see photograph below.</p>  <p>Independent air quality modelling and analysis indicates this project may reduce the maximum 24 h-hr average concentrations of PM₁₀ at the Community Park by 0.3 µg/m³.</p> <p>The EIP project was completed on the 23/10/2019 before the required compliance date of 26/11/2019.</p>

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
10	Fugitive dust - Sealing exposed unsealed surfaces	Seal area North of Kiln	33	<p>By 1/04/2022, ABC will complete the engineering design to enable capital approval for sealing 1200m2 of unsealed surface area to the North of the kiln.</p> <p>Completion date amended to 31/5/2024</p>	<p>AMENDMENT: Sealing of the area north of the kiln is dependent on completion of a separate non EIP project which may not now be progressed.</p> <p>An alternative area south of 4A ESP is now proposed to be sealed instead by 31/12/2023.</p> <p>The intention was to seal the surface area south of 4A ESP with a trial a lower carbon footprint concrete. The scheduled trial to produce a lower carbon footprint at the Angaston plant has been deferred due to market requirements to 2025. Access to seal the surface, has to be rescheduled to occur after the 2024 plant shutdown, as the area is currently being used to store steel work for replacement of 4A stack during the 2024 shutdown. ABC requested the compliance date be revised to 31 May 2024 which was approved by the EPA.</p>
11	Fugitive dust - Sealing exposed unsealed surfaces	Seal contractor compound (area far North of kiln)	36	<p>By 22/04/2022, ABC will complete the engineering design to enable capital approval for sealing 1200m2 of unsealed surface area to the far North of the kiln.</p> <p>Project Cancelled</p>	<p>AMENDMENT: Sealing the area of the contractor compound north of the kiln was dependent on completion of a separate project which may not now be progressed.</p> <p>Refer to EIP Project number 10 for alternative proposed area to be sealed.</p>

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
12	Fugitive Dust - Storage/processing buildings	CM6 Cladding	39	By 31/08/2020, ABC will complete an engineering study to enable capital approval for upgrading/maintaining the Cement Mill 6 (CM6) building cladding to improve the capture of dust generated from activities inside the building.	<p>ABC has developed an engineering scope of work to reduce dust emissions from the CM6 building</p> <p>Cladding will be applied to seal the building ventilation on the upper section of the western wall. This will improve the capture of dust generated from activities inside the building</p> <p>By 1/12/2020, ABC will obtain the capital expenditure to upgrade/maintain the CM6 Cladding.</p>

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
12	Fugitive Dust - Storage/processing buildings	CM6 Cladding	40	By 1/12/2020, ABC will obtain the capital expenditure to upgrade/maintain the CM6 Cladding.	ABC has approval for the expenditure to seal the CM6 building ventilation on the upper section of the western wall.

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
12	Fugitive Dust - Storage/processing buildings	CM6 Cladding	41	<p>Subject to capital approval by 1/12/2020, ABC will complete the upgrade/maintain the cladding on CM6 by 30/04/2022.</p> <p>AMENDMENT: Completion date has been amended to 31 December 2023, as a shutdown of CM6 is required for implementation of this EIP.</p> <p>AMENDMENT: Completion date has been amended to 31 May 2024, as a shutdown of CM6 is required for implementation of this EIP.</p>	<p>This project was scheduled to occur during the Cement mill 6 shutdown which was planned for April 2022.</p> <p>The shutdown of CM6 mill has been delayed and is now currently scheduled for October 2022.</p> <p>ABC was unable to secure contractors to undertake the work during the CM6 shutdown and is looking for the next available opportunity.</p> <p>There has been no planned shutdown of CM6 to enable this project to be progressed.</p> <p>Time frame for completion of this EIP is to be amended to 31 May 2024 as a shutdown of CM6 is required for implementation of this EIP.</p>

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
13	Fugitive Dust - Storage/processing buildings	CM6 Gantry Cladding	42	By 30/09/2021, ABC will complete an engineering study to enable capital approval to upgrade/maintain the CM6 Clinker Gantry cladding.	An engineering study has been completed, including a drone survey which has identified opportunities to improve the effectiveness of the gantry cladding to ensure the building remains well sealed.




Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
13	Fugitive Dust - Storage/processing buildings	CM6 Gantry Cladding	43	By 30/09/2021, ABC will submit a development application for CM6 Clinker Gantry cladding upgrade/maintenance.	The work to be undertaken will not require a development application to be submitted.

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
13	Fugitive Dust - Storage/processing buildings	CM6 Gantry Cladding	44	Subject to development approval, ABC will obtain the capital expenditure to upgrade/maintain the CM6 Clinker Gantry by 30/12/2021.	ABC has approval for the expenditure to seal the CM6 Gantry building ABC will complete the upgrade/maintain the cladding on CM6 by 29/09/2022.

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
13	Fugitive Dust - Storage/processing buildings	CM6 Gantry Cladding	45	<p>Subject to capital approval by 30/12/2021, ABC will complete the CM6 Clinker Gantry cladding upgrade/maintenance by 29/09/2022.</p> <p>Project Completed</p>	<p>ABC has approval for the expenditure to seal the CM6 Gantry building</p> <p>Photographs showing some of the sections where cladding has been replaced</p>    <p>The wall cladding works have now been completed.</p>


Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
14	Noise	CM1/CM7 Clinker Gantry Dust Collector Fans	46	By 18/7/2019, ABC will complete an engineering study to enable approval of capital expenditure to reduce noise emissions from CM1/CM7 Clinker Gantry Dust Collection Fans	<p>ABC has developed an engineering scope of work and obtained estimated project costs.</p> <p>In summary:</p> <ul style="list-style-type: none"> • ABC will install duct noise attenuators on the CM1/CM7 Clinker Gantry Dust Collection Fans <p>An expenditure proposal will be submitted to obtain funding for implementation by the 17/10/2019.</p>



Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
14	Noise	CM1/CM7 Clinker Gantry Dust Collector Fans	47	By 17/10/2019, ABC will commit to a noise attenuation option and obtain approval for the necessary expenditure.	<p>ABC has obtained capital funding to install duct noise attenuators on the CM1/CM7 Clinker Gantry Dust Collection Fans.</p> <p>Subject to the annual plant shutdown commencing on 6/01/2020, ABC will implement the CM1/CM7 Clinker Gantry Dust Collection Fans by the 31/01/2020.</p>

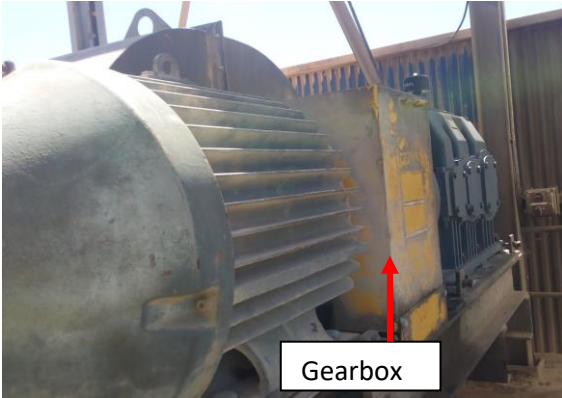

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
14	Noise	CM1/CM7 Clinker Gantry Dust Collector Fans	48	<p>Subject to capital approval by 17/10/2019 and annual plant shutdown commencing on 6/01/2020, ABC will implement the CM1/CM7 Clinker Gantry Dust Collection Fans by the 31/01/2020.</p> <p>Project completed</p>	<p>ABC has installed splitter silencers, designed by the dust collector fan supplier, on the CM1/CM7 Clinker Gantry Dust Collection Fans.</p>  <ul style="list-style-type: none"> • Measured noise levels from the dust collectors fitted with the new designed splitter silencer at 59-61 dBA • The new silencers have achieved a significant noise reduction of 10-12 dBA at source when compared with Vipac Engineers baseline measurements of 71dBA. <p>ABC will engage an acoustic engineer in accordance with EIP compliance action 51 to assess and validate the reductions achieved.</p>

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
15	Noise	BH Gas Train noise abatement (APA Project)	49	<p>By the 27/02/2020, ABC will work with APA Group (owners of the Gas Train and equipment) to assess and implement further noise abatement options. APA is solely responsible for the selection and implementation of noise attenuation measures.</p> <p align="center">Project completed</p>	<ul style="list-style-type: none"> • ABC has worked with APA to further reduce noise levels from the Gas Train • APA installed axial flow regulators, flow meter, associated pipework on duty leg of gas train - completed 19/02/2020 • A significant reduction of 10 - 12 dBA with the new equipment is indicated • ABC will engage an acoustic engineer in accordance with EIP action 51 to validate noise reduction <div style="text-align: center;">  <p>Before Modifications</p>  <p>After Modifications</p> </div>

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
16	Noise	Kiln Feed Elevator Gear box	50	<p>By the 26/4/2019, ABC will have replaced the noisy gearbox on the kiln feed elevator and reinstate its Western cladding.</p> <p align="center">Project completed</p>	<p>Kiln feed elevator gear box has been replaced and Western cladding has been reinstated.</p> <ul style="list-style-type: none"> • Photo showing gearbox installed  <ul style="list-style-type: none"> • Vipac (Acoustic Consultants) measured noise levels on 16/4/2019 from the replaced gearbox at 91dBA, at 1m distance from the gearbox. • A reduction of 9dBA has been achieved (previously 100dBA in November 2018) • Photo showing replacement of western cladding (dark blue section) 

Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
17	EIP Project Evaluation	Evaluation of the improvement in fugitive dust and noise emissions from the Birkenhead site.	51	<p>Subject to completion of all noise abatement EIP projects (EIP Project numbers 14 to 16) by the 27/02/2020, ABC will submit a report by 31/05/2020, that assess and validates the reductions achieved through the implementation of these EIP actions that includes: An evaluation of noise emissions by undertaking site noise modelling in accordance with the Environment Protection (Noise) Policy 2007</p> <p>Project completed</p>	<p>ABC engaged Vipac Engineers and Scientists Limited (Vipac), to undertake an evaluation of EIP projects 14, 15 and 16, in accordance with the Environment Protection (Noise) Policy 2007.</p> <p>Vipac’s report, “Birkenhead Plant Noise Survey - May 2020”, dated 29 May 2020, provides a detailed evaluation and confirmation of the expected project outcomes.</p> <p>The Vipac report is attached in the appendix B.</p> <p>ABC has prepared a report, “Summary report of the effectiveness of EIP Projects 14, 15 and 16 - EIP Project 17 – Compliance action 51”, dated 29 May 2020.</p> <p>The ABC report summarises the effectiveness of the EIP projects 14, 15 and 16, based on the findings in the Vipac report “Birkenhead Plant Noise Survey - May 2020”, dated 29 May 2020.</p> <p>The ABC report is attached in the appendix C.</p> <p>In summary:</p> <ul style="list-style-type: none"> • All the EIP projects have been independently assessed by acoustic engineers, Vipac. • The assessment confirms the effectiveness of EIP projects 14, 15 and 16. • The expected project outcomes have been achieved, reducing off-site sound levels.

**Adelaide Brighton Cement Ltd (ABC) Environmental Improvement Programme (EIP)
1 March 2019 – 31 December 2023**

EIP Project	Category	Project	Compliance Action	Project Milestones (Compliance actions)	Actions & Outcomes
17	EIP Project Evaluation	Evaluation of the improvement in fugitive dust and noise emissions from the Birkenhead site.	52	<p>Subject to completion of all particulate dust emissions EIP projects (EIP Project numbers 1 to 13) by the 29/09/2022, ABC will submit a report by 23/12/2022, that assess and validates the reductions achieved through the implementation of these EIP actions that includes:</p> <p>An evaluation of the whole of site air quality assessment in accordance with the Environment protection (Air Quality) Policy 2016 and EPA guidance publication “Ambient Air Quality Assessment - 2016”</p> <p>Amendment EIP Project 17 was amended to 30/09/2023. Noting that EIP 1,2,3,4,5,6,7,8,9 and 13 will be assessed and projects 10,11 &12 will be assessed at a later date after completion.</p>	<p>An Evaluation Report - Fugitive Dust Projects was prepared and submitted on the 29/9/2023 to the SA EPA. This report is included in the appendix of this report.</p> <p>To address the requirements of compliance action 52, ABC engaged Katestone Environmental Pty Ltd (Katestone) to complete an assessment of air emissions reductions achieved at the Birkenhead Cement Plant, through the implementation of mitigative actions outlined in the EPA approved Environment Improvement Programme (EIP)</p> <p>In the Evaluation Report – Fugitive Dust Projects, ABC has assessed the outcomes and effectiveness of EIP Projects 1-9 and 13, which is presented in Table 1: Summary of EIP Project Effectiveness, which provides the following information:</p> <ul style="list-style-type: none"> • EIP Project number, description, and implementation date • Potential benefits and where quantifiable, the original estimated potential particulate mitigation based on Katestone 2017 air quality assessment. • Project outcomes and evaluation of effectiveness where quantifiable, using the results from the Katestone 2022 air quality assessment. <p align="center">Project completed</p>

Environment Improvement Programme

EPA Licence 1126

Evaluation Report

Fugitive Dust Projects

29/9/2023

Prepared by: C. Mackenzie Advisor Environment C&L (SA/NSW/NT)

Glossary

Term	Definition
$\mu\text{g}/\text{m}^3$	micrograms per cubic metre
μm	micrometre
m	metre
m^2	square metres
m^3	cubic metres
Nomenclature	Definition
TSP	Total suspended particulates
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 Ltd
Air EPP	Environment Protection (Air Quality) Policy 2016
CM1	Cement Mill 1
CM6	Cement Mill 6
CM6 CF6	Cement Mill 6 Clinker feed
CM6 Clinker Gantry	Cement Mill 6 Clinker storage shed
CS2 CR2 CR3	Group of conveyors used to transfer clinker from kiln to storage stockpiles
EET	Emission Estimation Technique
EIP	Environment Improvement Programme
EP Act	Environment Protection Act 1993
EPA	Environment Protection Authority
Geo fabric	An impermeable fabric sheet
MM	Fringe Materials Management System- (transfer of bulk fringe materials to the kiln)

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Evaluation Report – Fugitive Dust Projects

1.0 Background

Adelaide Brighton Cement Ltd developed an EPA approved Environmental Improvement Programme (EIP) for the Birkenhead site operations in compliance with the sites Environmental Authorisation 1126 licence condition (U-925).

The current EPA approved EIP (document number 1126 Version 8, dated 29 May 2023), compliance action 52, requires that a report assessing and validating the reductions achieved through implementation of EIP particulate mitigative projects (EIP Project numbers, 1-9 and 13), by 30/09/2023. The assessment needs to include an evaluation of the whole of site air quality assessment in accordance with the Environment Protection (Air Quality) Policy 2016 and EPA guidance publication “Ambient Air Quality Assessment - 2016”. This report has been prepared in accordance with this requirement.

The Birkenhead EIP (document number 1126 Version 8, dated 29 May 2023), was informed by:

- Adelaide Brighton Cement Limited Report, August 2018, ‘Assessment of Options Report’
- Katestone Environmental Report, August 2018 “Birkenhead Cement Plant – Options Assessment Report”
- Katestone Environmental Report, 2017, “Air Quality Assessment of the Birkenhead Cement Plant”

2.0 Assessment Of EIP Projects

Where possible, the predicted reduction in particulate emissions at ABC’s Community Dog Park monitor location, were estimated for each of the EIP fugitive dust projects, using the Katestone, 2017, Air Quality Assessment of the Birkenhead Cement Plant, as a guide for assessing the effectiveness of the mitigation strategy.

A whole of site air quality assessment was undertaken by Katestone in 2023, which included the development of an updated emissions inventory and air dispersion modelling based on activity data from the 2022 calendar year which is documented in the Katestone Report, August 2023, “Birkenhead Cement Plant Air Emissions Inventory and Dispersion Modelling”, which has already been submitted to the EPA.

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.



To address the requirements of compliance action 52, ABC engaged Katestone Environmental Pty Ltd (Katestone) to complete an assessment of air emissions reductions achieved at the Birkenhead Cement Plant, through the implementation of mitigative actions outlined in the EPA approved Environment Improvement Programme (EIP) for the Birkenhead site, which is presented in the Katestone Report, September 2023, “ABC Birkenhead Facility EIP Achievements Assessment” (Appendix A).

The Katestone EIP achievements assessment aims to address the relevant requirements of compliance action 52 by evaluating reductions in particulate dust emissions and impacts achieved through EIP actions implemented to date at the Birkenhead site (Facility), where quantifiable, using results from the updated emissions inventory and dispersion modelling presented in Katestone Report “Birkenhead Cement Plant Air Emissions Inventory and Dispersion Modelling”, August 2023.


ABC assessment of the outcomes and effectiveness of EIP Projects 1-9 and 13, is presented in Table 1: Summary of EIP Project Effectiveness, which provides the following information:

- EIP Project number, description, and implementation date
- Potential benefits and where quantifiable, the original estimated potential particulate mitigation based on Katestone 2017 air quality assessment.
- Project outcomes and evaluation of effectiveness where quantifiable, using the results from the Katestone 2022 air quality assessment.













