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**sol**  
acoustics

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## Acoustic Design Note 015

### Review of Vale of Glamorgan Council's Memorandum: RA1-2215/17, dated 4 May 2018

This Acoustic Design Note (ADN) provides a review of comments raised by the Vale of Glamorgan Council (VGC) in their Memorandum, ref: Ra1-2215/17, dated 4 May 2018 (albeit received by Sol Acoustics for comment during August 2018), in reference to Sol Acoustics' Environmental Noise Impact Assessment Report, ref: P1714-REP02-Rev A-SJF, dated 14<sup>th</sup> July 2017.

For ease of reference, this Design Note cites all comments raised by the NRW in **Red** followed by Sol's response.

## 1. Acoustic Features

### VGC's Comments:

*'...The Sol Noise Impact Assessment has not independently considered tonality, impulsivity, or intermittency when referring to the standard. When considering all three acoustic features, totalled, they can give a combined acoustic penalty of 15dB.'*

*It is stated that a penalty of +3dB has been given in order to allow for all acoustic features. Each acoustic feature must be judged on its own merits and not given a combined penalty. It is not of the essence of the standard to give a rating in this way. If the acoustician decides that it is not necessary to consider the above factors, reasons and justification for omitting must be made. However, due to the acoustic features not being individually considered, this means that the initial assessment of noise impact described in Section 6.0 has possibly been underestimated by up to 12dB.'*

### Sol Acoustics' Response:

It is clearly the case that noise from individual plant and processes cannot, by definition, be considered prominently tonal and/or impulsive at a noise sensitive receptor if the Specific Level arising from their operation is at least 15dB below the typical night time background noise level (and in any event, acoustic tonality *et al* being significantly attenuated at source via the implementation of comprehensive Noise Mitigation Plan measures such as full, proprietary acoustic enclosure etc.).

Whilst individual noise sources associated with the Development are likely to generate noise with a particular acoustic character (i.e. such as tonal, impulsive intermittent features) when observed in isolation and at source (albeit significantly mitigated via measures prescribed within the Noise Mitigation Plan), such features would not be as prominent when observed when the remainder of the plant is running (i.e. there will be "masking" resulting from the simultaneous operation of hundreds of other plant and noise sources) and when observed at the noise sensitive receptor.

Further, it must be noted that the predicted Specific Level from the *entire and fully operating* site is, at worst just, 1dB above the existing "typical" Background Sound Level (dB  $L_{A90,15min}$ ) but significantly below (>10dB) the Residual Sound Level (dB  $L_{Aeq,T}$ ) in all instances.

Therefore, it simply cannot be the case that the acoustic character associated with the Development as a whole would be observed as being "highly" or "readily" perceptible, when observed against the existing environmental noise climate at the nearest noise sensitive premises, provided that the noise mitigation measures as prescribed by the Noise Mitigation Plan have been correctly, successfully and comprehensively installed. Therefore, in Sol's view, it is entirely incorrect, in this specific instance and context, to claim the assessment has been "*underestimated by up to 12dB*".

Taking these factors into account, a precautionary +3dB penalty for sound that might be 'readily distinctive' was considered to be appropriate for this assessment.

Regardless, it is the case that during the acoustic commissioning phase, ongoing acoustic assessments will be undertaken to determine the noise impact occurring in actuality at each of the identified noise sensitive receptors. If significant acoustic characteristics are observed and attributable to any item of plant in actual practice, notwithstanding the findings of the Sol acoustic assessment (and detailed 3D computer noise models underpinning this assessment) this will be identified to the Client and Contractor, and subsequently the Permit Regulator and Local Planning Authority, and a series of noise mitigation measures, potentially above and beyond those stated in the project Noise Mitigation Plan and as further based upon best available techniques (BAT), will be explored to further mitigate the environmental noise impact.

