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Marubeni Europower Ltd. Noise Impact Assessment

Hydrogen Refuelling Station, Swansea
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1. Introduction

- 1.1 Bureau Veritas was instructed by Marubeni Europower Ltd. to undertake a noise impact assessment for a proposed new Hydrogen Refuelling Station on brownfield land east of Amazon Ffordd, Crymlyn Burrows, Neath Port Talbot.
- 1.2 This assessment looks to ascertain the following:
- Identification of the closest Noise Sensitive Receptors (NSRs) to the Hydrogen Refuelling Station.
 - Establish daytime and night-time background sound levels at the nearest NSRs.
 - Preparation of an acoustic noise model with the inclusion of all noise generating equipment based on manufacturers and library data.
 - Creation of daytime and night-time colour contour noise plots to determine the noise levels of the new Hydrogen Refuelling Station incident on the nearest NSRs.
 - Assessment of noise impact at the nearest NSRs in line with the likely Local Authority requirements.
- 1.3 The noise impact assessment was facilitated by preparing a noise model using the CadnaA (version 2024) noise mapping software.
- 1.4 A glossary of acoustic terminology is included as Appendix A. The assessment criteria applicable to this site are reproduced in Section 3.
- 1.5 Scaled site plans of the proposed development were prepared by Garry Stewart Design Associates. A copy of the proposed site plan can be found in Appendix B.

2. Description of Site & Sensitive Receptors

- 2.1 It is understood that the new Hydrogen Refuelling Station will be located on brownfield land east of the Amazon distribution centre in Swansea, South Wales. The site is bounded by Ashleigh Terrace to the east, the A483 to the south, Ffordd Amazon to the west and Dainton Self Storage to the north.
- 2.2 It is understood the Hydrogen Refuelling Station will contain noisy equipment and process, including:
- Hydrogen Buffer Storage (500 and 900 bar);
 - Tube Trailer unloading;
 - HGV, bus & car refuelling dispensers (350 and 700 bar); and,
 - Ancillary infrastructure such as:
 - chillers;
 - high pressure compressors;
 - air compressor;
 - valve panel;
 - nitrogen cylinders;
 - electrical infrastructure; and,
 - critical spares storage.
- 2.3 The Hydrogen Refuelling Station is likely to be accessible 24 hours per day, but its operations will be sporadic, hence, a daytime and night-time assessment will be necessary. Due to the introduction of new noise sources in the area, it will be necessary to assess the impact of the new development at the nearest NSRs.

- 2.4 The nearest residential receptors are located on Ocean View approximately 250m north of the proposed development site. Other receptors that the Local Authority may deem to be sensitive are the Towers Hotel & Spa, the offices of Dainton Self Storage and Swansea Bay Golf Club and Course to the east.
- 2.5 The figure below shows the location of the proposed development site (red line) and sensitive receptors.

Figure 2.1: Location Plan & Sensitive Receptors



3. Criteria for Noise Assessment

- 3.1 Bureau Veritas have been commissioned as part of the planning process to undertake a noise impact assessment with a view to establishing whether the proposed development site is suitable for an industrial development.
- 3.2 The sounds caused by the proposed development are all considered as industrial noise, therefore British Standard 4142: 2014+A1: 2019 “*Methods for rating and assessing industrial and commercial sound*” is the main guidance for the assessment, along with the other relevant references, to assess the potential noise impact on the nearby sensitive receptors. The relevant guidance documents are listed below:
- Planning Guidance (Wales), Technical Advice Note (Wales) 11, Noise (TAN11);
 - British Standard BS 7445: 2003 – Description and Measurement of Environmental Noise – Guide to Quantities and Procedures;
 - British Standard 4142: 2014+A1:2019, “Methods for rating and assessing industrial and commercial sound” (BS4142);
 - British Standard 8233: 2014, “Guidance on sound insulation and noise reduction for buildings”;
 - IEMA Guidelines for Noise Impact Assessment; and,
 - ISO 9613-2:2024 ‘Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation’.

Planning Guidance (Wales), Technical Advice Note (Wales) 11, Noise (TAN11)

- 3.3 TAN 11 was introduced by the Welsh Government in October 1997. Paragraph 3 on page 1 of TAN11 indicates that it is intended to provide “advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which local planning authorities should take into account in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources.”
- 3.4 In relation to the assessment of new noise generating sources, TAN11 states that:
- “8. Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions.”*
- 3.5 Annex B of TAN 11 specifies that the assessment of potential noise disturbance from industrial and commercial developments (for this project this relates to M&E plant noise only) should be undertaken in accordance with BS4142:1990 (superseded by 2019 version, see below).

Planning Policy Wales Edition 12 | February 2024

- 3.6 Welsh local planning policy stipulates the following for a low carbon energy development.
- “Local authorities should facilitate all forms of renewable and low carbon energy development and should seek cross-department co-operation to achieve this. In doing so, planning authorities should seek to ensure their area’s full potential for renewable and low carbon energy generation is maximised and renewable energy targets are achieved. Planning authorities should seek to maximise the potential of renewable energy by linking the development plan with other local authority strategies, including Local Well-being plans and Economic/ Regeneration strategies.”*

Planning authorities should also identify and require suitable ways to avoid, mitigate or compensate adverse impacts of renewable and low carbon energy development. The construction, operation, decommissioning, remediation and aftercare of proposals should take into account:

