Dear Tim,

Adelaide Brighton Cement - Noise Abatement Project

Adelaide Brighton Cement (ABC) has engaged Vipac Engineers & Scientists (Vipac) to provide noise abatement recommendations in accordance with the Environmental Protection (Noise) Policy 2007. Vipac have previously conducted an environmental noise survey for the subject site [3] [5], in addition to 3D noise modelling [4].

To gain a further understanding of how noise from ABC affects the surrounding locality, Vipac conducted noise measurements on the 13th of July 2016 both internally and externally to the subject site (Adelaide Brighton Cement). The noise survey was conducted primarily to capture start-up of 4B Calciner.

1 REFERENCES


2 CRITERIA

The Environment Protection (Noise) Policy 2007 (EPA) [1] specifies the maximum allowable noise levels based on the time of day and land use, applicable at the most noise sensitive premises. These assessment criteria are determined based on the scheduled maximum noise levels for time of day and land use.
2.1 EXCERPT FROM THE CURRENT EPA POLICY 2007 (REF [2])

Part 1 – Section 5 – Indicative noise levels

(1) ... the indicative noise level for a noise source is to be determined as follows:

(a) where –
   i. the land uses principally promoted by the relevant Development Plan provisions for the noise source fall within a land use category specified in Table 1 in subclause (9); and
   ii. the land uses principally promoted by the relevant Development Plan provisions for the noise-affected premises fall within the same category as those principally promoted by the relevant Development Plan provisions for the noise source,

   by reference to indicative noise factors set out in Table 1;

(b) in any other case – by reference to indicative noise factors set out in Table 2 in subclause (9).

(2) When measurements to determine the source noise level (continuous) are taken –

   (a) between 7:00am and 10:00pm on the same day – an indicative noise factor used to determine the indicative noise level for the noise source is found in Table 1 or 2 in the column under the heading "day"; or

   (b) between 10:00pm on one day and 7:00am on the following day – an indicative noise factor used to determine the indicative noise level for the noise source is found in Table 1 or 2 in the column under the heading "Night".

(5) ... if the land uses principally promoted by the relevant Development Plan provisions for the noise source and those principally promoted by the relevant Development Plan provisions for the noise-affected premises do not all fall within a single land use category, the indicative noise level is the average of the indicative noise factors for the land use categories within which those land uses fall.

2.2 INDICATIVE NOISE FACTORS

From the Port Adelaide Enfield Development Plan [6], the residential receivers are located within the zone designated as "Residential", whereas the Adelaide Brighton Cement Birkenhead Plant is located in the zone designated "Industry".

Using the information contained within the excerpts detailed in Section 2.1, the indicative noise levels for the residential locations are detailed in Table 2-1. The average of the ‘General Industry’ and ‘Residential’ land use category indicative noise levels is presented.

<table>
<thead>
<tr>
<th>Table 2-1: Indicative Noise Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicative noise level – dB(A)</strong></td>
</tr>
<tr>
<td>Day</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>59</td>
</tr>
</tbody>
</table>

2.3 ADJUSTMENT FOR CHARACTERISTICS

Note that 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; and 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).
3 NOISE MEASUREMENTS

Noise measurements were conducted on the 13th of July 2016 with the objective of investigating noise levels with 4B Calciner off (largest stream of the kiln burning process/closest to the residential locations) and determine any noise increases as the 4B Calciner was turn back on. The 4A stream and kiln were operational during the entire period. With the Calciner off the opportunity was taken to undertake an assessment of noise generating equipment within the process. This included assessing CS2 / CS3 / CS4 Dust collector fan, CS2 Dust collector fan and Main gantry fan which were switched on and off during the process. The fans are elevated (third floor) and are located closest to the residential location. The fans measured operate independent of the calciner process (they typically run continuously). Conducting the noise measurements with the calciner off allowed for a more accurate determination of the noise impact of these fans. Noise measurements were conducted internally at the subject site and externally at noise sensitive receivers. Noise measurements were also conducted externally to the reclaimer at the nearest noise sensitive receivers.