Table 1: Summary of EIP Project Effectiveness

EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
1	Fugitive Dust - Stockpile emission reduction	Relocate Bauxite Stockpile and cover with Geofabric.	Relocate Bauxite stockpile from shell block close to the Materials Management (MM) Pit area and cover inactive stockpile areas with Geofabric.	<p>Optimising the location of the raw material stockpile reduces vehicle movements and associated fugitive dust as the stockpile is closer to the entry point of the process. Covering inactive areas of the stockpile with Geofabric prevents wind erosion and fugitive dust from the surface of the stockpile.</p> <p>Independent air quality modelling and analysis indicates that relocating the Bauxite stockpile and covering inactive areas with Geofabric may reduce maximum 24-hr average concentrations of PM₁₀ at the Community Park by 0.2 µg/m³.</p>	<p>Stockpile relocated and chemical dust suppression applied and used until the stockpile can be covered with geofabric.</p>  <p>Dust suppression (green) applied to stockpile before covers added.</p> <p>ABC completed installation of the covers on the relocated Bauxite Stockpile at the Southern end of the plant on 13/02/2020.</p>  <p>Bauxite Stockpile with geofabric covers applied.</p> <p>Slow stockpile turnover enables most of the stockpile to be covered, and progressively rolled back to expose a new stockpile working surface.</p>
1	Fugitive	Relocate			

EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
	Dust - Stockpile emission reduction	Bauxite Stockpile and cover with Geofabric	Relocate Bauxite stockpile from shell block close to the Materials Management (MM) Pit area and cover inactive stockpile areas with Geofabric.	<p>Optimising the location of the raw material stockpile reduces vehicle movements and associated fugitive dust as the stockpile is closer to the entry point of the process. Covering inactive areas of the stockpile with Geofabric prevents wind erosion and fugitive dust from the surface of the stockpile.</p> <p>Independent air quality modelling and analysis indicates that relocating the Bauxite stockpile and covering inactive areas with Geofabric may reduce maximum 24-hr average concentrations of PM₁₀ at the Community Park by 0.2 µg/m³.</p>	<p>ABC experienced significant safety issues with the application /removal of the geofabric material. Safety issues include:</p> <ul style="list-style-type: none"> • Need calm conditions for geofabric application/removal/adjustment to avoid personnel body injury from “whiplash” effects caused by wind lifting/pulling the geofabric. • Personnel working on stockpiles, uneven stockpile surfaces/slopes and threat of personal injury from slips /falls and engulfment by material. • Size/weight of the geofabric covers requires mobile equipment to deploy and creates a significant risk of injury to personnel from mobile equipment interaction. • Use of mobile equipment on narrow base stockpiles such as the (bauxite stockpile) is difficult and requires construction of benches which results in more material handling and significantly more dust emissions than from a static stockpile coated with polymer. <p>As a result of safety issues associated with their use, ABC will not continue to use geofabric covers for stockpiles.</p> <p>Relocated stockpile reduces emissions from double handling vehicle movements and associated fugitive dust as the stockpile is closer to the entry point of the process.</p> <p>ABC will continue to apply polymers to stockpile surfaces which are effective in reducing wind-blown particulate emissions from stockpiles.</p>

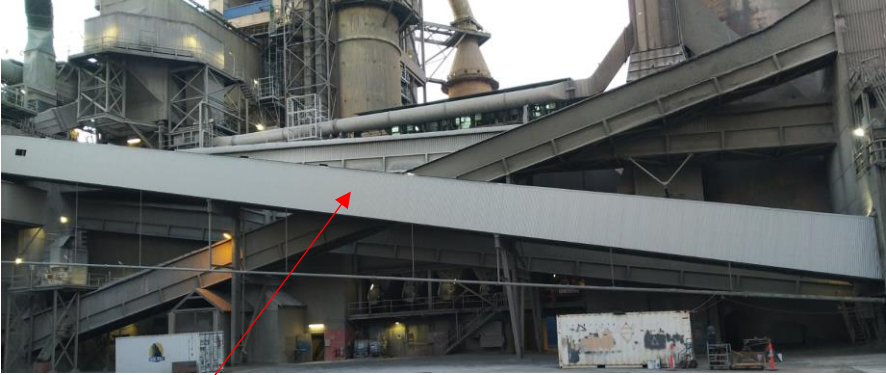
EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
2	Fugitive Dust - Stockpile emission reduction	Wind curtain - Limestone stockpile	Install a portable 6m high by 50m length wind curtain at the working face of the stockpile - (shell block).	<p>A porous windbreak curtain can reduce wind speed minimising dust lift-off and transport.</p> <p>A portable wind curtain provides the flexibility to manage the changing dynamics of the stockpile size, providing an effective means of reducing dust emissions from materials handling activities at the working face of the stockpile.</p> <p>Independent air quality modelling and analysis indicates that a portable wind curtain located at the working face of the stockpile when used in conjunction with chemical polymers applied to stockpile sides and exposed surface areas, and use of stockpile covers applied to 11,500m² of inactive nonworking exposed surface areas of the limestone stockpile may reduce maximum 24-hr average concentrations of PM₁₀ at the Community Park by 2.3 µg/m³.</p>	<p>ABC completed installation of 5 portable wind fences on the 22/3/2021, before commencement of the limestone stockpile reclamation in early April 2021.</p> <ul style="list-style-type: none"> • 5 portable wind fences (6m high x10m length each) installed at the working face of the limestone stockpile. • A porous windbreak fence can reduce wind speed minimising dust lift-off and transport. • A portable wind fence provides flexibility to manage changing dynamics of the stockpile size, providing an effective means of reducing dust emissions from materials handling activities at the working face of the stockpile.  <p>The intent of the curtain is to reduce wind speed at the active working face of the stockpile, reducing dust emissions. As the limestone stockpile size increases there will also be times the fence is adjacent to the limestone stockpile, which will reduce emissions from the limestone stockpile.</p>


EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
2	Fugitive Dust - Stockpile emission reduction	Wind curtain - Limestone stockpile	Install a portable 6m high by 50m length wind curtain at the working face of the stockpile - (shell block).	<p>A porous windbreak curtain can reduce wind speed minimising dust lift-off and transport.</p> <p>A portable wind curtain provides the flexibility to manage the changing dynamics of the stockpile size, providing an effective means of reducing dust emissions from materials handling activities at the working face of the stockpile.</p> <p>Independent air quality modelling and analysis indicates that a portable wind curtain located at the working face of the stockpile when used in conjunction with chemical polymers applied to stockpile sides and exposed surface areas, and use of stockpile covers applied to 11,500m² of inactive nonworking exposed surface areas of the limestone stockpile may reduce maximum 24-hr average concentrations of PM₁₀ at the Community Park by 2.3 µg/m³.</p>	<p>The potential benefits of this project included a wind curtain to reduce wind speed at the active working face of the stockpile, with inactive areas of the stockpile covered by geofabric to further minimise wind erosion of the stockpile (EIP Project 3).</p> <p>ABC will no longer use geofabric covers on this stockpile due to safety concerns and limited effective coverage time due to the nature of the stockpile build. ABC will however continue to apply polymers to stockpile surfaces which are effective in reducing wind-blown particulate emissions from stockpiles.</p> <p>Katestone have evaluated the range of realistic potential reductions achievable from the use of the wind curtain (in isolation of other controls), the range of which are covered by the following scenarios:</p> <ul style="list-style-type: none"> • Full 50 m length of the windbreak curtain adjacent to limestone stockpile, which provides a predicted maximum 24-hr average PM₁₀ concentration at ABC's Community Park monitor of 0.32 µg/m³. • Full 50 m length of the windbreak curtain adjacent to exposed unsealed surface area, which provides a predicted maximum 24-hr average PM₁₀ concentration at ABC's Community Park monitor of 0.07 µg/m³. <p>The wind curtain is effective in reducing dust emissions from materials handling activities at the working face of the stockpile.</p>


EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness														
3	Fugitive Dust - Stockpile emission reduction	Geofabric - Limestone stockpile	Geofabric cover is to be applied to 11,500m ² of inactive areas of limestone stockpiles on shell block.	<p>Covering inactive areas of the stockpile with Geofabric prevents wind erosion and fugitive dust from the surface of the stockpile.</p> <p>Independent air quality modelling and analysis indicates that covering 11,500m² of inactive stockpile surface with Geofabric may reduce maximum 24-hr average concentrations of PM₁₀ at the Community Park by 0.9 µg/m³.</p>	<p>ABC completed the installation of Geofabric on inactive surface areas of the limestone stockpile on 11/01/2021.</p> <p>At the time of preparing the EIP, ABC anticipated 11,500 m² of inactive surface area would be available by the 13/03/2020, to which a cover could be applied. Due to the dynamic nature of the stockpile build, this was not possible and variations to the project milestone was agreed with the EPA, allowing for progressive application of covers as the stockpile build enabled this to occur. Progress is summarised in the table below:</p> <table border="1"> <thead> <tr> <th>Date</th> <th colspan="2">Photos</th> </tr> </thead> <tbody> <tr> <td>18/3/2020</td> <td>Ariel view</td> <td></td> </tr> <tr> <td>30/09/2020</td> <td>Top of stockpile</td> <td></td> </tr> <tr> <td rowspan="2">11/01/2021</td> <td>Ariel view</td> <td></td> </tr> <tr> <td>Port River Side</td> <td></td> </tr> </tbody> </table>	Date	Photos		18/3/2020	Ariel view		30/09/2020	Top of stockpile		11/01/2021	Ariel view		Port River Side	
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EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
3	Fugitive Dust - Stockpile emission reduction	Geofabric - Limestone stockpile	Geofabric cover is to be applied to 11,500m ² of inactive areas of limestone stockpiles on shell block.	<p>Covering inactive areas of the stockpile with Geofabric prevents wind erosion and fugitive dust from the surface of the stockpile.</p> <p>Independent air quality modelling and analysis indicates that covering 11,500m² of inactive stockpile surface with Geofabric may reduce maximum 24-hr average concentrations of PM₁₀ at the Community Park by 0.9 µg/m³.</p>	<p>Limestone is transported by ship to the plant daily. The limestone stockpile is gradually built over 5 years to enable limestone to be available for the plant during a dry dock period required for mandatory ship recertification.</p> <p>The stockpile is built by progressively hauling limestone up constructed haul road ramps and placed on top of the stockpile to build height and length and reclaimed as needed from the stockpile base at ground level.</p> <p>Chemical dust suppression polymers are applied to stockpile surface areas (sides) and haul roads and working surfaces, to effectively reduce wind borne and wheel generated dust emissions.</p> <p>As the stockpile is dynamic, geofabric covers can only be applied to inactive non-working areas of the stockpile that have been completed, and due to the nature of the stockpile build, the effective coverage time is limited.</p> <p>ABC experienced significant safety issues with the application /removal of the geofabric material. Safety issues include:</p> <ul style="list-style-type: none"> • Need calm conditions for geofabric application/removal/ adjustment to avoid personnel body injury from “whiplash” effects caused by wind lifting/pulling the geofabric. • Personnel working on stockpiles, uneven stockpile surfaces/slopes and threat of personal injury from slips /falls and engulfment by material. • Size/weight of the geofabric covers requires mobile equipment to deploy and creates a significant risk of injury to personnel from mobile equipment interaction. <p>As a result of safety issues associated with their use, ABC will not continue to use geofabric covers for stockpiles.</p> <p>ABC will continue to apply polymers to stockpile surfaces, working surface areas and haul roads to effectively reduce wind borne and wheel generated dust emissions.</p>


EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
4	Fugitive Dust - Transfer operation	MM Wheel wash system	Install a wheel wash at the exit of the MM receiving system	<p>Installing a wheel wash at the exit of the MM transfer system will reduce track out of material carried on the wheels of vehicles and the subsequent resuspension as dust.</p> <p>Independent air quality modelling and analysis indicates that installing a wheel wash system may reduce maximum 24hr average concentrations of PM₁₀ at the Community Park by 0.1 µg/m³.</p>	Further investigations identified safety concerns with installation of a new wheel wash at the proposed location, due to the size/mass, breaking force and exit angle of the location. On-site traffic movement has been modified and double road trains, which used to deliver to site and could not fit the current wheel wash, are no longer used. Therefore, this EIP is no longer required.




EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
5	Fugitive Dust - Conveyors	CS2 CR2 CR3 wind shielding	Install wind shielding on outside of these conveyors	<p>Installing wind shielding on the weather-exposed side of the conveyors will reduce wind speed and minimise dust lift off.</p> <p>Reduction in off-site PM₁₀ dust concentration is not able to be quantified. It is expected this project will assist in reducing nuisance dust.</p>	<p>The roofing and cladding installation was completed on the 7/5/2021.</p> <p>The photograph below shows the completed project.</p>  <p>CS2CR2CR3 conveyor</p> <p>The cladding provides effective wind shielding, reducing fugitive dust emissions.</p> <p>The reduction in PM₁₀ emissions is not able to be robustly quantifiable, as there is no effective way of measuring the change.</p>

EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
6	Fugitive Dust - Storage/ processing buildings	CM6 CF6 Clinker Transfer Point Dust Collector	To install a dust collector on the CF6 clinker transfer point within the Cement Mill 6 (CM6) building.	<p>This project will reduce dust loadings within CM6 building and will lead to lower overall fugitive dust emissions from the building.</p> <p>Reduction in off-site PM₁₀ dust concentration is not able to be quantified. It is expected this project will assist in reducing nuisance dust.</p>	<p>Engineering analysis determined the existing dust collector is correctly sized, but dust capture at the transfer point needed improvement.</p> <p>ABC has completed the installation of the redesigned duct work to provide effective capture of dust at the transfer point. This work was completed on 24 June 2021</p>  <p>These improvements will reduce dust loadings within CM6 building and will lead to lower overall fugitive dust emissions from the building.</p> <p>The reduction in PM₁₀ emissions is not able to be robustly quantifiable, as there is no effective way of measuring the change.</p>

EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
7	Fugitive Dust - Storage/ processing buildings	CM6 Clinker Gantry Entry Air Knives	Install a high-speed blower/air knife system on the clinker gantry vehicle entry door.	<p>Reduce fugitive dust emissions from the CM6 clinker gantry doors when vehicles pass through.</p> <p>This project will further improve emissions from the CM6 Clinker gantry stockpile, which already has significant dust control measures in place (fully enclosed with dust collection and rapid raise doors and entry annex).</p> <p>Reduction in off-site PM₁₀ dust concentration is not able to be quantified. It is expected this project will assist in reducing nuisance dust.</p>	<p>ABC completed the installation of the air knives, and the system was operational from the 10/8/2021. The photos below show the installed air knife duct work and one of the two identical air fans that have been installed.</p>  <p>This project improves fugitive dust emissions from the CM6 Clinker Gantry door when vehicles pass through.</p> <p>The reduction in PM₁₀ emissions is not able to be robustly quantifiable, as there is no effective way of measuring the change.</p>

EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
8	Fugitive Dust - Dust Collectors	CM1 Dust Collector - redirect outlet	Change Cement Mill 1 (CM1) dust collector from a horizontal to vertical release with the release point above the height of the CM1 building	<p>A vertical outlet on the dust collector will improve the dispersion of and reduce the potential impact of emissions.</p> <p>Independent air quality modelling and analysis indicates that redirecting the CM1 to vertical release, may reduce maximum 24-hr average concentrations of PM₁₀ at the Community Park by 0.45 µg/m³.</p>	<p>Changes to the dust collector outlet were completed on 04/02/2020.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Horizontal outlet</p> </div> <div style="text-align: center;">  <p>Vertical outlet</p> </div> <div style="text-align: center;">  <p>Vertical outlet through roof</p> </div> </div> <p>Katestone has assessed that redirecting the CM1 outlet is predicted to have reduced maximum 24-hour average concentrations of PM10 at Community Park by 0.26 µg/m³.</p>

EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
9	Fugitive dust - Sealing exposed unsealed surfaces	Seal area - north of reclaimer shed	Seal 1200m ² of unsealed surface area on the northern side of the reclaimer shed with bitumen	<p>Paving exposed surface area with bitumen removes the erodible surface and eliminates the potential for dust generation.</p> <p>Independent air quality modelling and analysis indicates that sealing 1200 m² of exposed unsealed surface may reduce maximum 24-hr average concentrations of PM₁₀ at the Community Park by 0.3 µg/m³.</p>	<p>ABC completed the sealing of 1200m² of unsealed surfaces on the northern side of the reclaimer shed with bitumen on the 23/10/2019.</p> <p>The bituminised area is now being utilised to provide additional car parking spaces – see photograph below.</p>  <p>Paving exposed surface area with bitumen removes the erodible surface and eliminates the potential for dust generation.</p> <p>Katestone analysis indicates that sealing the exposed area north of the reclaimer shed is:</p> <ul style="list-style-type: none"> • Predicted to have reduced emissions of PM₁₀ by 51 kg/year • Predicted to have reduced the maximum 24-hour average contribution of this source to concentrations of PM₁₀ at the nearest residential receptor by 1.95 µg/m³.

EIP Project Number	Category	Project Title	Project Description	Potential Benefits	Outcomes and Evaluation of Effectiveness
13	Fugitive Dust - Storage/ processing buildings	CM6 Gantry Cladding	Upgrade/maintain the cladding on the CM6 Gantry building to ensure it remains well sealed.	<p>To ensure the building is able to maintain a high standard of dust control into the future. The existing building is old but has a number of dust control measures in place including the building itself, rapid raise doors and dust collection.</p> <p>The Reduction in off-site PM₁₀ dust concentration is not able to be quantified. It is expected this project will assist in reducing nuisance dust.</p>	<p>ABC completed sealing of the CM6 Gantry building on the 29/09/2022. Below are photographs showing some of the sections where cladding has been replaced.</p>    <p>Sealing the building reduces fugitive PM10 dust emissions.</p> <p>The reduction in PM₁₀ emissions is not able to be robustly quantifiable, as there is no effective way of measuring the change.</p>

3.0 APPENDIX A

ABC Birkenhead Facility EIP Achievements Assessment

Prepared for:

Adelaide Brighton Cement Ltd

September 2023

Final

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Glossary

Term	Definition
kg	kilograms
kg/year	kilograms per year
$\mu\text{g}/\text{m}^3$	micrograms per cubic metre
m	metres
m^2	square metres
m^3	cubic metres
Nomenclature	Definition
PM ₁₀	particulate matter with a diameter less than 10 micrometres
Abbreviation	Definition
ABC	Adelaide Brighton Cement
CF6	Cement Mill 6 Clinker feed
CM1	Cement Mill 1
CM6	Cement Mill 6
CS2, CR2, CR3	Group of conveyors used to transfer clinker from kiln to storage stockpiles
EIP	Environmental Improvement Programme
EP Act	<i>Environmental Protection Act 1994</i>
EPA	Environment Protection Authority
SA	South Australia
SA EPA	South Australian Environment Protection Authority
TAS	Tasmania

1. INTRODUCTION

Katestone Environmental Pty Ltd (Katestone) was commissioned by Adelaide Brighton Cement (ABC) to complete an assessment of air emissions reductions achieved at the Birkenhead Cement Plant (the Facility), through the implementation of mitigative actions outlined in the Facility's Environment Improvement Programme (EIP).