## 2. Uncertainty

VGC's Comments:

*'... Section 10 of BS4142:2014 describes how an assessment needs to consider the level of uncertainty involved with the data and associated calculations that could affect the conclusion of the report. The Environmental Noise Impact Assessment makes no mention of the uncertainty involved with the data collection or the associated calculations. As a result, it is not certain whether the assessment presented by Section 6.0 is accurate or what the margins for error are.'*

*'As a result, it is possible that the results of the assessment presented in Section 6.0 are an overestimation of the true value, but equally the results could be an underestimation. In relation to the magnitude of the over or underestimation, it is likely to be at least 1dB due to the uncertainty involved with Class 1 Sound Level Meters, however is likely to be more due to the other steps involved in the calculation and assessment process...'*

Sol Acoustics' Response:

Section 10 of BS4142: 2014 states the following with regards to uncertainty (emphases added):

*'... Consider the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, **take reasonably practicable steps to reduce the level of uncertainty**. Report the level and potential effects of uncertainty. ...'.*

It is clear, therefore, that BS4142: 2014 requires that the level of uncertainty be considered as part of the assessment. It is not, in Sol's view, a requirement of BS4142 that the level of uncertainty must be numerically quantified. Indeed, there is no prescriptive method presented within BS4142 to quantify the level of uncertainty for a given situation.

As part of the assessment, the following measures were taken with a view to limit the level of uncertainty arising:

- The background noise levels were recorded at three separate measurement positions, and over an extensive monitoring period (over 12 consecutive days) to ensure that the measured background noise levels were not unduly affected by environmental factors or spurious / atypical events (such as road closures due to traffic incidents etc). Further, weather conditions were recorded throughout the survey to ensure that the measurement results were not unduly affected by adverse weather conditions.
- Calculations have been conducted in line with appropriate and nationally recognised acoustic standards (ISO 9613-2, BS12354: 2000), and using *proprietary* 3D noise modelling software, CadnaA, as duly recognised by Local Authorities and other UK Regulatory Bodies. (It should also be noted that CadnaA modelling files have been specifically issued and provided by Sol for Third Party expert peer review purposes at the time of report submission, all as part of its environmental noise report and assessment).
- In the absence of appropriate noise level data provided by the suppliers for a number of key noise sources, Sol carried out its own, dedicated Biomass Plant noise assessment at a similar site in Enna, Sicily, to measure, augment and further validate the assessed noise levels generated by similar plant in-situ for the purposes of obtaining accurate and representative noise level data.

On this basis, it is clear that Sol has considered the potential impact of uncertainty throughout the assessment process, and, in line with the requirements of BS4142: 2014, has taken all reasonable steps to reduce the level of uncertainty expected.

### 3. Background

#### *VGC's Comments:*

‘...When referring to BS4142: 2014 The Sol Environmental Noise Impact Assessment has not compared the lower rating level (as advised in the British Standard) to the measured background sound level.

When looking at typical background noise, if the Environmental Noise Impact Assessment had considered the worst case *typical* background noise level per site, the background noise level would have been 2-3dB lower than reported. This equates to a potential overestimation of the background noise levels by 2-3dB and a subsequent underestimation of the assessment of the impacts in in Section 6.0 by 2-3dB per site.

By comparing the *typical* background noise level for each site with the  $L_{A90, 15min}$  plot there appears to be considerable periods where the measured background levels drop below *typical* background noise level for a many hours at a time and by a considerable margin. This raises question as to the validity of choosing such *typical* levels.

For example, if the process is repeated for graph B1 it can be seen that the measured background levels drop below the *typical* background noise levels for 10 of the 12 night-time periods, again sometimes for 4-5 hours at a time, sometimes dropping by as much as 5-10dB below the “typical” background noise level.

If the process is repeated for graph B2 it can be seen that the measured background levels drop below the *typical* background noise levels for every one of the 11 night-time periods, again sometimes for 4-5 hours at a time, sometimes dropping by as much as 12-13dB.

Again, if the *typical* background noise level is plotted on to graph B3 it can be seen that for the night time periods the measured background noise levels dropped below the *typical* background noise levels for 8 out of the 12 night-time periods, sometimes for 4-5 hours at a time, dropping by as much as 5-10dB below the “typical” background noise level.