3.1 EQUIPMENT

The equipment used for the noise survey is presented in Table 3-1. All equipment used holds current NATA calibration certification.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Serial Number</th>
<th>Last Calibration Date</th>
<th>Next Calibration Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brüel &amp; Kjaer Type 1 Hand-held Analyser model 2250-G4 Sound Level Meter</td>
<td>3002841</td>
<td>4th Feb 2016</td>
<td>4th Feb 2018</td>
</tr>
<tr>
<td>01dB-Metravib Duo</td>
<td>10295</td>
<td>29th October 2015</td>
<td>29th October 2017</td>
</tr>
<tr>
<td>01dB-Metravib Duo</td>
<td>10270</td>
<td>17th February 2016</td>
<td>17th February 2018</td>
</tr>
<tr>
<td>Larson Davis CA-250</td>
<td>2386</td>
<td>5th February 2016</td>
<td>5th February 2017</td>
</tr>
</tbody>
</table>

The sound level meters used in the noise measurements were fitted with approved windshields. The sound level meters used in the noise measurements were calibrated before and after measurements with an acoustic pistonphone calibrator and no or negligible drift was found in the meters.

3.2 INTERNAL NOISE MEASUREMENTS

Internal noise measurements were conducted on site at the ABC plant to measure the source noise levels of the 4B Calciner and a series of fans located closest to the residential locations. During the process the 4A plant and kiln were operational. The internal noise measurements conducted are presented in Table 3-2. Provided in Figure 3-1 are images of ABC plant.
Figure 3-1: Images of ABC plant

a) CS2 Dust collector fan

b) CS2 / CS3 / CS4 Dust collector fan

c) Reclaimer shed
Table 3-2: Internal noise measurements

<table>
<thead>
<tr>
<th>Start Time</th>
<th>Measured noise level, dB(A) L_{Aeq}</th>
<th>Measurement Location</th>
<th>CS2 Dust collector fan</th>
<th>CS2 / CS3 / CS4 Dust collector fan</th>
<th>Main gantry fan</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:07pm</td>
<td>80</td>
<td>CS2 / CS3 / CS4 Dust collector fan at 1m</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>8:09pm</td>
<td>87</td>
<td>CS2 Dust collector fan at 1m</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>8:17pm</td>
<td>109</td>
<td>CS2 Dust collector fan at 1m</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>8:18pm</td>
<td>101</td>
<td>CS2 / CS3 / CS4 Dust collector fan at 1m</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>8:38pm</td>
<td>87</td>
<td>Main gantry fan at ~10m</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>8:42pm</td>
<td>76</td>
<td>Main gantry fan at ~10m</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
</tbody>
</table>

3.3 EXTERNAL NOISE MEASUREMENTS

External noise measurements were conducted between 7:20pm and 10:20pm at locations L1 (corner of Alfred Street and Hargrave Street) and L2 (corner of Victoria Road and Gunn Street) as annotated on Figure 3-2. Unattended continuous noise monitoring was undertaken at location L1 and attended noise measurements were conducted at locations L1 and L2.

Figure 3-2: External noise measurement locations [7]
3.3.1 ATTENDED NOISE MEASUREMENTS

Attended noise measurements were conducted at both location L1 and L2 as annotated on Figure 3-2. The provided noise levels are indicative and only useful as a guide. These noise measurements were affected by inclement weather conditions. Wet ground conditions typically increase the reflectivity of the ground and generally increase noise levels. These noise measurements were conducted over short periods as to provide indicative noise data with respect to changing plant configurations at ABC. Although an attempted to exclude road traffic noise was made, it is likely that due to the time at which the noise measurements were conducted (7:20pm – 10:20pm) they were still influenced by distant road traffic noise.