Environment improvement programmes are regulatory tools intended to outline demonstrable improvements to be undertaken by a licensee to enable them to meet the general environmental duty under section 54 of the *Environmental Protection Act 1993* (EP Act). ABC developed an EIP in compliance with license condition U-925, consisting of 17 projects designed to reduce noise and fugitive particulate emissions from the site. Katestone previously completed work for ABC that was utilised in the development of the EIP, namely:

- Katestone Report D16076-16, "Air Quality Assessment of the Birkenhead Cement Plant" (2017)
- Katestone Report D17053-14, "Birkenhead Cement Plant – Options Assessment Report" (2018)

Katestone has since developed an updated emissions inventory and undertaken air dispersion modelling for the Facility using activity data from the 2022 calendar year, presented in Katestone Report D22081-3, "Birkenhead Air Emissions Inventory and Dispersion Modelling" (2023).

Compliance action 52 under EIP project 17 requires ABC to submit a report by 30/09/2023 that assesses and validates the reductions achieved through the implementation of EIP projects 1-9 and 13, noting that projects 10-12 are not yet complete and will be assessed after completion (see Section 2). Compliance action 52 requires this evaluation to include:

"An evaluation of the whole of site air quality assessment in accordance with the Environment protection (Air Quality) Policy 2016 and EPA guidance publication "Ambient Air Quality Assessment - 2016"."

This whole of site evaluation is essentially provided in Katestone Report D22081-3 (described above), which has already been submitted to SA EPA.

This assessment aims to address the relevant requirements of compliance action 52 by evaluating reductions in particulate dust emissions and impacts achieved through EIP actions implemented to date at the Facility, where quantifiable, using results from the updated emissions inventory and dispersion modelling presented in Katestone Report D22081-3 alongside Katestone's previous work.

2. INITIAL SCREENING OF EIP PROJECTS

Projects 1 through to 13 of the EIP pertain to actions relevant to air quality, designed to reduce particulate dust emissions from the Facility. Not all 13 projects are able to be evaluated in this assessment, for a variety of reasons. Table 1 presents an initial screening of all 13 EIP projects pertaining to air quality, with commentary on each detailing whether assessment of emissions reductions can or cannot be made.

Table 1 Initial screening of EIP projects at the Facility pertaining to air quality

EIP Project	Category	Project	Status	Included in assessment?	Comments
1	Fugitive dust – Stockpile emission reduction	Relocate bauxite stockpile and cover with Geofabric	Complete	✘	Geofabric no longer in use ¹
2	Fugitive dust – Stockpile emission reduction	Wind curtain - limestone stockpile	Complete	✓	Emissions reduction assessable
3	Fugitive dust – Stockpile emission reduction	Geofabric - limestone stockpile	Complete	✘	Geofabric no longer in use ²
4	Fugitive dust – transfer operation	MM Wheel wash system	Cancelled	✘	Project no longer required
5	Fugitive dust - conveyors	CS2, CR2, CR3 wind shielding	Complete	✘	Emissions reduction not robustly quantifiable
6	Fugitive dust – storage/processing buildings	CM6, CF6, Clinker transfer point dust collector	Complete	✘	Emissions reduction not robustly quantifiable
7	Fugitive dust – storage/processing buildings	CM6 clinker gantry entry air knives	Complete	✘	Emissions reduction not robustly quantifiable
8	Fugitive dust – dust collectors	CM1 dust collector – redirect outlet	Complete	✓	Emissions reduction assessable
9	Fugitive dust – sealing exposed unsealed surfaces	Seal area – north of reclaimer shed	Complete	✓	Emissions reduction assessable
10	Fugitive dust – sealing exposed unsealed surfaces	Seal area – north of kiln	Not Complete	✘	Sealing of the area north of the kiln is dependent on completion of a separate non EIP project which may not now be progressed. An alternative area south of 4A ESP is now proposed to be sealed instead by 31 December 2023
11	Fugitive dust – sealing exposed unsealed surfaces	Seal contractor compound (area far north of kiln)	Not Complete	✘	Sealing this area was dependent on completion of a separate project which may not now be progressed.

EIP Project	Category	Project	Status	Included in assessment?	Comments
					Refer to EIP Project number 10 for alternative proposed area to be sealed.
12	Fugitive dust – storage/processing buildings	CM6 cladding	Not Complete	x	Time frame for completion of this EIP is to be amended to 31 December 2023 as a shutdown of CM6 is required for implementation of this EIP.
13	Fugitive dust – storage/processing buildings	CM6 gantry cladding	Complete	x	Emissions reduction not robustly quantifiable

Table notes:

¹ Geofabric covers were applied as intended under EIP project 1, however, due to safety concerns relating to their application/removal (principally wind-related) they are not currently in use and ABC does not intend to resume their use. Chemical dust suppression is applied to the stockpile surfaces as a dust control measure.

² As the stockpile is dynamic, geofabric covers can only be applied to inactive non-working areas of the stockpile that have been completed, and due to the nature of the stockpile build, the effective coverage time is limited. The same safety concerns as described above also apply, thus the geofabric covers are not currently in use and ABC does not intend to resume their use. Chemical dust suppression and watering are applied to the stockpile surfaces as dust control measures.

3. EMISSIONS REDUCTION ASSESSMENT

This section details the assessments undertaken to determine reductions in dust emissions and subsequent reductions in PM₁₀ concentrations in the community due to the assessable EIP projects implemented at the Facility.

3.1 EIP Project 2 – Windbreak curtain

EIP Project 2 involved the installation of a portable wind curtain on the eastern side of the limestone stockpile at the 'Shell Block' area of the Facility. The porous mesh curtain is 6 m high and spans a length of 50 m. The purpose of the curtain is to act as a windbreak, slowing wind speed over the stockpile and thus minimising dust lift-off and transport.

The curtain was designed such that it would reduce wind speed at the active working face of the stockpile, whilst the inactive area of the stockpile would be covered by geofabric to further minimise wind erosion of the stockpile (EIP Project 3). However, Katestone understands that the geofabric covers are not used at the Facility due to safety issues. This has been accounted for in the assessment of dust emission reduction, with a 30% control factor for a wind break curtain applied only to areas behind the 50 m length of the curtain, and no further control factor applied. The assessment has considered the effect of this additional control under two potential scenarios; one where the full 50 m length of the windbreak curtain is adjacent to limestone stockpile and one where there is no stockpile behind the windbreak curtain, just an exposed unsealed surface. This provides a realistic range of potential reductions from the windbreak curtain.

The analysis indicates that when the full 50 m length of the windbreak curtain is adjacent to limestone stockpile, it is:

- predicted to reduce emissions of PM₁₀ by 101.4 kg/year
- predicted to reduce the maximum 24-hour average contribution of this source to concentrations of PM₁₀ at the Community Park monitor by 0.32 µg/m³.

If the area behind the windbreak curtain is entirely exposed unsealed surface, it is:

- predicted to reduce emissions of PM₁₀ by 16.8 kg/year
- predicted to reduce the maximum 24-hour average contribution of this source to concentrations of PM₁₀ at the Community Park monitor by 0.07 µg/m³.

3.2 EIP Project 8 – Redirection of CM1 dust collector outlet

Previously a horizontal release point, the Cement Mill 1 (CM1) dust collector has been reconfigured to have a vertical release above the height of the CM1 building as part of EIP Project 8. Vertical discharge increases the initial dispersion of pollutants, as atmospheric mixing will affect a greater proportion of the upward plume. This increased initial dispersion thus results in lower ground-level concentrations of pollutants.

The CM1 dust collector was modelled as having both a horizontal and vertical release, with results at the Community Park receptor compared between the two configurations to determine the reduction that EIP Project 8 will have resulted in.

The analysis indicates that redirecting the CM1 outlet is predicted to have reduced maximum 24-hour average concentrations of PM₁₀ at Community Park by 0.26 µg/m³.

3.3 EIP Project 9 – Sealing area north of reclaimer shed

EIP Project 9 comprised of paving 1,200 m² of unsealed surface area north of the reclaimer shed with bitumen. Sealing the exposed surface effectively eliminates the potential for dust generation from wind erosion, provided that the sealed surface is regularly cleaned and maintained appropriately.

Due to the distance and direction relative to the Community Park monitor, reductions in ground-level concentrations as a result of EIP Project 9 are very small there. Hence, impact reductions due to EIP Project 9 have been quantified at the nearest residences, which are ~60 m west of the source.

The exposed area north of the reclaimer shed has not been modelled as a source. Instead, results from a discrete receptor ~60 m west of a modelled exposed area source elsewhere within the Facility have been extracted and scaled by the size ratio between the modelled source and the 1,200 m² area north of the reclaimer shed.

The analysis indicates that sealing the exposed area north of the reclaimer shed is:

- Predicted to have reduced emissions of PM₁₀ by 51 kg/year
- Predicted to have reduced the maximum 24-hour average contribution of this source to concentrations of PM₁₀ at the nearest residential receptor by 1.95 µg/m³.

3.4 Additional assessment – Sealing area south of clinker blend building

An additional assessment has been undertaken for the area south of the clinker blend building, which was sealed in 2017 but is/was not a formal EIP Project. Figure 1 shows the area prior to and after sealing. The entire unsealed area south of the clinker blend building from the picture on the left was modelled as an exposed area in Katestone's D16076-16 report, while the smaller unsealed area from the picture on the right was modelled in Katestone's D22081-3 report.



Figure 1 Area south of clinker blend building before (left) and after (right) sealing

Results from Katestone's D22081-3 report were scaled up to the original exposed area, with the difference between the scaled-up emissions/impacts of the larger unsealed area and the modelled emissions/impacts of the smaller unsealed area taken to quantify the emissions reduction due to sealing part of the exposed area.

Due to the distance and direction relative to the Community Park monitor, reductions in ground-level concentrations as a result of sealing this area are very small there. Hence, impact reductions have been quantified using maximum concentrations within receptor zones used in the D22081-3 report.

The analysis indicates that sealing the exposed area south of the Clinker 13 building is:

- Predicted to have reduced emissions of PM₁₀ by 39.5 kg/year
- Predicted to have reduced the maximum 24-hour average contribution of this source to concentrations of PM₁₀ within a receptor zone by 0.53 µg/m³. However, this reduction occurs in the Port Adelaide receptor zone to the east, which does not actually contain sensitive receptors directly east of the Facility
- Predicted to have reduced the maximum 24-hour average contribution of this source to concentrations of PM₁₀ within a receptor zone to the west of the Facility by 0.16 µg/m³.



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Adelaide Brighton Cement Ltd

Birkenhead Plant Noise Survey – May 2020

Acoustic Report





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1 INTRODUCTION

Vipac Engineers & Scientists (Vipac) were engaged by Adelaide Brighton Cement Limited (ABC) to undertake an on-site noise measurement survey of selected plant (plant upgraded or refurbished since previous noise survey in April 2019), environmental noise survey at residential locations within proximity of the ABC Birkenhead plant during typical operations and update the computer noise model (SoundPLAN model) for the plant based on the survey results. The noise survey (off-site and on-site) was conducted on Monday, 04 May 2020 between 12:00PM and 02:30AM the following day.

This report provides details of the results of the on-site and off-site attended noise survey, details of the noise model update and comparison of the results of the noise survey and the updated noise model predictions against the three most recent previous surveys.

2 REFERENCES

- [1] Vipac report 50B-18-0036-TRP-8950467-0 “Attended Noise Survey April 2019”, dated 16 April 2019.
- [2] Vipac report 50B-18-0036-TRP-805659-2 “Attended Noise Survey June 2018”, dated 10 August 2018.
- [3] Vipac report 50B-18-0036-TRP-6755126-2 “Birkenhead Environmental Noise–Noise Model Update and Abatement Options”, dated 27 February 2019.
- [4] Environment Protection Act 1993, Government of South Australia (1995).
- [5] Licence No. 1126 Adelaide Brighton Cement Limited (issued 01 November 2017), Environment Protection Authority
- [6] Environment Protection (Noise) Policy 2007, Government of South Australia (2008).
- [7] Guidelines for the Use of the Environment Protection (Noise) Policy 2007, Environment Protection Authority (SA) (2009).
- [8] AS 1055.1-1997 Acoustics – Description and measurement of environmental noise – Part 1: General procedures, Standards Australia (1997).
- [9] Port Adelaide Enfield Council Development Plan (consolidated 30 April 2020), Department of Planning, Transport and Infrastructure (DPTI).
- [10] Australian Standard AS IEC 61672.1-2004 Electroacoustics – Sound level meters Specifications, Standards Australia (2004).
- [11] Sonus Report S4682.1C3 “Adelaide Brighton Cement Birkenhead – Plant Shutdown Noise Measurements”, January 2020.

3 BACKGROUND

Adelaide Brighton Cement’s Birkenhead operations are licensed by the EPA for conduct of an activity identified in Schedule 1 of the *Environment Protection Act 1993* [4]. Condition U-787 of ABC’s EPA License for the Birkenhead site [5] relates to noise. Specifically, ABC is required to develop and implement a noise management plan for the site. Regular attended noise monitoring surveys, development of a computer noise model for the site, and identification and implementation of noise abatement projects form part of the noise management plan.

ABC, therefore, have engaged Vipac to conduct annual attended noise monitoring surveys (day and night time) in the community surrounding the plant and within the plant for selected equipment/machinery refurbished or upgraded in the preceding year, and to annually update a computer noise model for the site (most recently updated in February 2019 [3]).

This report provides details of the noise surveys, detailed computer noise model review, and provides a comparison of the predicted and measured noise levels against the historical data.

4 ASSESSMENT CRITERIA

4.1 ENVIRONMENT PROTECTION (NOISE) POLICY 2007

Noise from industrial activities (such as those conducted at the ABC Birkenhead site) is subject to the provisions of the *Environment Protection (Noise) Policy 2007* (Noise EPP) [6]. The Noise EPP outlines Noise Goals which provide one method for demonstrating compliance with the General Environmental Duty under Section 25 of the *Environment Protection Act 1993* (the Act) [4]. Compliance with the Noise Goals may be achieved by demonstrating compliance with the Indicative Noise Levels (INLs) applicable to the site, as determined in accordance with Clause 5 of the Noise EPP and the relevant council Development Plan provisions.

Indicative Noise Levels have been calculated in accordance with the procedure outlined in Clause 5 of the Noise EPP and the relevant provisions of the Port Adelaide Enfield Council Development Plan (consolidated 30 April 2020) [9]. With reference to the Development Plan, the site is located partially within the “Industry” zone, and partially within the “Light Industry” zone (no policy areas or precincts apply to either locality). The nearest noise sensitive receptors (NSRs) are located within Policy Areas 57 and 65 of the “Residential” zone.

In accordance with the Development Plan, the “Industry” zone primarily accommodates industrial, warehouse, storage and transport land uses, and the “Light Industry” zone promotes light industry, service industry, storage and warehouse land uses. With reference to the *Guidelines for the Use of the Environment Protection (Noise) Policy 2007* [7], it is therefore considered that the “Industry” zone principally promotes the “General Industry” Land Use Category as set out in Table 2 of the Noise EPP, while the “Light Industry” zone principally promotes the “Light Industry” Land Use Category. With reference to the relevant development plan provisions, it is considered that the “Residential” zone (and associated policy areas 57 and 65) principally promote the “Residential” land use category.

As such, the following Indicative Noise Levels (INLs) apply to ABC’s operations:

Table 1 – Indicative Noise Levels

Zone	Indicative Noise Levels (L _{eq} , dB(A))	
	Day-time (7am to 10pm)	Night-time (10pm to 7am)
Residential Zone <i>(Policy Area 57 – Le Fevre Peninsula East)</i>	57	49
Residential Zone <i>(Policy Area 65 – Restricted Residential)</i>	57	49

The above criteria have been updated to reflect the current zoning outlined in the current Port Adelaide Enfield Council Development Plan [9].

NOTE: The Environment Protection Authority (EPA) has advised that comparison of the L_{A90} noise level descriptor measured within 100 metres of the centre line of Victoria Road with the above Indicative Noise Levels is an acceptable method for eliminating the influence of short-term/transient noise level events (such as intermittent passing road traffic, for example) on the results. This includes measurement positions N1, R2, R10, R12, R15 and R16. At distances greater than 100 metres, the use of the L_{Aeq} descriptor is required.

4.2 ADJUSTMENT FOR CHARACTERISTICS

For a noise containing a characteristic (tonal, impulsive, low frequency or modulating), the following adjustments are to be made to the source noise level:

- Noise containing 1 characteristic; a 5dB(A) penalty must be added to the noise level (continuous),
- Noise containing 2 characteristics; an 8dB(A) penalty must be added to the noise level (continuous),
- Noise containing 3 or 4 characteristics, a 10dB(A) penalty must be added to the noise level (continuous).

5 NOISE SURVEY DETAILS

5.1 OFF-SITE ENVIRONMENTAL NOISE SURVEY

5.1.1 SURVEY METHODOLOGY

All measurements were conducted in accordance with the requirements of the *Environment Protection (Noise) Policy 2007* [6], with guidance from the *Guidelines for the Use of the Environment Protection (Noise) Policy 2007* [7] and AS 1055.1-1997 [8].

The attended noise survey was conducted on 04 May 2020 between 12:00PM and 02:30AM the following day. The measurements were conducted during EPA defined day-time and night-time period, to measure the noise impact to the nearest noise sensitive receivers due to the plant operation. Following methodology and equipment were used to conduct the survey:

- Measurements using the noise descriptors L_{Aeq} and L_{A90} were taken for a period of 15 minutes at each receiver location.
- Where possible, measurements were paused to avoid influence from the extraneous sources (such as traffic, etc.).
- Where heavy traffic were observed (near or on Victoria Road), Vipac has provided comments to reflect the noise influence.