As a result of these points it can be said that the *typical* background noise levels that have been chosen are not actually representative of the noise environment at sites 1, 2 and 3 given the context of the area. It could be argued, in fact, that the background noise level could be 5dB lower than the *typical* background noise levels chosen, possibly more. Subsequently, it could be argued that the assessment of impacts has been considerably underestimated in Section 6.0, perhaps by 5dB, maybe much more...’

*Sol Acoustics' Response:*

It should be noted that BS4142: 2014 does *not* provide an absolute, prescriptive or formulaic method for determining a typical background noise level but does provide some *guidance* for determining a suitable background noise level, as follows (emphases added):

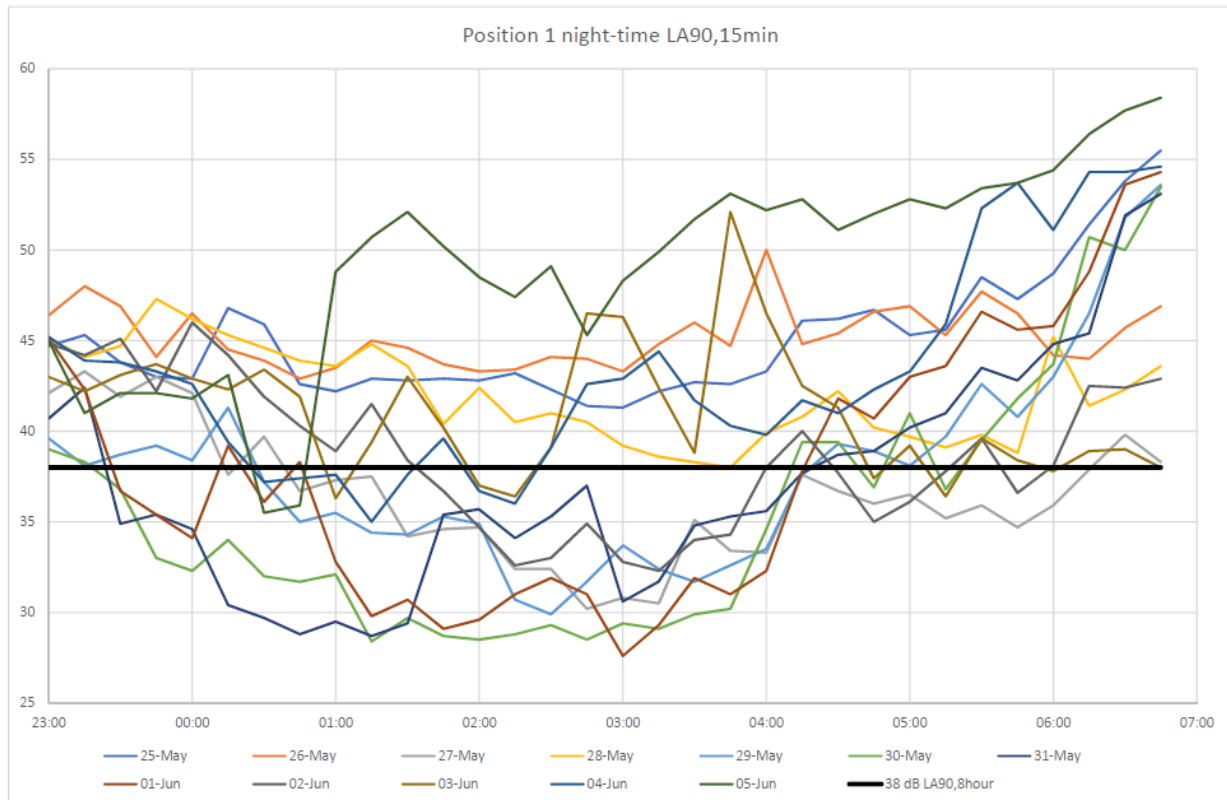
*'... In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, **the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods.***

*Among other considerations, diurnal patterns can have a major influence on background sound levels and, for example, **the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes.** Furthermore, in this general context it can also be necessary to separately assess weekends and weekday periods. ...'.*

The selected, typical background noise level has been determined based upon statistical analysis of the noise level data obtained from each individual daytime and night-time period (as over a number of consecutive days and nights so as to ensure a good sized data sample upon which to base such analysis), but also by considering the time of night in particular, upon which each background noise level was recorded.