<table>
<thead>
<tr>
<th>Start Time</th>
<th>Duration</th>
<th>Location</th>
<th>Measured noise level, dB(A)</th>
<th>CS2 Dust collector fan</th>
<th>CS2 / CS3 / CS4 Dust collector fan</th>
<th>Main gantry fan</th>
<th>Calciner</th>
<th>Reclaimer</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:06pm</td>
<td>48sec</td>
<td>L1</td>
<td>54</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>8:17pm</td>
<td>53sec</td>
<td>L1</td>
<td>55</td>
<td>On</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>8:44pm</td>
<td>23sec</td>
<td>L1</td>
<td>53</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>8:47pm</td>
<td>1min 15sec</td>
<td>L1</td>
<td>53</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>8:58pm</td>
<td>2min 15sec</td>
<td>L1</td>
<td>54</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>9:08pm</td>
<td>1min 29sec</td>
<td>L1</td>
<td>54</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>9:23pm</td>
<td>1min 56sec</td>
<td>L1</td>
<td>54</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>9:42pm</td>
<td>17sec</td>
<td>L1</td>
<td>54</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>10:06pm</td>
<td>1min 48sec</td>
<td>L2</td>
<td>56*</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
</tbody>
</table>

*L_{A90} noise level used as noise measurement was affected by traffic noise.

3.3.2 UNATTENDED NOISE MONITORING

Unattended noise monitoring was conducted at location L1 between 7:20pm and 9:50pm. The results for the unattended noise monitoring are presented in Figure 3-3. The unattended noise measurements were heavily affected by frequent traffic noise along Victoria Road. The continuous equivalent noise level, L_{Aeq}, was influenced greatly by traffic noise. As noise from ABC did not vary greatly with respect to time the L_{A90} noise descriptor better represents the noise associated with ABC for the unattended noise measurements.

There was a discernible change in noise levels measured when the fans (i.e. CS2 / CS3 / CS4 Dust collector fan and CS2 Dust collector fan) were turned off and then when they were turned on again. This change is annotated on Figure 3-3. The main gantry fan was not discernible during the survey (On–Off) at the nearest receptors (L1), however the reclaimer was audible at the nearest receptors (L2).
Figure 3-3: Results from unattended noise monitoring located at corner of Alfred Street and Hargrave Street
4 RECOMMENDATIONS

Based on the noise measurements conducted, Vipac recommend that noise abatement measures be investigated for the fans (i.e. CS2 / CS3 / CS4 Dust collector fan and CS2 Dust collector fan) and reclaimer. Noise abatement measures for the fans (i.e. CS2 / CS3 / CS4 Dust collector fan and CS2 Dust collector fan) i.e. cleaning, adjustments and balancing of the fans will be conducted by ABC in conjunction with Vipac as a preliminary measure. Vipac then will measure the noise of the fans and reassess whether further noise treatment is required.

Noise abatement measures have previously been applied to the reclaimer (replacing the entire chain assembly). Further noise abatement measures to be applied to the reclaimer shed will be postponed until after the noise from the remainder of the plant has been investigated during January 2017 shutdown period. This will allow for a more accurate understanding of the noise impact from the reclaimer at the nearest noise sensitive receivers and understand the contribution of noise from the remainder of the plant.

It is understood that ABC have an ongoing process of monitoring, measurement and noise abatement projects to reduce any noise impacts emanating from the plant. During the January 2017 shutdown, ABC have scheduled to overhaul and harmonise the three largest plant fans, which includes the Bypass, 4A & 4B stack fans, in attempt to reduce noise from these sources.

We trust that the information provided is satisfactory. However, if you have any queries or require further information, please do not hesitate to contact us.

Yours sincerely,

Vipac Engineers & Scientists Ltd

Matthew Tripodi
Acoustic Consultant

Pablo Gasalla
Senior Vibro-Acoustic Engineer

Attachments:

Appendix A: Glossary of Acoustic Terminology
Appendix A : GLOSSARY OF ACOUSTIC TERMINOLOGY

**dBA**
A unit of measurement, decibels(A), 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.

**L_{10}**
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)]. Nominal measurement period is usually 15 minutes.

**L_{90}**
The noise level which is equalled or exceeded for 90\% of the measurement period. L_{90} or L_{95} 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}**
The equivalent continuous noise level for the measurement period, weighted for duration and intensity. L_{eq} is an indicator of the average noise level [usually in dB(A)].

**L_{max}**
The maximum noise level for the measurement period [usually in dB(A)].

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

A 3dBA change in sound pressure level is just noticeable or perceptible to the average human ear; a 5dBA increase is quite noticeable and a 10dBA increase is typically perceived as a doubling in loudness.

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19 Aug 2016

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