5.1.2 SURVEY EQUIPMENT

The following equipment were used to conduct the off-site noise survey. Please note that the sound level meters satisfies the requirements of AS IEC 61672.1-2004 [10].

- Equipment 1:
 - Model – Brüel & Kjær Type 2250 Class 1 sound level meter.
 - Serial number – 3002257
 - Calibration – Due for calibration on February 2022
 - Spot calibration check – The calibration of the sound level meter was checked before and after measurements and no drift in sensitivity was detected.
- Equipment 2:
 - Model – Brüel & Kjær Type 2250 Class 1 sound level meter.
 - Serial number – 3002841
 - Calibration – Due for calibration on May 2022
 - Spot calibration check – The calibration of the sound level meter was checked before and after measurements and no drift in sensitivity was detected.

5.1.3 OFF-SITE SURVEY LOCATIONS

Monitoring locations for both the day-time and night-time surveys were consistent with the previous attended measurement surveys, including the most recent survey conducted in June 2018 [1]. The monitoring locations are summarised in Table 2, with an overview of the monitoring locations provided in Figure 1.

Table 2: Summary of off-site attended measurement locations

Measurement Location	Location Address/ Description
R2	Corner of Alfred St and Hargrave St, Peterhead
R3	Adjacent to 145 Hargrave St, Peterhead (facing Fletcher Rd)
R4	Corner of Robert St and Hargrave St, Birkenhead
R5	Adjacent to 23 Levi St, Birkenhead
R6	Adjacent to 19 Craigie St, Birkenhead
R8	Adjacent to 39 Mary St, Peterhead
R9	Corner of Wills St and Whyte St, Peterhead
R10	Corner of Olive St and Victoria Rd, Largs Bay
R11	Adjacent to 158 Fletcher Rd, Largs Bay (facing east along Olive St)
R12	Adjacent to 33 Hilton St, Birkenhead
R13	Adjacent to 28 Whyte St, Peterhead (facing east down Matilda St)
R14	Adjacent to 15 Waverley St, Largs Bay
R15	Adjacent to 9 Walton St, Peterhead
R16	Adjacent to 77 Victoria Rd, Birkenhead
R17	Corner of Fletcher Rd and Rose St, Birkenhead (adjacent to 53 Fletcher Rd)
R18	Adjacent to 20 Fletcher Rd, Birkenhead (In the park)
N1	Corner of Gunn St and Well St, Birkenhead (adjacent to 39 Well St)
N2	Adjacent to 9 Mary St, Peterhead
N3	Corner of Walton St and Mary St, Peterhead (adjacent to 23 Mary St)



Figure 1: Overview of attended monitoring locations

5.2 ON-SITE NOISE SURVEY

5.2.1 SURVEY METHODOLOGY

An attended noise survey of selected plant on-site was conducted to obtain updated noise measurement data for items of plant which were serviced, refurbished or upgraded since the previous noise survey and computer noise model update. As identified by ABC, the plant/equipment serviced in the preceding year with upgrades/changes are listed in Table 3 below.

Table 3: EIP Projects undertaken since previous noise survey

Plant/Equipment	Environmental Improvement Programme (EIP) Number	Upgrade/Abatement Works	Time
CM1/CM7 Clinker Gantry Dust Collector Fans	EIP Project 14	New discharge silencers installed to the fans	January 2020
Gas Train	EIP Project 15	Upgrade works to the gas train assembly by APA group	February 2020
Kiln Feed Elevator Gear Box	EIP Project 16	Noisy gearbox replaced and cladding to the western end reinstalled	April 2019
CM1 Dust Collector Fan	EIP Project 8	Discharge ducting redirected from horizontal discharge to vertical	February 2020
Kiln Refractory	-	Installation of temporary noise barrier to reduce noise impact due to activities associated with Kiln Refractory demolition. Barrier installed in accordance with Sonus Report S4682.1C3 [11]	January 2020

Noise measurements were conducted generally at a distance of 1-5 metres from the subject plant. Where possible, measurements were conducted at the same position as during previous surveys [1].

5.2.2 SURVEY EQUIPMENT

The following equipment were used to conduct the on-site noise survey. Please note that the sound level meters satisfies the requirements of AS IEC 61672.1-2004 [10].

- Equipment Details
 - Model – Brüel & Kjær Type 2250 Class 1 sound level meter.
 - Serial number – 3002257
 - Calibration – Due for calibration on February 2022
 - Spot calibration check – The calibration of the sound level meter was checked before and after measurements and no drift in sensitivity was detected.

5.3 SURVEY WEATHER CONDITIONS

Temperatures ranging between 11 – 17 degrees Celsius were observed throughout the survey, with wind speeds of between 0 – 5.4m/s observed during the noise survey. No rainfall was observed. The meteorological data is presented in Appendix D.

6 NOISE MODELLING

Based on the results of the attended noise monitoring survey (on-site and off-site), and the plant data provided by ABC, the existing noise model for the Birkenhead plant was significantly updated. Noise level predictions for each of the annual off-site attended measurement survey positions were generated, along with noise contour plots for “neutral” and “worst case” weather conditions. Dominant noise sources were identified for each survey position (where possible), and the effect of significantly reducing or eliminating the noise source was then investigated. Details of the updated noise model, and the methodology followed in constructing the noise model and generating predictions are presented below.

6.1 MODELLING ASSUMPTIONS

The following assumptions were relied upon in developing the 3D computer noise model (using SoundPLAN software) for the Birkenhead cement plant:

- The ground areas within and surrounding the ABC Birkenhead plant were assumed to be flat terrain.
- Ground absorption within the Birkenhead site was assumed to be fully reflective (based on on-site observations and Vipac’s previously validated predictive noise model of the Birkenhead cement plant).
- Ground absorption outside of the site was assumed to be partially reflective grass terrain, with the exception of roads and other reflective surfaces which were assumed to be fully reflective.
- The heights and location of buildings and other on-site structures were generally based on the information provided by ABC (plant geometry provided in dxf format on 08 November 2018) and on-site observations.
- All doors and openings closed during operations.
- Traffic noise and other noise sources not included.

6.2 INPUT DATA

Sound power levels for each noise source were calibrated based on on-site survey data conducted on 04 May 2020. Please note that source noise levels for plant equipment refurbished/upgraded were measured during the site survey. As such, computer noise model was only updated with the noise measurements for the

upgraded plant (refer Table 3), whereas, for the remaining sources the sound power level was based on previous data.

Details of all noise sources included in the model, their sound power level, and position within the plant (including measurement position) are provided in Appendix B.

6.3 MODELLING SCENARIOS

Noise predictions were generated for “neutral” and “worst-case” meteorological conditions corresponding to the recommended conditions detailed in the *Guidelines for the Use of the Environment Protection (Noise) Policy 2007* [7] for each of the above modelling scenarios. In accordance with standard practice, noise predictions were also generated for the existing situation using weather conditions corresponding to the 04 May 2020 attended measurement survey (average wind speed of 2m/s) for the purposes of calibration of the updated noise model against the survey results.

6.4 CALIBRATION

As discussed above, noise model calibration was carried out against the results of Vipac’s most recent noise monitoring survey. Noise level predictions at each standard receiver position (R1-R18, N1-N3) were generated for the current situation using meteorological conditions corresponding to the 04 May 2020 night-time attended measurement survey (average wind speed of 2m/s), with the results compared against the noise levels measured at the relevant location during the survey. Meteorological conditions were based on a combination of on-site observations (for wind speed and direction), and Bureau of Meteorology (BoM) data for other parameters (temperature, pressure and humidity).

A comparison of the predicted noise levels from the computer noise model and the attended off-site survey has been discussed in Section 7.3.2 below. The predicted results show good agreement with measured noise levels.

7 ASSESSMENT RESULTS & DISCUSSION

7.1 OFF-SITE ENVIRONMENTAL NOISE SURVEY

The off-site noise survey results for day-time and night-time period are presented in Appendix A, with results discussion and comparison against historical data discussed below. As discussed in Section 4.1 above, for measurement positions within 100 metres of the centreline of Victoria Road the L_{A90} descriptor has been used to eliminate the influence of short-term transient noise sources (such as passing road traffic) from the results. For each measurement position, the descriptor used for comparison with the noise goal is indicated by bold text and shading in the results table in Appendix A.

7.1.1 DAY-TIME

The day-time attended survey was conducted between 12:15PM and 14:15PM on Monday, 04 May 2020, with following conditions observed during the survey:

- Temperatures ranging between 16 – 17 degrees Celsius were observed throughout the survey period.
- Wind speeds of between 0 – 4.5m/s observed during the noise survey.
- No rainfall was observed.

The results of the day-time survey are provided in Appendix A.

Both the L_{Aeq} and L_{A90} noise levels met the day-time criterion for all measurement locations, with the exception of the following (the descriptor used for comparison with the noise goal is indicated by bold text and shading).

Table 4: Day-time survey exceedances

Location	L_{Aeq} , [dB(A)]	L_{A90} , [dB(A)]	Criterion [dB(A)]	Exceedance [dB(A)]
R3	58	44	57	1
R9	58	37	57	1
R10	72	59	57	2
R11	59	39	57	2
R16	76	61	57	4
R17	65	42	57	8
R18	61	42	57	4

Receivers R3, R9, R10 and R11 show minor exceedance, which are influenced by the road traffic noise, with frequent vehicles pass-by on Fletcher Road, Victoria Road and Hargrave Street contributing significantly to noise levels. The measurements at R11 were also influenced by the continuous construction noise from a nearby residential property.

The exceedance at location R16 resulted due to continuous traffic movements (heavy traffic with frequent truck pass-by) along Victoria Road. The measured noise levels at R17 were heavily influenced by frequent dog barking in the nearby property and traffic movements along Fletcher Road. Measured levels at R18 were affected by the continuous noise from the nearby playground (group of children playing) and traffic noise from Fletcher Road. Please note that due to the extraneous noise influence, the plant was inaudible at R17 and R18.

Notwithstanding, the L_{A90} noise levels at R3, R9, R11, R17 and R18 comfortably met the day-time noise goal.

7.1.2 NIGHT-TIME

The night-time survey was conducted between 10:15PM on Monday, 04 May 2020, and 2:30AM on Tuesday, 05 May 2020, with following conditions observed during the survey:

- Temperatures between 7 – 10 degrees were observed throughout the survey period.
- Wind speeds between approximately 1 – 3.1m/s observed over the course of the survey.
- No rainfall was observed.

The results of the night-time survey are provided in Appendix A.

Both the L_{Aeq} and L_{A90} noise levels met the day-time criterion for all measurement locations, with the exception of the following (the descriptor used for comparison with the noise goal is indicated by bold text and shading).

Table 5: Night-time survey exceedances

Location	L_{Aeq} , [dB(A)]	L_{A90} , [dB(A)]	Criterion [dB(A)]	Exceedance [dB(A)]
R2	56	54	49	5
R3	52	49	49	3
R4	51	44	49	2
R5	54	52	49	5
R12	56	54	49	5
R15	56	53	49	4
R16	58	55	49	6
R17	50	45	49	1
R18	50	46	49	1
N2	52	49	49	3
N3	53	50	49	4

The exceedance at R2, R3, R4, R5, R15, R17, N2 and N3 were mostly associated with traffic noise influence from nearby road (Victoria Road and Fletcher Road). However, during the measurement period, an intermittent screeching noise (possibly from drag chain conveyor) was clearly audible and contributed to the overall measured levels. Please note that the screeching noise was also observed within the plant while on-site noise survey. ABC advised that the noise was an unusual occurrence and was later rectified after the survey (further discussed in Section 8). As such, Vipac notes that the distinctive screeching noise stopped after 11:45PM and therefore, for all the measurements conducted after 11:45PM, the screeching noise was not observed.

The measured noise levels at R12, R16 and R18 were influenced by traffic noise from Victoria Road and Fletcher Road. The plant was clearly audible at all of the locations, however, the distinctive screeching noise was only audible at R15.

In addition to above, Vipac notes that contributions from distant traffic noise and potentially other industrial sites to the east were also noted in a number of measurements, which may have increased the measured noise levels. This is particularly relevant considering that wind conditions favourable to noise propagation

(slight easterly breeze) were present during the night-time survey, which may have increased the contribution of these sources to measured noise levels. As such, the noise levels measured during the night-time survey are likely to be representative of worst case noise emissions from the plant, and are useful for validation of future computer noise model predictions for the plant. Weather conditions are discussed further below.

Notwithstanding, the L_{A90} noise levels at R3, R4, R17, R18 and N2 met the night-time noise goal.

7.1.3 RESULT COMPARISON WITH PREVIOUS SURVEYS

The L_{A90} noise levels measured during the 2020 attended measurement survey were compared against the noise levels measured during the two most recent attended measurement surveys (2019 [1] and 2018 [2]). Similar to our previous surveys, the L_{A90} descriptor was considered to provide a more meaningful comparison between measurement surveys as it is less susceptible to the influence of extraneous transient noise sources. Table 6 and Table 7 show the comparison between the 2020 survey and preceding year results.

Table 6: Day-Time Survey Results Comparison

Receiver Location	Day-Time L_{A90} Noise Level (dB(A))				
	Criterion	2018	2019	2020	Difference (2019/2020)
R2	57	54	53	53	0
R3	57	47	45	44	-1
R4	57	39	34	38	+4
R5	57	49	48	49	+1
R6	57	37	35	38	+3
R8	57	46	48	41	-7
R9	57	37	38	37	-1
R10	57	-	56	59	+3
R11	57	38	41	39	-2
R12	57	50	52	53	+1
R13	57	40	36	36	0
R14	57	36	39	36	-3
R15	57	52	53	50	-3
R16	57	-	62	61	-1
R17	57	42	37	42	+5
R18	57	38	38	42	+4
N1	57	46	47	47	0
N2	57	47	44	42	-2
N3	57	48	50	44	-6

Table 7: Night-Time Survey Results Comparison

Receiver Location	Night-Time L _{A90} Noise Level (dB(A))				
	Criterion	2018	2019	2020	Difference (2019/2020)
R2	49	55	54	54	0
R3	49	48	48	49	+1
R4	49	43	41	44	+3
R5	49	51	50	52	+2
R6	49	44	46	46	0
R8	49	47	48	47	-1
R9	49	40	41	42	+1
R10	49	49	47	47	0
R11	49	39	41	39	-2
R12	49	51	52	54	+2
R13	49	43	43	43	0
R14	49	40	41	42	+1
R15	49	53	53	53	0
R16	49	54	56	55	-1
R17	49	43	43	45	+2
R18	49	41	43	46	+3
N1	49	48	48	49	+1
N2	49	50	48	49	+1
N3	49	51	50	50	0

Noise levels were observed to decrease at a number of locations, however; a number of increases were also observed. The discrepancies may be attributed to a number of factors, such as:

- The day of the week and time of day that the measurement was conducted,
- Extraneous noise sources present during the measurement,
- Weather conditions during the measurement (such as temperature, humidity, wind speed and wind direction); and,
- Specific site operations during the measurement.

As discussed above, the day-time noise measurements were heavily influenced by road traffic noise and other activities around the measurement locations (such as children playing in the playground, construction noise, resident noise, etc.). Hence, Vipac considers the night-time measurements provide appropriate comparison to the historical data.

In terms of human response to change in noise levels, a 3 dB(A) increase in sound pressure level is just perceptible to the average human ear to notice a change, a 5 dB(A) increase is quite noticeable and a 10 dB(A) increase is typically perceived as a doubling in loudness. As such, based on the results presented above, despite noise levels at some positions increasing compared with the 2019 survey, night-time measured noise level differences at most of the locations are below 3 dB(A), except at location R4 and R18. Measurement positions R4 and R18, where the noise levels were observed to have increased are located further from the plant, and as such are susceptible to increased influence from extraneous noise sources.

The night-time noise measurements at receivers other than R4 and R18 showing exceedance compared to 2019 data were influenced by the traffic movements (Victoria Road and Fletcher Road) and the distinctive screeching noise from the plant. As advised by ABC the screeching noise was later rectified and therefore, it is expected that the actual incident noise levels due to the plant operation at these receivers would be lower than the measured levels presented above.

7.1.4 INFLUENCE OF EXTRANEOUS NOISE SOURCES

With reference to the survey results and our previous surveys, the L_{A90} noise levels were found to be a better descriptor of the plant noise emissions, which is expected due to the steady-state nature of the majority of the noise emitted by the plant. However, Vipac notes that frequent traffic noise from nearby roads and noise from other industrial properties (particularly at night when weather conditions were more favourable to noise propagation from distant sources) may have also contributed to the background noise level. As such, the measured L_{A90} background noise levels during the survey may be considered to represent a slight over-estimate of the noise level contributed by the ABC plant to the measured noise levels.

Irrespective of the noise conditions during the measurement, the L_{A90} noise levels are considered to be a better estimate of noise emissions than the L_{Aeq} noise levels for ABC's operations. As discussed above, the Environment Protection Authority (EPA) has advised that the L_{A90} descriptor may be used only for locations in close proximity to Victoria Road (within 100 metres of the centreline of the road), which includes measurement positions N1, R2, R10, R12, R15 and R16.

Even though care was taken to minimise the influence of extraneous noise sources (such as passing vehicles, and traffic on nearby major roads) by pausing the sound level meter and erasing the extraneous noise influence (by using back erase function in B&K Sound Level Meter), it was not possible to entirely remove the influence of these noise sources. In particular, high volumes of road traffic on Victoria Road influenced the measurements at locations R10 and R16 to such a degree that road traffic noise is overwhelmingly the dominant noise source at these positions. As such, the results presented in Appendix A for these measurement locations provide a representation of the traffic noise impact at these locations, and are not reflective of noise emissions from the ABC site.

Due to the lower traffic volume at night, better quality measurements were obtained at R10 and R16 during the night-time survey, and the measured L_{A90} noise levels at these locations provide a reasonable estimate of worst-case noise emissions at these locations. Similarly, frequent vehicle movements on Fletcher Road made measurements at locations R3, R11, R17 and R18 difficult, particularly during the day-time survey.