In the majority of cases, the modes and median of the data set for each separate daytime and night time period has been considered. However, in the case of the recorded night time background noise levels, care has been taken to ensure that the resultant typical background noise level reported for each period is not unduly affected by the background noise levels as recorded during periods which are specifically considered by BS4142 to be of "*lesser importance*".

As an example, Figure 1 presents the full set of night time background noise levels as recorded at Measurement Position 1 during the noise survey. The results of the background noise levels are compared to the derived typical night-time background noise level of 38dB  $L_{A90,8\text{hour}}$  as reported for this measurement position:



**Figure 1:** Summary of all recorded night time background noise level at Position 1, dB  $L_{A90,15min}$

The following observations can be made from the Figure:

- During the more critical periods of the night time (i.e. between 23:00 – 00:00 hours and 06:00 – 07:00 hours), the as-measured 15-minute background noise levels during each night time period rarely, if at all, drops below the derived typical background noise level of 38dB  $L_{A90,8hour}$ .
- There are a number of dates where the as measured night time 15-minute background noise levels do not drop below the derived typical background noise level *at any point*.
- Whilst there are some periods where the background noise level drops below the derived background noise level, these generally occur at such times of the night which are specifically considered by BS4142 to be of “*lesser importance*”, as per the excerpt from the Standard cited herein.
- The results of the survey do not suggest a significant difference between the background noise levels as recorded during weekdays, weekends and bank holidays. Therefore, and in order to simplify the assessment, a single typical background noise level has been reported at each measurement position for both the daytime and night time periods.

On this basis, Sol believes that the derived *typical* background noise levels, as used within its acoustic assessment are entirely appropriate and in keeping with the requirements of BS4142: 2014.



#### **4. Consideration of Low Frequency Noise**

VGC's Comments:

*'...There are also concerns about the potential for Low Frequency Noise affecting nearby noise sensitive receptors.*

*Appendix E of the Environmental Noise Impact Assessment provides the expected noise levels of each piece of equipment, including octave band levels, and the mitigation measures that are to be installed. Appendix F of the Environmental Noise Impact Assessment provides the expected Sound Reduction Index for each building element for each of the new buildings that are to be installed.*

*Appendix G takes the information from Appendices E and F and provides details of the composite Sound Reduction Index for the buildings and details the expected reverberant Sound Pressure Level that would exist within the building when the site is operating.*

*By comparing the expected reverberant sound pressure level and the composite Sound Reduction Index it is possible to predict the likely noise breakout from the building. There are concerns that the low frequency noise, in particular that in the 63Hz and 125Hz Octave Bands have not been adequately considered at the measurement positions.*

*For example, Appendix G examines the noise breakout for the Reception Building. Page 69 states that the composite Sound Reduction Index for 63Hz ranges between 8 and 9dB for the facades and the roof. For the 125Hz Octave Band the composite Sound Reduction Index (SRI) ranges between 12-15dB. However, page 71 states that the corrected Reverberant Sound Pressure Level (SPL) for 63Hz is 81dB and for 125Hz is 71dB. This means that the machinery noise immediately outside of the building is likely to be between 72- 73dB in the 63Hz Octave Band and between 56-59dB for the 125Hz Octave Band.*

*A similar pattern is found for the Main Process Building (corrected reverberant SPL of 83dB in 63Hz octave band and 77dB in 125Hz octave band but a composite SRI of 12-16dB for the 63Hz octave band and 13-20dB for the 125Hz octave band).*

*Again, the same pattern is present for the lean to building (corrected reverberant SPL of 100dB in 63Hz octave band and 100dB in 125Hz octave band but a composite SRI of 13-16dB for the 63Hz octave band and 13-19dB for the 125Hz octave band).*

*The pattern is also present for the Turbine Building (corrected reverberant SPL of 75dB in 63Hz octave band and 75dB in 125Hz octave band but a composite SRI of 11-14dB for the 63Hz octave band and 14-19dB for the 125Hz octave band.)*