As such, due to the influence of extraneous noise sources in the measured levels, the results do not necessarily reflect an exceedance of the noise criteria due to ABC operations alone and essentially provide an upper limit to the noise levels that may be contributed by ABC's operations.

7.2 ON-SITE NOISE SURVEY

An attended noise survey of selected plant on-site was conducted to obtain updated noise measurement data for items of plant which were serviced, refurbished or upgraded since the previous noise survey. The results of the survey are presented in Table 8 below, along with the corresponding results from the most recent previous survey.

Table 8: EIP Projects undertaken since previous noise survey

Plant/Equipment	EIP Number	Measurement Position & Distance	Measured Sound Pressure Level, dB(A)			Notes
			2020 Survey	2019 Survey	2018 Survey	
CM1/CM7 Clinker Gantry Dust Collector Fans	EIP Project 14	15 metres	66	71	71	Note 1
Gas Train	EIP Project 15	1 metre from north end of the enclosure	60	67	73	Note 2
Kiln Feed Elevator Drive (Top of 4B Tower)	EIP Project 16	1 metre from the motor/gearbox on top of 4B tower	89	100	-	Note 3
CM1 Dust Collector Fan (DC 26)	EIP Project 8	12 metres approximately	79	80	-	Note 4

Based on the results presented above, Vipac comments as follows:

- Note 1 – Vipac notes that a significant reduction (5 dB(A)) in the noise emissions from the Clinker dust collector fans was observed. As expected, the installation of attenuators to the discharge point, reduced the noise emissions.
- Note 2 – A reduction of 7 dB(A) was observed when compared to 2019 survey results. In addition to the reduction of overall noise levels, the tonal components observed during 2019 survey were no longer observed in the measured levels.
- Note 3 – A significant reduction (11 dB(A)) in the noise emanating from the 4A elevator drive on top of 4B tower. No tonal components were observed from the elevator drive. However, Vipac believes that structure borne noise due to vibrations from the system contributed to the measured noise levels, which was observed during the survey (the support structure and the platform was vibrating).
- Note 4 – During 2019 survey, this measurement was conducted at 1.5m from the discharge point. However, since the last survey, discharge point has been reoriented from horizontal to vertical discharge. Hence, a measurement at 1.5m was not possible during this survey. As such, the 2019 survey values have been readjusted for 12m distance for consistency. The results indicate a reduction of 1dB(A). Vipac notes that the reduction of 1dB(A) is insignificant and would result in no change in incident noise levels at noise sensitive receivers.

Whilst not intended as a noise reduction project, changing the discharge directivity from east to vertical (with increase in height) had no significant impact on the noise sensitive receivers. However, a significant reduction in noise levels on the ground level on the eastern side of CM1 building was observed (also observed by ABC operators). As such, Vipac measured noise levels of 74dB(A) averaged over the entire eastern façade of the building, which was 3dB(A) lower than the noise levels measured during the November 2019 survey (77dB(A) averaged over the entire eastern façade of the building) [3].

7.3 COMPUTER NOISE MODEL

7.3.1 NOISE LEVEL PREDICTIONS

The computer noise model representing the current operations of the ABC Birkenhead plant predicts the incident noise levels at each noise sensitive receiver location used for the attended noise survey during day-time and night-time period, as highlighted in Figure 1 and Table 2 above. The model predicted noise levels for “neutral” and “worst case” meteorological conditions (as discussed above). The predicted noise levels are presented in Table 9 below. For comparison, the noise level predictions for each location prior to updating the model are also presented (as detailed in Vipac’s previous report [3]). At some locations, predicted noise levels generated by the updated noise model differed from the previous noise model by up to 3dB(A). This is due to an emphasis on ensuring that predicted noise levels match measured noise levels as accurately as possible (as discussed in the preceding section), particularly those closer to the plant where measured noise levels are less influenced by extraneous noise sources. Updated plant geometry and directivity patterns of noise sources having been updated to better match with real-world conditions has also contributed to a discrepancy between previous noise level predictions and those generated by the updated noise model.

Table 9: Computer Noise Modelling (SoundPLAN) Results

Receiver ID	Night-Time Criterion	Neutral Weather Conditions (CONCAWE Category 4) dB(A)			Worst- Case Weather Conditions (CONCAWE Category 6) dB(A)		
		2020 Model Results (Updated)	2019 Model Results (Previous)	Difference	2020 Model Results (Updated)	2019 Model Results (Previous)	Difference
R2	49	51	54	-3	53	56	-3
R3	49	43	43	0	45	45	0
R4	49	38	38	0	41	41	0
R5	49	50	51	-1	52	53	-1
R6	49	40	41	-1	43	43	0
R8	49	44	45	-1	46	47	-1
R9	49	37	37	0	40	40	0
R10	49	46	46	0	50	50	0
R11	49	38	39	-1	41	41	0
R12	49	49	50	-1	53	53	0
R13	49	39	39	0	42	42	0
R14	49	36	37	-1	39	40	-1
R15	49	50	50	0	51	52	-1
R16	49	51	51	0	53	53	0
R17	49	40	41	-1	43	43	0
R18	49	38	39	-1	40	41	-1
N1	49	47	47	0	48	49	-1
N2	49	46	47	-1	48	50	-2
N3	49	47	48	-1	49	50	-1

Note: Corresponding noise contour maps are provided in Appendix C.

During the previous (2019) noise model update, Vipac provided noise predictions considering certain noise abatement projects (CM1/CM7 Clinker Gantry fans, Gas Train and 4A Kiln Feed Elevator Drive Gearbox). As such, Table 10 below provides a further comparison of the updated noise model predictions against the results predicted with noise abatement projects in place in our previous (2019) model update [3].

Table 10: Noise Model Results Comparison

Receiver	Worst- Case Weather Conditions (CONCAWE Category 6) dB(A)		
	2020 Model Results (Updated)	2019 Model Predictions with Noise Abatement Projects	Difference
R2	53	54	-1
R3	45	45	0
R4	41	40	1
R5	52	52	0
R6	43	43	0
R8	46	46	0
R9	40	40	0
R10	50	50	0
R11	41	41	0
R12	53	53	0
R13	42	42	0
R14	39	40	-1
R15	51	51	0
R16	53	53	0
R17	43	43	0
R18	40	41	-1
N1	48	49	-1
N2	48	49	-1
N3	49	50	-1

The results provide appropriate comparison between the previous model and the updated model predictions. In most cases the updated model verifies with the 2019 model predictions with a further reduction of 1dB(A) at R2, R14, R18, N1, N2 and N3 receivers, except receiver R4 which predicts noise levels 1dB(A) higher.

As such, Vipac notes that the EIP Projects implemented by ABC have successfully reduced the noise emissions from the upgraded/refurbished plant and provide noise level reductions as expected/estimated by Vipac in the 2019 noise model.

7.3.2 CALIBRATION RESULTS

A comparison of the computer noise model predictions against the off-site noise measurements (night-time), has been presented below:

Table 11: Results Comparison

Receiver	Predicted Noise Levels (L _{Aeq} , dB(A))	Measured Noise Levels (L _{A90} , dB(A))	Difference
R2	53	54	-1
R3	45	49	-4
R4	41	44	-3
R5	52	52	0
R6	43	46	-3
R8	46	47	-1
R9	40	42	-2
R10	50	47	3
R11	41	39	2
R12	53	54	-1
R13	42	43	-1
R14	39	42	-3
R15	51	53	-2
R16	53	55	-2
R17	43	45	-2
R18	40	46	-6
N1	48	49	-1
N2	48	49	-1
N3	49	50	-1

Predicted noise levels generated by the updated model were within +/- 3dB of measured noise levels for most representative receiver locations, indicating good agreement with measured noise levels. The measured noise levels exceeded the predicted noise levels by 4 dB(A) and 6dB(A) at locations, R3 and R18, respectively. As discussed above (refer Section 7.1.2), the measurements at R3 and R18 were heavily influenced by the extraneous noise sources (traffic noise, etc.), which may have resulted in the discrepancy.

As such, considering the complexity of the computer noise model, the predicted results show good calibration with the measured noise levels.

7.3.3 NOISE SOURCE CONTRIBUTION

Based on the predicted noise levels presented for the current situation in Table 9 above, the noise sources predicted to contribute most significantly to off-site noise levels were able to be identified. For receiver locations where worst-case predicted noise levels exceed the Noise EPP night-time goals, the most significant sources and their contributions to noise levels at the receiver location were identified.

The predicted worst-case night-time noise levels at noise sensitive receiver locations where current noise levels exceed the night-time goal noise level, along with the most significant noise sources at each location and their relative contribution to worst-case predicted noise levels at that location are presented in Table 12.

Table 12: Most significant noise sources

Receiver	Worst-case predicted noise level	Noise Source	Contribution
R2	53	Road Bulk Station DC30	45dB(A)
		Gas Train	43dB(A)
		CS4/CS5 Dust Collector Fan	42dB(A)
		Kiln Cooling Fans	37dB(A)
		CM1&7 Clinker Gantry Fans	42dB(A)
R5	52	Gas Train	36dB(A)
		CM1&7 Clinker Gantry Fans	47dB(A)
		Road Bulk Station DC30	42dB(A)
R10	50	Kiln 4 airslide fan	40dB(A)
		CM1 (western façade)	39dB(A)
		4B EP duct	40dB(A)
		Woodchip plant 2	40dB(A)
R12	53	CM1&7 gantry fans	48dB(A)
		CM7 (western façade)	47dB(A)
		Gas train	36dB(A)
		Limestone reclaimer shed	41dB(A)
		CSC Compressor	39dB(A)
R15	51	Gas train	36dB(A)
		Kiln 4 airslide fan	38dB(A)
		4B EP duct	39dB(A)
		Woodchip plant 1	39dB(A)
		Woodchip plant 2	37dB(A)
		Kiln Feed Elevator Gearbox	29dB(A)
R16	53	Gas train	38dB(A)
		Limestone reclaimer shed	48dB(A)
		CM7 (western façade)	41dB(A)
		Kiln Feed Elevator Gearbox	31dB(A)

Based on the results presented above, Vipac notes that the noise contribution of the sources refurbished or serviced during the preceding year have shown a noise reduction. As a comparison, the reduction in noise contribution of these sources at noise sensitive receiver locations where current noise levels exceed the night-time goal noise level have been presented in Table 13 below:

Table 13: Most significant noise sources

Receiver	Noise Source	Predicted Contribution		Difference (2020/2019) dB(A)
		2019 Model	2020 Model	
N2	Gas train	46dB(A)	36dB(A)	-10
	CM 1&7 clinker gantry fans	35dB(A)	32dB(A)	-3
	Kiln Feed Elevator Gearbox	34dB(A)	28dB(A)	-6
N3	Gas train	45dB(A)	34dB(A)	-11
	Kiln Feed Elevator Gearbox	34dB(A)	28dB(A)	-6
R2	Gas train	53dB(A)	43dB(A)	-10
	CM1&7Clinker Gantry Fans	44dB(A)	42dB(A)	-2
	Kiln Feed Elevator Gearbox	37dB(A)	31dB(A)	-6
R5	Gas Train	46dB(A)	36dB(A)	-10
	CM1&7 gantry fans	49dB(A)	47dB(A)	-2
	Kiln Feed Elevator Gearbox	36dB(A)	30dB(A)	-6
R12	CM1&7 gantry fans	51dB(A)	48dB(A)	-3
	Gas train	47dB(A)	36dB(A)	-11
R15	Gas train	46dB(A)	36dB(A)	-10
	Kiln Feed Elevator Gearbox	35dB(A)	29dB(A)	-6
R16	Gas train	48dB(A)	38dB(A)	-10
	Kiln Feed Elevator Gearbox	37dB(A)	31dB(A)	-6

Based on the results above, Vipac comments as follows:

- Gas Train** – The gas train rectification works conducted by APA Group have resulted in significant reduction in noise emanating from the enclosure. The onsite measurement results indicated a reduction of approximately 7dB(A) at 1m from the enclosure (refer Table 8 above) and the computer noise model predictions indicate a reduction of approximately 10-11dB(A) at the nearest noise sensitive receivers (refer Table 13 above). A higher reduction in noise levels at the noise sensitive receivers may have resulted due to elimination of the tonal component, which was observed during the previous surveys (tonal penalty of 5 dB(A) was added in previous model). Vipac notes, that in comparison to the previous year survey, the noise from the gas train was not clearly audible at the off-site measurement locations during 2020 noise survey.

- **CM1 & CM7 Clinker Gantry Dust Collector Fans** – The EIP project undertaken by ABC involved installing attenuators/silencers to each of the fan discharge points. The onsite measurements results showed a reduction of 5dB(A) at 15m from the discharge location (refer Table 8 above) and the computer noise model predictions indicate a reduction of 2-3 dB(A) at the nearest noise sensitive receivers (refer Table 13 above).
- **4A Kiln Feed Elevator Drive (on top of Tower 4B)** – The changes to the elevator drive involved replacing the noisy gearbox and reinstalling the western end cladding. The onsite measurements results showed a reduction of 11dB(A) at 1m from the gearbox (refer Table 8 above) and the computer noise model predictions indicate a reduction of 6 dB(A) at the nearest noise sensitive receivers (refer Table 13 above). Vipac notes that a lower reduction in noise levels at the noise sensitive receivers may have resulted due reflections from the surrounding structure and the structure-borne noise resulting due to the gearbox operation.
- **CM1 Dust Collector Fan (DC 26)** – The EIP project involved redirecting the horizontal discharge to vertical. As such, a 1dB(A) reduction in noise levels were measured during the onsite survey and resulted in no significant reduction in incident noise levels at the receivers based on the computer noise model predictions.

7.3.4 TEMPORARY NOISE BARRIER

A temporary noise barrier was installed to reduce noise impact due to activities associated with Kiln Refractory demolition works. The barrier was installed in accordance with Sonus Report S4682.1C3 [11]. To assess the influence of the temporary barrier at the noise sensitive receivers, in addition to the noise survey conducted on 04 May 2020 with the barrier place, an additional noise survey was conducted at 6-off locations once the barrier was removed, on 24 May 2020 between 10:00PM and 1:30AM the following day. The measurement locations were selected in accordance with the Sonus Report S4682.1C3, as presented below.



Figure 2: Measurement Locations as per Sonus Report S4682.1C3

Table 14: Measurement location details

Sonus Location Reference	Vipac Location Reference	Location Description
1	-	Near / Adjacent 37 Alfred Street
2	R8	Adjacent 39 Mary Street
3	R15	Corner Alfred and Walton Street (near/adjacent 9 Walton street)
4	R2	Corner of Alfred Street and Hargraves Street (corner of Park)
5	-	32 Baker Street
6	-	Near/Adjacent 19 Walton street

It is noted that the initial survey was conducted by Sonus during the annual shutdown period and the measurement locations were selected by ABC in coordination with Sonus to identify/measure the noise impact due to demolition works. The results presented below compare the noise levels measured by Sonus during their survey conducted with the barrier in place (07-08 January 2020) and, Vipac's survey conducted on 04 May 2020 with the barrier in place and on 24 May 2020 survey with the barrier removed.

Table 15: Results comparison (temporary barrier)

Sonus Location Reference	Vipac Location Reference	Survey Results Sound Pressure Levels (L _{Aeq}), dB(A)		
		Sonus Survey Results (with Barrier)	Vipac Survey Results (with Barrier)	Vipac Survey Results (without Barrier)
1	-	50	-	52
2	R8	47	49	48
3	R15	50	56	55
4	R2	50	56	55
5	-	45	-	50
6	-	50	-	60

Based on the results presented above, Vipac comments as follows:

- The Sonus survey results do not represent the noise emissions associated with the plant operation, as the measurements were conducted during the shutdown period. This is also evident from the difference in the measured levels in comparison to Vipac's survey with the barrier in place. As such, Sonus' survey results do not provide an appropriate assessment of the barrier influence on noise emissions during the normal operation of the plant.
- Vipac did not conduct the noise measurements at locations 1, 5 and 6. However, based on the levels measured at locations 2 (R8), 3 (R15) and 4 (R2), Vipac notes that the noise levels measured with the barrier in place were 1 dB(A) higher than the levels without the barrier. This minor difference of 1 dB(A),

could be attributed to the wind conditions (direction and speed) during the survey and influence from other extraneous sources (traffic and nearby industrial developments). As such, Vipac considers the influence of the barrier to be insignificant in reducing the noise emitted during the normal operation of the plant.

- Based on the results presented above, Vipac notes that constructing a permanent barrier at the same location would likely have a negligible effect on the noise levels at the noise sensitive locations.

8 ADDITIONAL COMMENTS

As discussed in Section 7.1, a characteristic screeching noise was observed at several off-site noise sensitive receiver locations during the night-time attended noise survey of 04 May 2020. ABC had confirmed that the screeching noise was associated with the drag chain conveyor, which was later rectified after the survey. As such, to ensure that the screeching noise was no longer present at the receivers, during the night-time attended noise survey conducted on 24 May 2020, additional measurements were conducted at receiver locations N2, N3 and R5 (in addition to R2, R8 and R15) where the screeching noise was observed to be most prominent during the previous survey. The results of the survey compared against the previous survey conducted on 04 May 2020 are presented below:

Table 16: Night-time survey exceedances

Location	Criterion [dB(A)]	Measured Sound Levels 04 May 2020 Survey		Measured Sound Levels 24 May 2020 Survey	
		L _{Aeq} , [dB(A)]	L _{A90} , [dB(A)]	L _{Aeq} , [dB(A)]	L _{A90} , [dB(A)]
R2	49	56	54	55	53
R5	49	54	52	51	50
R8	49	49	47	48	46
R15	49	56	53	55	53
N2	49	52	49	48	46
N3	49	53	50	52	49

Based on the results presented above and our observations during the survey, Vipac comments as follows:

- The distinctive screeching noise was no longer audible at each measurement location.
- The measured levels were lower than the levels measured during the 04 May 2020 survey.
- The major difference in noise level was observed at location R5 (3 dB(A)) and N2 (4 dB(A)).

Considering the reduction in noise levels observed after the rectification works, Vipac recommends that ABC perform regular checks (maintenance, servicing, etc.) on the drag chain conveyor to ensure no unusual noise emissions from the system.



Appendix A : ENVIRONMENTAL NOISE SURVEY RESULTS



Day-Time Noise Survey Results

Location	Start time (hh:mm)	L _{Aeq} [dB(A)]	L _{A90} [dB(A)]	Criterion [dB(A)]	Exceedance [dB(A)]	Wind Speed [m/s]	Wind Direction	Observations / Comments
R2	15:23	58	53	57	-	4.5	SW	Audible noise from the plant with heavy traffic noise influence from Victoria Road and Hargrave Street.
R3	13:46	58	44	57	1	3.6	WSW	Traffic noise from Victoria Road. Noise from gardening activities (power tools) from the nearby property.
R4	14:08	52	38	57	-	4.0	SW	Plant not audible. Noise from construction activities (road works and house). 1-off aircraft fly-by.
R5	13:28	54	49	57	-	3.6	WSW	Distant traffic noise from Victoria Road. Audible plant noise (fan noise). Infrequent bird noise.
R6	13:01	42	38	57	-	3.6	SSE	Plant barely audible. Infrequent dog barking and bird noise. Resident noise from nearby properties.
R8	14:42	50	41	57	-	4.5	WSW	Audible plant noise with infrequent dog barking and bird noise.
R9	14:57	58	37	57	1	4.5	SW	Plant not audible. Traffic noise dominant.
R10	15:43	72	59	57	2	4.5	WSW	Traffic noise from Victoria Road (heavy traffic) dominant source.
R11	15:42	59	39	57	2	4.5	SW	Traffic noise (Fletcher Road). Continuous bird noise and construction noise from far away.
R12	13:07	60	53	57	-	3.6	SSE	Traffic noise from Victoria Road (heavy traffic) dominant source. Plant noise audible.
R13	14:36	51	36	57	-	4.5	WSW	Audible plant noise. Lawnmower noise from nearby property. Infrequent dog barking from property far away.
R14	15:22	47	36	57	-	4.5	SW	Plant not audible. Loud resident noise. Audible lawnmower noise.
R15	15:04	56	50	57	-	5.4	SW	Audible noise from the plant with heavy traffic noise influence from Victoria Road.
R16	12:45	76	61	57	4	2.7	SE	Traffic noise from Victoria Road (heavy traffic) dominant source.
R17	13:25	65	42	57	8	3.6	WSW	Plant inaudible. Frequent dog barking. Traffic noise from nearby roads/streets.
R18	12:35	61	42	57	4	2.7	SE	Plant not audible. Influence from infrequent bird noise, traffic movements and children noise in the nearby playground.
N1	12:25	56	47	57	-	2.7	SE	Faint noise from the ABC plant. Continuous traffic noise from Victoria Road (trucks, cars, etc.)
N2	13:58	46	42	57	-	4.0	SW	Audible noise from plant (possible fan noise). Distant traffic noise from Victoria Rd. Infrequent bird noise and dog barks.
N3	14:20	50	44	57	-	4.5	WSW	Plant noise audible. Frequent drilling noise from nearby property. Infrequent bird noise.



Night-Time Noise Survey Results

Location	Start time (hh:mm)	L _{Aeq} [dB(A)]	L _{A90} [dB(A)]	Criterion [dB(A)]	Exceedance [dB(A)]	Wind Speed [m/s]	Wind Direction	Observations / Comments
R2	23:55	56	54	49	5	3.1	NNE	Low traffic noise from nearby roads (Victoria Rd). Audible plant noise with noise from drag chain conveyor (screeching noise) prominent in the first 5 minutes of the measurement.
R3	23:24	52	49	49	3	3.1	N	Traffic noise from nearby roads (Victoria Rd). Audible plant noise with noise from drag chain conveyor (screeching noise).
R4	23:44	51	44	49	2	3.1	NNE	Audible plant noise with noise from drag chain conveyor (screeching noise).
R5	22:14	54	52	49	5	2.7	NE	Plant clearly audible with traffic noise from Victoria Road.
R6	22:41	49	46	49	-	2.7	NE	No traffic noise. Plant noise clearly audible.
R8	23:16	49	47	49	-	3.1	N	Low traffic noise from nearby roads (Victoria Rd). Audible plant noise with noise drag chain conveyor (screeching noise).
R9	0:27	46	42	49	-	1.3	ENE	Faint noise from plant. Music noise from nearby property.
R10	1:20	50	47	49	-	2.2	NE	Plant audible. Some influence of traffic pass-by.
R11	1:02	45	39	49	-	2.2	NE	Barely any noise from plant. Traffic noise from Victoria Rd.
R12	1:00	56	54	49	5	2.2	NE	Plan audible. Traffic noise from Victoria Road.
R13	0:05	46	43	49	-	3.1	ENE	Faint noise from plant.
R14	0:46	44	42	49	-	1.3	ENE	Faint noise from plant.
R15	23:37	56	53	49	4	3.1	NNE	Low traffic noise from nearby roads (Victoria Rd). Audible plant noise with noise from drag chain conveyor (screeching noise).
R16	0:34	58	55	49	6	1.3	ENE	Faint traffic noise from nearby roads (Victoria Rd). Audible plant noise.
R17	23:03	50	45	49	1	3.1	N	Traffic noise from nearby roads (Victoria Rd). Audible plant noise with noise from drag chain conveyor (screeching noise).
R18	22:20	50	46	49	1	2.7	NE	Plant clearly audible.
N1	0:18	51	49	49	-	3.1	ENE	Faint traffic noise from nearby roads (Victoria Rd). Audible plant noise.
N2	22:37	52	49	49	3	2.7	NE	Low traffic noise from nearby roads (Victoria Rd). Audible plant noise with noise from drag chain conveyor (screeching noise).
N3	22:55	53	50	49	4	3.1	N	Low traffic noise from nearby roads (Victoria Rd). Audible plant noise with noise from drag chain conveyor (screeching noise).



Appendix B : NOISE SOURCE INVENTORY



ID	Group	Noise source	Type	Source Position (UTM co-ordinates zone 54H)			Sound Power Level (dB(A) re 1pW)																											
				X	Y	Z	Overall	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k
1	CM7	Dust Collector Discharge	Point	271852	6142575	20	100	55	65	55	68	70	75	76	80	87	87	86	91	90	89	89	91	91	89	83	79	78	76	76	71	68	65	63
2	Kiln 4	Kiln Cooling Fan 1	Point	271686	6142840	4	104	45	50	55	58	68	69	75	82	82	85	92	93	92	95	95	95	95	94	93	91	89	87	85	81	77	74	68
3	Kiln 4	Kiln Cooling Fan 7	Point	271668	6142835	2	96	41	49	54	53	59	63	63	70	71	76	81	86	81	82	86	84	86	89	87	85	83	81	79	75	75	73	70
4	Kiln 4	Kiln Cooling Fan 6	Point	271666	6142849	5	91	44	50	54	59	58	60	66	71	69	78	77	80	83	81	81	81	81	80	79	78	77	75	72	70	68	64	59
5	Kiln 4	Kiln Cooling Fan 4	Point	271672	6142850	5	93	50	52	55	61	63	65	66	67	71	76	77	79	86	81	82	83	84	85	81	80	78	75	72	68	69	67	57
6	Kiln 4	Kiln Cooling Fan 5	Point	271672	6142836	5	104	54	61	70	72	73	71	75	77	83	82	84	91	96	95	92	96	96	94	91	90	88	86	83	79	76	72	68
7	Kiln 4	Kiln Cooling Fan 3	Point	271678	6142838	5	103	53	61	69	70	71	71	72	76	81	84	83	90	94	94	92	95	96	93	91	89	87	86	83	79	77	73	66
8	Kiln 4	Kiln Cooling Fan 2	Point	271683	6142838	5	101	50	58	67	68	69	71	71	75	82	81	83	88	93	91	89	93	93	91	90	87	86	83	80	76	74	70	65
9	Kiln 4	Kiln 4 Primary Air Fan	Point	271671	6142837	5	83	37	43	50	48	51	54	54	59	62	66	66	70	71	73	72	72	72	71	68	67	69	77	66	66	67	58	60
10	Slag Dryer	Slag Dryer	Line	271780	6142824	2	97	63	59	61	72	86	76	74	79	77	80	82	82	83	85	86	86	91	88	84	83	82	80	78	77	76	74	68
11	Kiln 4	Ventilation Oven Fan 1	Line	271631	6142835	5	115	60	65	70	72	74	83	82	86	92	104	101	99	107	105	105	105	105	105	103	103	101	97	92	89	85	81	77
12	Kiln 4	Ventilation Oven Fan 2	Line	271660	6142841	5	115	60	65	70	72	74	83	82	86	92	104	101	99	107	105	105	105	105	105	103	103	101	97	92	89	85	81	77
13	Raw mill 4B	EP Outlet Duct	Line	271611	6142876	5	110	66	69	72	76	80	86	88	90	101	100	98	96	98	99	100	100	98	99	98	95	92	90	87	85	83	79	76
14	Raw mill 4B	4B Air Slide Blower	Point	271598	6142880	35.5	94	43	50	56	71	79	74	72	75	73	78	74	74	78	82	88	77	76	81	82	83	85	83	82	81	79	75	72
15	4A/4B Tower	4A Elevator Discharge Air Slide Fan	Point	271602	6142821	37.3	90	38	40	43	51	58	53	59	58	68	79	80	78	79	79	85	79	77	76	76	73	72	69	69	68	65	61	59
16	Transfer Conveyors	D/C - CS1/CS2 Central Tower	Point	271662	6142805	16	102	43	47	55	68	65	71	73	76	84	85	84	85	92	95	95	93	92	92	89	86	86	84	81	79	75	71	67
17	Transfer Conveyors	D/C - CR1/CR2 Conveyors	Point	271610	6142802	13	91	46	49	50	54	59	63	63	64	69	73	75	74	81	80	81	84	83	79	76	78	80	79	76	73	69	68	65
18	Level 3 Dust Collector Area	D/C - CS 2 Conveyor	Point	271600	6142791	22	91	49	52	55	59	60	66	72	71	76	78	76	77	78	76	78	81	79	81	79	77	76	78	81	80	76	72	
19	Level 3 Dust Collector Area	D/C - North Gantry Building	Point	271599	6142798	24	101	52	58	64	70	67	73	77	76	82	84	96	87	88	92	92	89	89	88	86	84	83	83	83	83	81	76	72
20	Level 3 Dust Collector Area	D/C - CS2/CS3A/CS4 Conveyor	Point	271596	6142790	22	91	51	51	55	66	62	67	67	68	75	76	81	80	80	80	80	80	80	82	78	76	75	76	75	76	74	73	71
21	Level 3 Dust Collector Area	CR4 DC	Point	271592	6142798	22.5	95	54	58	61	63	64	68	69	74	78	83	83	83	87	88	80	81	80	86	82	80	80	78	78	77	73	68	63
22	Transfer Conveyors	D/C - 36 Bypass Dust Disposal	Point	271585	6142821	15.5	86	40	43	51	56	53	58	62	68	70	71	71	69	73	73	73	75	77	80	76	75	73	70	64	61	59	55	51
23	4A/4B Tower	4A Elevator Drive	Point	271601	6142847	87	100	55	61	63	65	61	64	67	70	73	78	85	92	88	88	89	96	100	87	86	85	84	82	81	78	75	70	65
24	4A/4B Tower	D/C - 41 Kiln 4 Feed Surge Bin	Point	271605	6142837	87	97	47	50	63	63	60	73	76	77	75	80	86	86	88	86	85	88	88	86	88	83	79	78	74	72	68	65	62
25	4A/4B Tower	D/C - 38 Blending Silo Top	Point	271596	6142866	35.5	84	35	40	46	54	70	59	66	63	68	70	73	74	78	73	73	72	70	71	69	66	67	67	65	63	66	66	59
26	Woodchip Plant 1	Dust Collector	Point	271588	6142903	5	105	64	67	70	75	75	76	78	80	86	87	89	94	94	100	95	92	95	95	92	89	86	83	82	81	77	75	72
27	Slag Dryer	D/C - Slag Outfeed	Point	271769	6142823	7	87	39	45	48	53	52	56	59	60	63	69	71	72	72	81	78	78	80	79	73	72	69	68	67	65	59	55	50
28	Clinker Gantry	Cement Mill 1 & 7-Clinker Gantry 1	Point	271865	6142494	15	97	55	57	63	65	66	67	70	70	73	74	82	85	85	86	89	89	88	90	90	88	81	76	73	69	65	60	54
29	Clinker Gantry	Cement Mill 1 & 7-Clinker Gantry 2	Point	271869	6142460	15	97	55	57	63	65	66	67	70	70	73	74	82	85	85	86	89	89	88	90	90	88	81	76	73	69	65	60	54
30	Clinker Gantry	Cement Mill 1 & 7-Clinker Gantry 3	Point	271873	6142426	15	97	55	57	63	65	66	67	70	70	73	74	82	85	85	86	89	89	88	90	90	88	81	76	73	69	65	60	54



ID	Group	Noise source	Type	Source Position (UTM co-ordinates zone 54H)			Sound Power Level (dB(A) re 1pW)																												
				X	Y	Z	Overall	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k	
31	Clinker Gantry	Cement Mill 1 & 7- Clinker Gantry 4	Point	271888	6142427	15	97	55	57	63	65	66	67	70	70	73	74	82	85	85	86	89	89	88	90	90	88	81	76	73	69	65	60	54	
32	Clinker Gantry	Cement Mill 1 & 7- Clinker Gantry	Point	271883	6142463	15	97	55	57	63	65	66	67	70	70	73	74	82	85	85	86	89	89	88	90	90	88	81	76	73	69	65	60	54	
33	Clinker Gantry	Cement Mill 1 & 7- Clinker Gantry 6	Point	271877	6142496	15	97	55	57	63	65	66	67	70	70	73	74	82	85	85	86	89	89	88	90	90	88	81	76	73	69	65	60	54	
34	Clinker Gantry	Building CM1 Shed motor	Point	271871	6142391	1	85	42	49	52	55	57	61	62	65	71	71	71	74	74	77	77	78	75	72	73	70	68	69	65	61	56	52	47	
35	Clinker Gantry	Clinker Blend Building CM1 Shed motor	Point	271877	6142392	1	84	41	49	52	55	57	61	65	66	71	70	70	76	77	76	75	73	71	69	69	68	67	65	62	58	55	52	46	
36	Wharf Bulk Loading Station	D/C - CSC Bulk	Point	271910	6142540	26	91	61	65	67	70	73	75	77	79	81	77	80	79	79	79	80	81	82	79	76	73	71	71	69	69	67	66	62	
37	Clinker Gantry	D/C - 23 CE1 Conveyor	Point	271868	6142535	6	105	71	77	81	86	89	91	94	95	96	95	95	93	95	92	92	94	90	87	85	83	82	82	81	78	76	74	70	
38	Wharf Silos	D/C - 20 Wharf 30000T Silo #2	Point	271927	6142529	51	83	40	45	49	49	53	59	60	64	68	72	70	72	73	72	73	73	72	74	71	68	67	67	64	62	61	60	54	
39	Wharf Silos	D/C - 19 Wharf 30000T Silo #1	Point	271933	6142532	51	95	41	52	55	55	61	67	70	71	72	80	82	90	81	82	85	86	84	81	83	83	80	79	75	73	69	66	62	
40	Wharf Silos	D/C - 18 Ship Loader	Point	271932	6142551	20	87	42	49	52	60	78	72	78	75	75	77	74	72	72	79	67	69	71	74	73	73	70	71	70	68	66	61	56	
41	Wharf Silos	D/C - 16000 Silo Top (South)	Point	271928	6142566	50	95	53	59	59	79	78	71	72	69	75	83	87	84	83	84	87	83	83	83	84	80	77	75	73	71	68	65	63	
42	Wharf Silos	D/C - 16000 Silo Top (North)	Point	271927	6142567	50	82	32	40	47	69	66	59	63	65	68	74	75	71	70	69	72	69	66	67	69	66	66	62	60	59	55	51	48	
43	Wharf Silos	D/C - Silo Bottom 16000	Point	271929	6142576	6	91	56	64	69	74	77	77	78	78	78	77	80	79	73	77	77	75	84	83	78	76	74	74	72	72	69	65	61	
44	Woodchip Plant 1	Woodchip Compressor Dryer	Point	271570	6142913	0.5	73	5	11	15	20	24	28	31	34	37	65	67	55	60	67	55	62	63	65	57	57	55	49	54	31	35	34	28	
45	CM6	Cooling Tower North CM 6	Point	271610	6142760	1.9	89	-45	39	-35	57	-26	-23	60	67	-13	70	69	74	79	80	83	83	78	77	74	72	68	63	1	1	0	52	46	
46		CSC Compressor	Point	271708	6142551	1	93	-45	-39	-35	-30	-26	-23	61	63	-13	70	69	82	79	78	78	79	86	88	80	77	78	77	1	1	0	69	57	
47	Wharf Bulk Loading Station	Air Slide SE BDC	Point	271909	6142546	21	93	-45	-39	-35	-30	-26	-23	68	70	73	81	-9	86	83	73	82	84	85	84	83	80	79	74	69	1	0	-1	55	
48		4A Stack	Point	271649	6142814	75	100	8	16	23	50	59	71	82	86	96	85	83	79	81	82	83	89	92	89	81	75	71	69	68	62	56	51	44	
49	4A/4B Tower	4B Stack	Point	271604	6142847	95	103	63	62	64	69	67	74	79	88	84	85	87	91	90	91	91	94	95	91	92	90	89	89	87	85	86	83	76	
50	Level 3 Dust Collector Area	Gantry Dust Collector Fan Housing	Point	271598	6142796	21	98	57	60	61	62	66	77	71	75	81	82	91	87	87	87	88	86	86	86	82	79	79	79	80	83	79	73	74	
51	Transfer Conveyors	T2 Dust Collector Fan	Point	271855	6142639	12	108	62	65	68	72	73	77	83	91	96	94	96	94	96	97	99	99	99	99	96	94	92	91	87	83	78	74	68	63
52	Level 3 Dust Collector Area	CS4/CS5 Dust Collector Fan	Point	271629	6142603	12	99	55	57	62	66	69	71	76	78	78	87	87	88	88	86	90	89	89	89	85	84	83	78	74	70	67	61	56	
53	Road Bulk Loading Station	Dust Collector DC 30	Point	271711	6142746	26	94	49	59	50	62	64	69	71	74	82	81	80	85	85	84	83	85	86	83	78	73	72	70	70	65	62	59	57	
54	Road Bulk Loading Station	Southern Fan Discharge	Point	271711	6142744	26	86	59	67	67	69	71	72	73	73	74	74	75	76	75	77	76	72	71	71	69	67	67	66	69	65	64	62	61	
55	Level 3 Dust Collector Area	CR3 Dust Collector	Point	271596	6142799	22	96	63	69	73	78	80	83	84	86	87	87	87	86	86	83	82	80	79	77	76	74	75	73	72	72	69	67	66	
56	4A/4B Tower	4A Airslide East Fan	Point	271608	6142844	37	101	49	51	54	62	69	64	70	69	79	90	91	89	90	90	96	90	88	87	87	84	83	80	80	79	76	72	70	