*As a result of the above points the Environmental Noise Impact Assessment must compare the predicted noise levels in the different octave band levels at each measurement position, especially the 63Hz and 125 Hz octave bands, with the measured background noise levels in the different octave bands. This will allow the assessment to fully understand the context of the noise and allow a better understanding of what mitigation measures may be needed to control the noise from site. As it currently stands, low frequency noise is likely to have a detrimental impact on amenity...'*

**Sol Acoustics' Response:**

When assessing for low frequency noise, or for any other distinguishable character, it is appropriate to consider the noise level contribution from the Development site in its entirety. Table 1 below presents the as Octave-band Specific Level expected at the nearest and worst affected noise sensitive receptors. Note that the octave band noise levels have been A-weighted to account for the response of the human ear.

NSR	Period	A-Weighted Octave- Band Specific Level at the Worst Affected NSR, dB(A) $L_{eq}$								dB $L_{Aeq,T}$
		63	125	250	500	1k	2k	4k	8k	
Dock View Road	Daytime (07:00 – 23:00)	28	32	32	36	38	36	24	-9	43
	Night-time (23:00 – 07:00)	26	32	30	32	32	27	16	-16	38
Cory Way	Daytime (07:00 – 23:00)	28	30	32	33	36	35	27	7	41
	Night-time (23:00 – 07:00)	27	29	30	30	32	31	25	5	38

**Table 1:** As predicted Specific Level at the worst affected NSR

It can be seen from Table 1 that there is no significant low frequency noise component associated with the combined noise level contribution expected from the Development site. For example, referring to the table, the predicted 63Hz low frequency Specific Noise Level at any receptor is invariably at least 11dB lower than the corresponding overall, A-weighted Specific Noise Level (i.e. the low frequency component of the overall predicted noise level is much lower than the headline, overall A-weighted value).

Regardless, it should again be noted that during the acoustic commissioning phase, ongoing acoustic assessments will be undertaken to determine the noise impact actually occurring at each of the identified noise sensitive receptors, including in specific low frequency noise terms.

If significant acoustic characteristics are observed and attributable to any item of plant in actual practice, notwithstanding the findings of the Sol acoustic assessment (and detailed 3D computer noise models underpinning this assessment) this will be identified to the Client and Contractor, and subsequently the NRW, and a series of noise mitigation measures, potentially above and beyond those stated in the project Noise Mitigation Plan and as further based upon best available techniques (BAT), will be explored to further mitigate the environmental noise impact (including in low frequency terms, as applicable and appropriate).

## 5. Conclusion

### *VGC's Comments:*

*'...Having reviewed the Environmental Noise Impact Assessment this department has concerns about the conclusions presented in Section 6.0 as such believes that there will be a detrimental impact on amenity. Whilst we do not object to the application, this memo identifies concerns with noise break out and in particular, low frequency noise.*

- 1. The initial assessment of the likely impact of the site appears to significantly underestimate the initial assessment of impact, potentially up to 19dB.*
- 2. Low frequency noise has not been appropriately considered and likely to have a detrimental impact.*
- 3. There appears to be insufficient consideration of the context after the initial assessment of the impact, meaning that the impact assessment presented is incomplete.*
- 4. As the proposed mitigation measures cannot be considered appropriate at this stage it cannot be said that Best Available Techniques have been used to mitigate the noise from the site.*
- 5. Due to the levels of expected noise from the site, the measured background noise levels and the currently proposed mitigation package it has to be concluded that Statutory Nuisance enforcement would be likely if the site were to operate as planned.*

*Prior to full commissioning of the site, the developer shall provide the local planning authority with a scheme of works, agreed by the authority, identifying the above concerns and how they will mitigated. Once all works have been completed and agreed by the authority, can full commissioning commence...'*

*Sol Acoustics' Response:*

Taking into consideration the further information as presented within this ADN, Sol Acoustics do not accept that the Development will result in a '*detrimental impact on amenity*'. Please see below our specific comments to each point raised in VGC's memo:

1. As stated in the relevant sections herein, the "potential underestimation" is not accepted by Sol Acoustics for the reasons provided.
2. With regards to low frequency noise, it can be seen from Table 1 of this ADN that there is no significant low frequency noise component associated with the combined noise level contribution expected from the Development site at the worst affected noise sensitive receptors.
3. The main body of the VGC's memo does not make any reference to context. Therefore, please find overleaf our comments regarding the context of the Development. Taking these additional comments into consideration, Sol Acoustics does not believe that context has any significant impact on the findings of the assessment and does not accept that the current assessment is incomplete.
4. There are no specific comments within the main body of VGC's memo with regards to any noise mitigation measures put forwards within the Environmental Noise Impact Assessment and therefore it is unclear as to why VGC do not consider that '*Best Available Techniques have been used to mitigate the noise from the site*' and as such Sol Acoustics do not accept this comment.
5. Again, it is unclear, based upon the results of the assessment and the further details as presented within this letter as to why the VGC would consider that "*Statutory Nuisance enforcement would be likely if the site were to operate as planned*" as there is no reference to this in the main body of VGC's memo. As such, Sol Acoustics do not accept this comment.

*Sol Acoustics' comments on Context:*

In accordance with BS4142: 2014, the following three factors must be considered when determining the *context* of a sound:

- The absolute level of sound
- The character of the residual sound compared to the character and level of the specific sound
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions

The highest predicted Specific Level from the Development site expected outside the nearest noise sensitive receptors is 43dB  $L_{Aeq,16hours}$  during the daytime and 38dB  $L_{Aeq,8hours}$  during the night time.

These noise levels are not considered to be particularly loud, and, taking into consideration relevant design guidance as provided in BS8233: 2014, which provide guidance for desired absolute noise levels to be achieved within dwellings, and also within external gardens, taking into consideration the likely level of sound attenuation afforded by the external building fabric, the predicted noise levels are not expected to result in a loss of amenity either within the nearby residential premises or within the associated garden spaces in absolute noise level terms.

In terms of the character of the residual sound arising from individual plant and noise sources, in some cases involving plant and/or processes, which, in an unmitigated, unattenuated state may exhibit notable acoustic characteristics such as acoustic tonality et al (e.g. large fan plant such as ID fan), it is important to note that the Noise Mitigation Plan appertaining to the Development (and all as stated at length within Sol Acoustics' report and appendices) is specifically designed and intended to ameliorate such acoustic characteristics at source.

It should also be noted that the Noise Mitigation Plan specifically reduces the specific noise level of any major plant noise source, with full acoustic mitigation in place (e.g. ID fan within proprietary acoustic enclosure) to at least c.15dB below the typical night time background noise level at any noise sensitive receptor.

In acoustic terms, if a given noise source such as a major fan or other plant item is mitigated at source to remove or greatly reduce adverse acoustic characteristics such as tonality - via the use of a very high acoustic performance, proprietary acoustic enclosure and splitter attenuators either side of fans – and if it is furthermore the case that the resultant specific noise level arising from that major fan or other plant item is at least 15dB below night time background noise level in any event – then it can be clearly seen that by definition, the character of the specific sound, as compared to the pre-existing residual and background noise level will, by definition, be assessed as favourable.

In specific terms of context, it is also essential to note that the Development site is located alongside and in very close proximity to an existing, active Port, and also within a predominantly industrial area, with many active factory units directly adjacent to the Development. Many of these factory units have been directly observed as having very noisy (pre-existing) activities, plant and processes, including very frequent unmitigated open-door metal angle grinding, welding and metals handling resulting in significant, frequent impact sounds. Thus, it is clearly and unequivocally the case that in contextual terms, the existing and proposed residential premises site within the vicinity of the Development are already be exposed to noise of an industrial nature. Taking this into consideration, the Development proposals are clearly not out of context with the surrounding environment.

Taking all of the above into consideration, Sol believe that context does not have any significant effect on the result of the assessment.

Yours sincerely

For and on behalf of Sol Acoustics Limited

A handwritten signature in black ink, appearing to read 'B Horner', written in a cursive style.

Brian Horner MIOA  
Associate Director