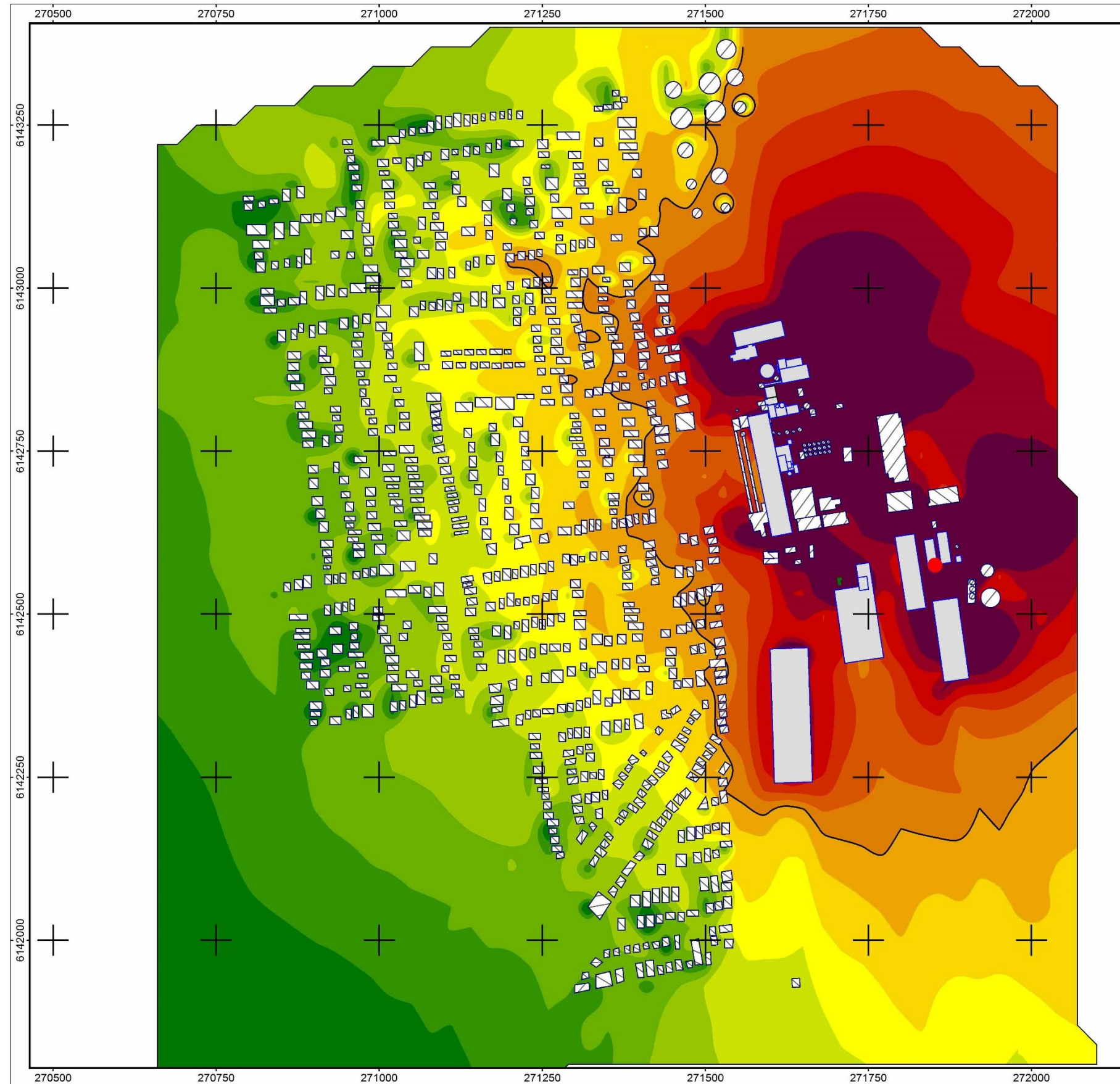
ID	Group	Noise source	Type	Source Position (UTM co-ordinates zone 54H)			Sound Power Level (dB(A) re 1pW)																											
				X	Y	Z	Overall	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k
57	Raw Mill 4B	4B Elevator Drive	Point	271607	6142879	37	90	42	45	51	58	61	61	63	67	69	80	80	77	77	80	79	83	79	79	76	75	74	72	71	70	68	66	62
58	4A/4B Tower	Kiln 4 Airslide Fan	Point	271595	6142849	75	102	48	54	57	60	60	62	67	74	76	78	80	82	89	93	91	92	98	91	88	87	85	86	82	80	76	74	71
59	Kiln 4	Kiln burner	Point	271673	6142844	12	112	49	54	61	74	63	68	74	79	83	92	93	91	92	88	87	89	88	86	89	88	89	90	90	95	109	109	92
60	Gas Train	Gas Train	Point	271566	6142622	2	93	51	57	59	65	69	70	71	73	77	77	78	78	79	81	83	86	91	91	91	90	91	90	88	90	94	92	89
61	CM1	compressor Room Exhaust & Opening	Point	271884	6142587	2.5	88	35	44	45	51	62	61	62	63	71	74	72	74	73	77	80	79	79	77	76	74	72	71	71	70	71	69	68
62		Point source O2	Point	271893	6142582	2.5	88	35	44	45	51	62	61	62	63	71	74	72	74	73	77	80	79	79	77	76	74	72	71	71	70	71	69	68
63	CM1	CM1 - South Roof	Area	271868	6142590	25	91	-	-	-	71	70	74	73	76	79	79	85	80	81	82	81	77	74	74	76	76	74	72	69	66	-	-	-
64	CM1	CM1 - North Roof	Area	271864	6142614	25	91	-	-	-	71	70	74	73	76	79	79	85	80	81	82	81	77	74	74	76	76	74	72	69	66	-	-	-
65	CM1	CM1 - South Facade	Area	271869	6142578	10	95	-	-	-	69	70	74	79	82	85	87	88	87	86	84	83	80	78	76	79	78	76	73	68	64	-	-	-
66	CM1	CM1 - West Facade	Area	271858	6142601	12.7	102	-	-	-	76	77	81	86	89	92	93	95	94	92	91	89	86	84	83	85	84	83	79	74	71	-	-	-
67	CM1	CM1 - North Facade	Area	271862	6142626	10	95	-	-	-	69	70	74	79	82	85	87	88	87	86	84	83	80	78	76	79	78	76	73	68	64	-	-	-
68	CM1	CM1 - East Facade	Area	271874	6142603	12.7	101	-	-	-	75	76	80	85	88	91	92	94	93	91	90	88	85	83	82	84	83	82	78	73	70	-	-	-
69	CM1	DC26 CM1	Point	271876	6142588	12	101	63	64	64	73	80	85	86	89	90	92	100	98	100	102	100	99	96	95	96	93	91	88	85	80	77	71	64
70	CM6	CM6 Lower - South	Area	271625	6142720	4	108	53	57	65	68	67	68	74	79	84	82	89	93	92	96	99	98	98	102	97	95	93	92	91	88	85	81	74
72	CM6	CM6 Lower - North	Area	271618	6142758	4	94	47	51	58	60	51	57	66	73	79	70	77	87	78	82	89	82	82	86	81	79	76	76	78	76	74	71	69
73	CM6	CM6 Lower - East	Area	271632	6142741	4	97	50	53	61	63	54	60	68	75	81	72	80	90	80	84	91	84	85	88	84	81	79	79	80	79	77	74	72
74	CM6	CM6 Upper - West Roof	Area	271616	6142730	19	91	50	52	59	65	59	60	65	69	73	69	76	86	77	79	84	79	79	82	75	72	70	69	68	66	64	59	54
75	CM6	CM6 Upper - East Roof	Area	271622	6142732	19	91	50	52	59	65	59	60	65	69	73	69	76	86	77	79	84	79	79	82	75	72	70	69	68	66	64	59	54
76	CM6	CM6 Upper - South	Area	271621	6142719	13.5	90	49	51	58	65	58	59	64	68	72	68	75	86	76	78	83	79	78	81	75	71	69	68	68	65	63	59	53
77	CM6	CM6 Upper - West	Area	271613	6142730	13	93	52	54	61	67	61	62	67	71	75	71	78	88	79	81	86	81	81	84	77	74	72	71	70	68	66	61	56
78	CM6	CM6 Upper - North	Area	271616	6142743	13.5	90	49	51	58	65	58	59	64	68	72	68	75	86	76	78	83	79	78	81	75	71	69	68	68	65	63	59	53
79	CM6	CM6 Upper - East	Area	271625	6142732	13	93	52	54	61	67	61	62	67	71	75	71	78	88	79	81	86	81	81	84	77	74	72	71	70	68	66	61	56
80	CM6	Compressor Room - South Opening	Point	271633	6142764	1	88	37	39	44	49	48	50	53	57	61	64	80	74	69	75	73	72	75	76	74	74	79	82	70	73	75	68	60
81	CM6	Compressor Room - North Opening	Point	271632	6142766	1	102	42	44	48	54	57	58	62	65	69	77	101	87	80	85	84	83	86	85	85	84	88	90	83	83	83	78	73
82	CM7	CM7 - Roof (north)	Area	271844	6142605	25	86	-	-	-	67	68	68	68	72	75	76	78	73	75	73	74	71	70	70	74	74	72	70	68	67	-	-	-
83	CM7	CM7 - Roof (south)	Area	271847	6142585	25	86	-	-	-	67	68	68	68	72	75	76	78	73	75	73	74	71	70	70	74	74	72	70	68	67	-	-	-
84	CM7	CM7 - South	Area	271848	6142575	10	93	-	-	-	57	63	69	72	73	77	84	85	87	83	84	83	80	76	74	77	75	71	68	61	57	-	-	-
85	CM7	CM7 - East	Area	271853	6142596	12.7	98	-	-	-	62	68	74	77	78	82	90	90	92	88	90	88	85	81	79	82	80	76	73	66	62	-	-	-
86	CM7	CM7 - North	Area	271842	6142615	10	93	-	-	-	57	63	69	72	73	77	84	85	87	83	84	83	80	76	74	77	75	71	68	61	57	-	-	-
87	CM7	CM7 - West	Area	271838	6142594	12.7	103	-	-	-	67	73	79	82	83	87	95	95	97	93	95	93	90	86	85	87	85	81	78	71	67	-	-	-
88	CM7	CM7 Compressor Room Opening	Area	271841	6142571	3.5	98	41	41	46	57	56	60	63	72	71	75	78	76	83	81	76	80	77	87	83	87	91	90	92	81	80	79	75
89	Kiln 4	Heat Exchanger Fan	Point	271674	6142826	16	91	41	49	61	60	60	66	67	71	71	83	77	80	83	81	80	81	81	80	77	75	74	72	69	66	66	63	54
105	Limestone Reclaimer Shed	Eastern Roof	Area	271646	6142345	19.5	93	-	-	-	69	75	78	79	81	81	79	80	79	91	79	77	77	73	72	73	73	72	69	65	63	-	-	-
106	Limestone Reclaimer Shed	Western Roof	Area	271617	6142344	19.5	93	-	-	-	69	75	78	79	81	81	79	80	79	91	79	77	77	73	72	73	73	72	69	65	63	-	-	-



ID	Group	Noise source	Type	Source Position (UTM co-ordinates zone 54H)			Sound Power Level (dB(A) re 1pW)																											
				X	Y	Z	Overall	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k
107	Limestone Reclaimer Shed	West Facade	Area	271603	6142344	3.5	86	47	51	52	61	67	71	72	70	72	69	71	69	81	74	74	74	74	74	74	72	69	66	62	58	53	48	42
108	Limestone Reclaimer Shed	South Facade	Area	271635	6142242	11.1	85	46	50	51	60	66	70	71	69	70	68	70	68	80	73	73	73	73	73	73	71	68	65	61	57	52	47	40
109	Limestone Reclaimer Shed	East Facade	Area	271661	6142346	3.5	86	47	51	52	61	67	71	72	70	72	69	71	69	81	74	74	74	74	74	74	72	69	66	62	58	53	48	42
110	Limestone Reclaimer Shed	North Facade	Area	271628	6142448	11.1	85	46	50	51	60	66	70	71	69	70	68	70	68	80	73	73	73	73	73	73	71	68	65	61	57	52	47	40
111	Woodchip Plant 1	Roof	Area	271561	6142900	15	93	-	-	-	57	63	63	73	91	76	81	78	84	73	80	77	76	72	71	61	58	56	53	51	53	51	45	40
112	Woodchip Plant 1	Facade 01	Area	271552	6142889	7.5	89	-	-	-	53	59	59	69	87	73	77	74	80	69	76	73	72	68	67	57	54	52	49	48	49	47	41	36
113	Woodchip Plant 2	Facade 02	Area	271542	6142890	7.5	84	-	-	-	48	54	54	63	82	67	72	69	74	64	70	67	66	63	61	51	48	47	43	42	44	41	36	31
114	Woodchip Plant 2	Facade 03	Area	271540	6142892	7.5	81	-	-	-	46	52	52	61	80	65	70	67	72	61	68	65	64	60	59	49	46	45	41	40	41	39	33	28
115	Woodchip Plant 1	Facade 04	Area	271538	6142894	7.5	84	-	-	-	48	54	54	63	82	67	72	69	74	64	70	67	66	62	61	51	48	47	43	42	44	41	36	31
116	Woodchip Plant 1	Facade 05	Area	271542	6142898	7.5	86	-	-	-	50	56	56	66	84	70	74	71	77	66	73	70	69	65	64	54	51	49	46	45	46	44	38	33
117	Woodchip Plant 1	Facade 06	Area	271545	6142902	7.5	84	-	-	-	48	54	55	64	82	68	73	70	75	64	71	68	67	63	62	52	49	47	44	43	44	42	36	31
118	Woodchip Plant 1	Facade 07	Area	271555	6142908	7.5	90	-	-	-	54	60	60	69	88	73	78	75	80	70	76	73	72	68	67	57	54	53	49	48	49	47	42	36
119	Woodchip Plant 1	Facade 08	Area	271564	6142911	7.5	-	-	-	-	38	32	32	22	4	18	14	17	11	22	15	18	19	23	24	34	37	39	42	44	42	44	50	55
120	Woodchip Plant 1	Facade 09	Area	271568	6142913	7.5	86	-	-	-	50	56	56	65	84	69	74	71	76	66	72	69	68	64	63	53	50	49	45	44	45	43	38	33
121	Woodchip Plant 1	Facade 10	Area	271572	6142913	7.5	81	-	-	-	45	51	51	60	79	64	69	66	72	61	67	65	63	60	58	48	46	44	41	39	41	38	33	28
122	Woodchip Plant 1	Facade 11	Area	271575	6142912	7.5	83	-	-	-	47	53	53	62	81	66	71	68	73	63	69	66	65	61	60	50	47	46	42	41	42	40	35	29
123	Woodchip Plant 1	Facade 12	Area	271579	6142904	7.5	89	-	-	-	53	59	59	68	87	72	77	74	80	69	75	73	71	68	66	56	54	52	49	47	49	46	41	36
124	Woodchip Plant 1	Facade 13	Area	271575	6142894	7.5	87	-	-	-	51	58	58	67	86	71	76	73	78	67	74	71	70	66	65	55	52	51	47	46	47	45	39	34
125	Woodchip Plant 1	Facade 14	Area	271569	6142892	7.5	79	-	-	-	43	49	49	58	77	62	67	64	69	59	65	62	61	57	56	46	43	42	38	37	38	36	31	26
126	Woodchip Plant 1	Facade 15	Area	271565	6142890	7.5	85	-	-	-	50	56	56	65	84	69	74	71	76	65	72	69	68	64	63	53	50	49	45	44	45	43	37	32
127	Woodchip Plant 1	Facade 16	Area	271561	6142890	7.5	80	-	-	-	44	50	50	60	78	63	68	65	71	60	66	64	62	59	58	47	45	43	40	38	40	38	32	27
128	Woodchip Plant 2	Roof	Area	271582	6142930	14	95	-	-	-	-	71	73	69	80	76	76	77	78	77	79	88	83	81	91	86	76	74	73	70	70	67	64	-
129	Woodchip Plant 2	South Façade	Area	271585	6142918	7	92	-	-	-	-	68	71	66	77	74	73	74	75	74	76	85	81	78	88	84	74	71	70	67	67	65	62	-
130	Woodchip Plant 2	West Facade	Area	271545	6142921	7	88	-	-	-	-	63	66	61	72	69	68	69	71	69	71	80	76	73	83	79	69	66	65	62	62	60	57	-
131	Woodchip Plant 2	North Façade	Area	271579	6142942	7	92	-	-	-	-	68	71	66	77	74	73	74	75	74	76	85	81	78	88	84	74	71	70	67	67	65	62	-
132	Woodchip Plant 2	East Facade	Area	271620	6142939	7	88	-	-	-	-	63	66	61	72	69	68	69	71	69	71	80	76	73	83	79	69	66	65	62	62	60	57	-



Appendix C : NOISE CONTOUR PLOTS



Customer:
 Adelaide Brighton Cement Ltd
Project: ABC Birkenhead Environmental Noise
 Project-No. 50B-18-0036

6143250
6143000
6142750
6142500
6142250
6142000

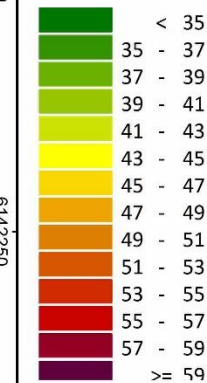


Map
1

Current Situation - Neutral Conditions
Result number 17
 Calculation at 0 m above ground level

Project engineer: BH
 Created: 17/05/2020
 Processed with SoundPLAN 8.0, Update 9/08/2017

Levels Leq
 in dB(A)



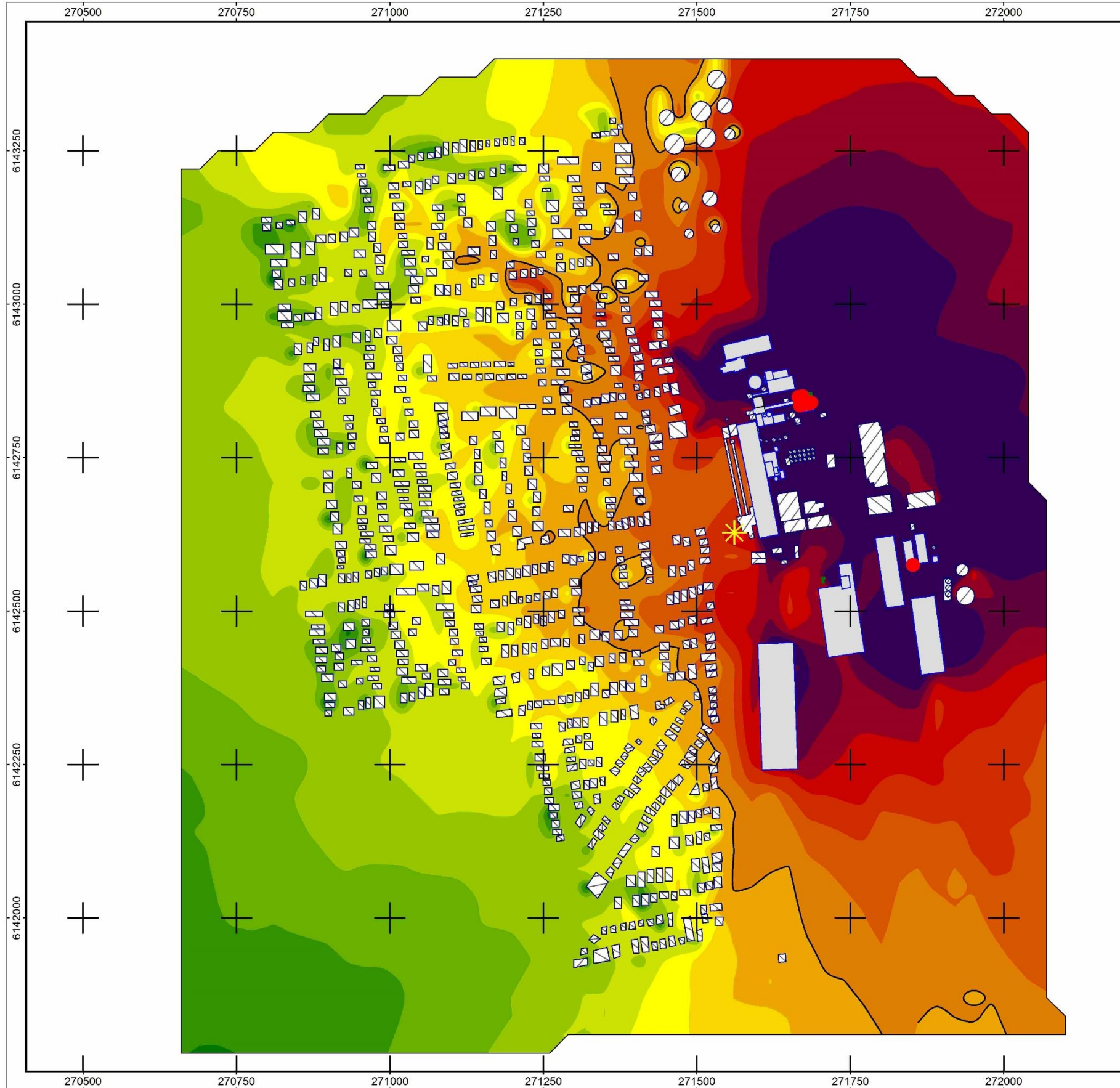
Signs and symbols

- Road axis
- Emission line
- Surface
- ▬ Central reservation
- Wall
- - - inside tunnels
- Signal
- Railway axis
- Emission line
- Surface
- Wall
- - - inside tunnels



Length scale 1:6000





Customer:
 Adelaide Brighton Cement Ltd
Project: ABC Birkenhead Environmental Noise
 Project-No. 50B-18-0036

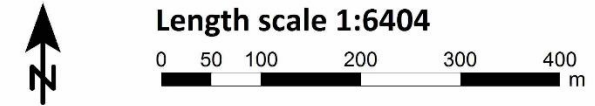


Map
2

Current Situation - Worst-case Conditions
Result number 8
 Calculation at 1.5 m above ground level

Project engineer: BH
 Created: 19/12/2018
 Processed with SoundPLAN 8.0, Update 9/08/2017

Levels Leq in dB(A)	Signs and symbols																																																				
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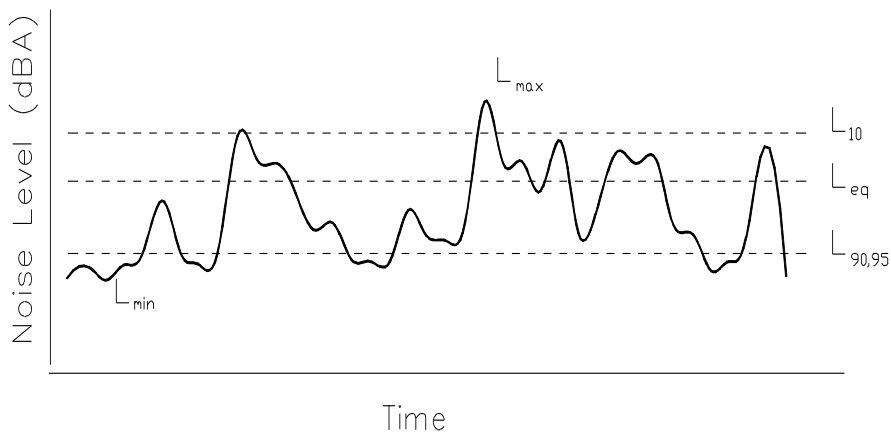
Appendix D : METEOROLOGY DATA

Time (04/05/20 – 05/05/20)	Temperature [degC]	Wind Speed [m/s]	Wind Direction	Dew Point [degC]	Relative Humidity [%]
10:00	15.0	3.6	ENE	6.1	55
10:30	16.1	3.6	E	6.1	52
11:00	15.0	2.7	E	7.2	55
11:30	16.1	2.7	SSE	7.2	55
12:00	16.1	3.6	E	7.2	55
12:30	16.1	2.7	SE	7.2	55
13:00	17.2	3.6	SSE	7.8	55
13:30	16.1	3.6	WSW	7.2	55
14:00	16.1	4.0	SW	7.2	55
14:30	17.2	4.5	WSW	7.2	55
15:00	16.1	5.4	SW	7.8	52
15:30	16.1	4.5	SW	7.8	55
16:00	16.1	4.5	WSW	7.8	59
16:30	16.1	4.0	WSW	7.8	59
17:00	16.1	4.0	SW	7.8	59
17:30	15.0	3.1	SW	8.9	59
18:00	15.0	2.7	SW	8.9	63
18:30	13.9	0.9	SW	8.9	67
19:00	12.8	0.0	CALM	7.8	72
19:30	11.1	2.7	ENE	7.8	77
20:00	11.1	2.7	E	7.8	82
20:30	11.1	2.2	E	7.8	82
21:00	11.1	2.2	E	7.8	82
21:30	10.0	2.7	NNE	7.8	82
22:00	8.9	2.7	NE	7.2	87
22:30	10.0	2.7	NE	7.2	82
23:00	11.1	3.1	N	7.2	76
23:30	11.1	3.1	NNE	6.1	71
0:00	8.9	3.1	ENE	6.1	82
0:30	8.9	1.3	ENE	6.1	82
1:00	7.8	2.2	NE	6.1	87



Appendix E : GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)	A-weighted decibels; a unit of measurement of sound pressure level which has its frequency characteristics modified by a filter ("A-weighted") so as to more closely approximate the frequency response of the human ear.
L₁₀ or L_{A10}	The noise level which is equalled or exceeded for 10% of the measurement period. L ₁₀ is an indicator of the mean maximum noise level, and is used in Australia as the descriptor for intrusive noise (usually in dB(A)).
L₉₀ or L_{A90}	The noise level which is equalled or exceeded for 90% of the measurement period. L ₉₀ is an indicator of the mean minimum noise level, and is used in Australia as the descriptor for background or ambient noise (usually in dB(A)).
L_{eq} or L_{Aeq}	The equivalent continuous noise level for the measurement period. L _{eq} is an indicator of the average noise level (usually in dB(A)).
L_{max} or L_{Amax}	The maximum noise level for the measurement period (in dB(A))
Broadband noise	Noise comprising energy distributed across a large range of frequencies
Impulsive noise	A noise distinguished by a sharp rise and fall in noise level. Often characterised as thumping or banging.
Low frequency noise	A noise characterised as rumbling, roaring, booming or similar.
Modulating noise	A noise that fluctuates in either frequency (such as a wailing siren), or loudness (such as intermittent traffic). May be described as varying, fluctuating, pulsating or similar.
Tonal noise	A noise having a well-defined pitch or note which is clearly audible above other noise.



Note: *The subjective reaction or response to changes in noise levels can be summarised as follows:*

A 3 dB(A) increase in sound pressure level is required for the average human ear to notice a change; a 5 dB(A) increase is quite noticeable and a 10 dB(A) increase is typically perceived as a doubling in loudness.



Adelaide Brighton Cement Ltd

ABN 96 007 870 199

Summary report of the effectiveness of EIP Projects 14, 15 and 16

EIP Project 17 – Compliance action 51

Prepared by C. Mackenzie, Environmental and Sustainability Engineer 29/5/2020

1.0 Noise Emissions Evaluation Report:

Compliance action 51 requires that a report assessing and validating the reductions achieved through implementation of EIP noise abatement projects (EIP Project numbers, 14,15 and 16), that includes an evaluation of noise emissions, by undertaking site noise modelling in accordance with the Environment Protection (Noise) Policy 2007.

Vipac Engineers and Scientists Limited (Vipac), have undertaken an evaluation of these EIP projects in accordance with the Environment Protection (Noise) Policy 2007. Vipac's report, "Birkenhead Plant Noise Survey - May 2020", dated 29 May 2020, provides a detailed evaluation and confirmation of the expected project outcomes.

2.0 Summary of the effectiveness of EIP Projects 14, 15 and 16

ABC has summarised the effectiveness of the EIP projects 14, 15 and 16, based on the findings in the Vipac report "Birkenhead Plant Noise Survey - May 2020", dated 29 May 2020.

Effectiveness of the EIP projects can be verified through:

- Reduction in source sound pressure level dB(A) for each EIP project
- Reduction in contribution of the EIP noise source at off-site noise sensitive receptors
- Reduction in noise levels at off-site noise sensitive receptors

2.1 Reduction in EIP project source sound pressure level

Details of the implemented EIP noise abatement projects, along with the source sound pressure level, dB(A) reduction achieved are summarised in Table 1, EIP Noise Project Summary.

Table 1: EIP Noise Project Summary

EIP Project Number	Project Title	Project Summary	Measurement Position and Distance	Measured Sound Pressure Level, (dB(A))			
				2018 Survey	2019 Survey	2020 Survey	Reduction Achieved
14	CM1/CM7 Clinker Gantry Dust Collector Fans	Installed duct noise attenuators on the CM1/CM7 Clinker Gantry Dust Collection Fans. Completed January 2020	15 Metres	71	71	66	5
15	Gas Train noise abatement	Upgrade to control equipment on the duty leg of the APA gas train. Completed February 2020	1 metre from north end of the enclosure	73	67	60	7
16	Kiln Feed Elevator Gear box	Replaced noisy gearbox and reinstated the western cladding Completed April 2019	1 metre from the motor/gearbox on top of 4B tower	-	100	89	11

Based on the results tabled above, there has been a significant reduction in source noise emissions for all the implemented EIP noise projects.

2.2 Predicted improvement in EIP project contribution at off-site sensitive noise receivers

Attended off-site noise measurements were undertaken at the receiver locations as shown in Figure 1:



Figure 1: Overview of attended monitoring locations

For each EIP project, Vipac modelled the predicted worst-case night-time noise level contribution at noise sensitive receiver locations, where the current noise levels exceed the night-time noise goal level (2019 noise model). In addition, Vipac estimated the reduction in noise level contribution that may be possible if practical abatement measures were applied to each EIP project.

Following implementation of the EIP projects, an attended day and night-time, off-site noise survey was undertaken by Vipac in May 2020, that included measurements at sensitive noise receivers. These attended noise measurements along with on-site noise measurements of the EIP projects were used to update the noise model (2020 model).

The change in predicted contribution to noise at sensitive noise receivers is summarised in Table 2.

Table 2: Predicted change in contribution at sensitive receivers for each EIP project

Receiver	Noise Source	Predicted Contribution		Difference (2020/2019) dB(A)
		2019 Model	2020 Model	
N2	Gas train	46dB(A)	36dB(A)	-10
	CM 1&7 clinker gantry fans	35dB(A)	32dB(A)	-3
	Kiln Feed Elevator Gearbox	34dB(A)	28dB(A)	-6
N3	Gas train	45dB(A)	34dB(A)	-11
	Kiln Feed Elevator Gearbox	34dB(A)	28dB(A)	-6
R2	Gas train	53dB(A)	43dB(A)	-10
	CM1 &7 Clinker Gantry Fans	44dB(A)	42dB(A)	-2
	Kiln Feed Elevator Gearbox	37dB(A)	31dB(A)	-6
R5	Gas Train	46dB(A)	36dB(A)	-10
	CM1&7 gantry fans	49dB(A)	47dB(A)	-2
	Kiln Feed Elevator Gearbox	36dB(A)	30dB(A)	-6
R12	CM1&7 gantry fans	51dB(A)	48dB(A)	-3
	Gas train	47dB(A)	36dB(A)	-11
R15	Gas train	46dB(A)	36dB(A)	-10
	Kiln Feed Elevator Gearbox	35dB(A)	29dB(A)	-6
R16	Gas train	48dB(A)	38dB(A)	-10
	Kiln Feed Elevator Gearbox	37dB(A)	31dB(A)	-6

Table 2 shows that each EIP project has resulted in a significant reduction in the contribution of the EIP noise source at sensitive noise receivers where night-time noise criterion levels are exceeded.

2.3 Reduction in noise levels at off-site noise sensitive receptors

Table 3: contains the noise model sound levels at off-site receiver locations for 2019 model results, 2019 model with predicted EIP noise abatement projects pre implementation and 2020 model results with EIP projects post implementation.

Table 3: Noise model sound levels at off-site noise locations.

Receiver ID	Night-Time Criterion	Worst-Case Weather Conditions (CONCAWE Category 6) dB(A)			
		2019 Model Results	2019 Model Predictions with EIP Noise Abatement Projects (pre implementation)	2020 Model Results with EIP projects (post- implementation)	Difference (2019 Model Predictions with Noise Abatement Projects) and 2020 Model Results
R2	49	56	54	53	-1
R3	49	45	45	45	0
R4	49	41	40	41	1
R5	49	53	52	52	0
R6	49	43	43	43	0
R8	49	47	46	46	0
R9	49	40	40	40	0
R10	49	50	50	50	0
R11	49	41	41	41	0
R12	49	53	53	53	0
R13	49	42	42	42	0
R14	49	40	40	39	-1
R15	49	52	51	51	0
R16	49	53	53	53	0
R17	49	43	43	43	0
R18	49	41	41	40	-1
N1	49	49	49	48	-1
N2	49	50	49	48	-1
N3	49	50	50	49	-1

Note: shaded cells indicate exceedance of night-time criterion

Comparison of this data shows that all the EIP projects have successfully achieved the expected / estimated EIP improvements, with reductions in noise levels at all receiver locations, except R4, being achieved with a further reduction of 1dB(A) at locations R2 , R14, R18, N1, N2, N3. Location R4, shows a predicted increase of 1dB(A), however this location currently complies with the night-time criterion.

Table 3, and the night-time attended measurements show there are some locations where night-time noise levels exceed the night-time criteria, however most of these are less than 3dB(A). A 3dB(A) increase in sound pressure level is a just perceptible change for the average human ear.

3.0 Conclusions:

All the EIP projects have been independently assessed by acoustic engineers, Vipac.

The assessment confirms the effectiveness of EIP projects 14, 15 and 16.

The expected project outcomes have been achieved, reducing off-site sound levels.

The attended noise measurements undertaken as part of this assessment show there are some off-site locations where the night-time noise policy criterion is exceeded, however most of these are less than 3dB(A) which is a sound pressure level that is a just perceptible change for the average human ear.