- *the need to minimise impacts on local communities, such as from noise and air pollution, to safeguard quality of life for existing and future generations;*
- *the impact on the natural and historic environment;*
- *cumulative impact;*
- *the capacity of, and effects on the transportation network;*
- *grid connection issues where renewable (electricity) energy developments are proposed; and*
- *the impacts of climate change on the location, design, build and operation of renewable and low carbon energy development. In doing so, consider whether measures to adapt to climate change impacts give rise to additional impacts."*

British Standard 4142

- 3.7 BS 4142:2014+A1:2019 "Methods for rating and assessing industrial and commercial sound," sets out a method for assessing the likelihood of adverse impact from industrial noise. The standard has been used to set noise targets for any noise generating plant associated with the new development.
- 3.8 The standard compares the Rating Level of the noise source under investigation with the Background Sound Level. The Rating Level is obtained by measuring or predicting the Specific Noise Level from the source, in terms of $L_{Aeq,T}$, and applying a correction factor to account for the acoustic character of the noise.
- 3.9 The standard states that certain acoustic features can increase the significance of impact and hence a correction should be applied if the noise in question contains any tonality, impulsivity intermittency or has any other specific sound characteristics. The Background Sound Level is the $L_{A90,T}$ measured in the absence of the source.
- 3.10 The Background Sound Level ($L_{A90,T}$) is then arithmetically subtracted from the Specific Noise Level. The difference between the two is considered to reflect the likelihood of adverse impact. The standard states the following:
- "a) Typically, the greater this difference, the greater the magnitude of the impact.*
 - b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
 - c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
 - d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

Guidelines for Noise Impact Assessment (IEMA)

- 3.11 The Institute of Environmental Management and Assessment (IEMA) are recognised as good practice guidance for the scope and methodology for noise impact assessments.

- 3.12 These guidelines address the key principles of noise impact assessment and are applicable to all development proposals where noise effects are likely to occur. The guidelines state that for any assessment, the noise level threshold and significance should be determined based on specific evidence and likely subjective response to noise. New industrial noise may be perceived as a change in quality of life for occupants of dwellings or a perceived change in the acoustic character of an area. When considered collectively for groups of dwellings and their shared community open areas, such effects may be significant. An example of how the impact arising from a change in sound levels can be evaluated is presented in Table 3.1.

Table 3.1: Sensitivity of Receptor to Noise Level Exposure

	Large	Medium	Small	Negligible
Relative Change	Greater than 10 dB(A) change in sound level	5 to 9.9 dB(A) change in sound level	3 to 4.9 dB(A) change in sound level	2.9 dB(A) or less change in sound level

- 3.13 A combination of receptor sensitivity and magnitude of impact before is used to determine the overall degree of effect, as shown in Table 3.2. Substantial and Very Substantial effects are considered to be significant. For the purpose of this study, we have assumed private residential properties to be of "High" sensitivity and the hotel, offices and golf course to be of "Medium" sensitivity.

Table 3.2: Degree of Effect Matrix

		Importance/Sensitivity of Receptor			
		High	Medium	Low	Negligible
Magnitude of Change	Large	Very Substantial	Substantial	Moderate	None
	Medium	Substantial	Substantial	Moderate	None
	Small	Moderate	Moderate	Slight	None
	Negligible	None	None	None	None

- 3.14 The description of effects which correspond to the Degree of Effect matrix are shown in Table 3.3 below.

Table 3.3: Noise Effects Descriptors

Very Substantial	Greater than 10 dB L_{Aeq} change in sound level perceived at a receptor of great sensitivity to noise
Substantial	Greater than 5 dB L_{Aeq} change in sound level at a noise-sensitive receptor, or a 5 to 9.9 dB L_{Aeq} change in sound level at a receptor of great sensitivity to noise
Moderate	A 3 to 4.9 dB L_{Aeq} change in sound level at a sensitive or highly sensitive noise receptor, or a greater than 5 dB L_{Aeq} change in sound level at a receptor of some sensitivity
Slight	A 3 to 4.9 dB L_{Aeq} change in sound level at a receptor of some sensitivity
None / Not Significant	Less than 2.9 dB L_{Aeq} change in sound level and/or all receptors are of negligible sensitivity to noise or marginal to the zone of influence of the proposals

British Standard 8233:2014

- 3.15 BS 8233:2014 “Guidance on sound insulation and noise reduction for buildings,” provides recommendations for the control of noise in and around dwellings.
- 3.16 BS 8233:2014 suggests that an internal noise level of 30 dB $L_{Aeq,T}$ within bedrooms is desirable for the night-time (23:00 and 07:00). For living rooms and dining rooms, a design target of 35 dB and 40 dB $L_{Aeq,T}$ respectively is desired for the daytime (07:00 and 23:00). The criteria are summarised overleaf.

Table 3.4: BS 8233:2014 Criteria

Location	Activity	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Living Room	Resting	35 dB $L_{Aeq,16hr}$	-
Dining Room/area	Dining	40 dB $L_{Aeq,16hr}$	-
Bedroom	Sleeping (daytime resting)	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$
Gardens	-	50-55 dB $L_{Aeq,16hr}$	-

- 3.17 BS 8233 further states that gardens should not exceed an upper limit of 55 dB L_{Aeq} with a noise level of 50 dB L_{Aeq} or less desirable. These limits only apply to daytime noise levels.
- 3.18 The now surpassed, BS 8233:1999 stated that a partially open window, which allows ventilation provides approximately 10 – 15 dB(A) attenuation. For the purposes of this assessment, we have assumed 13 dB(A) attenuation.

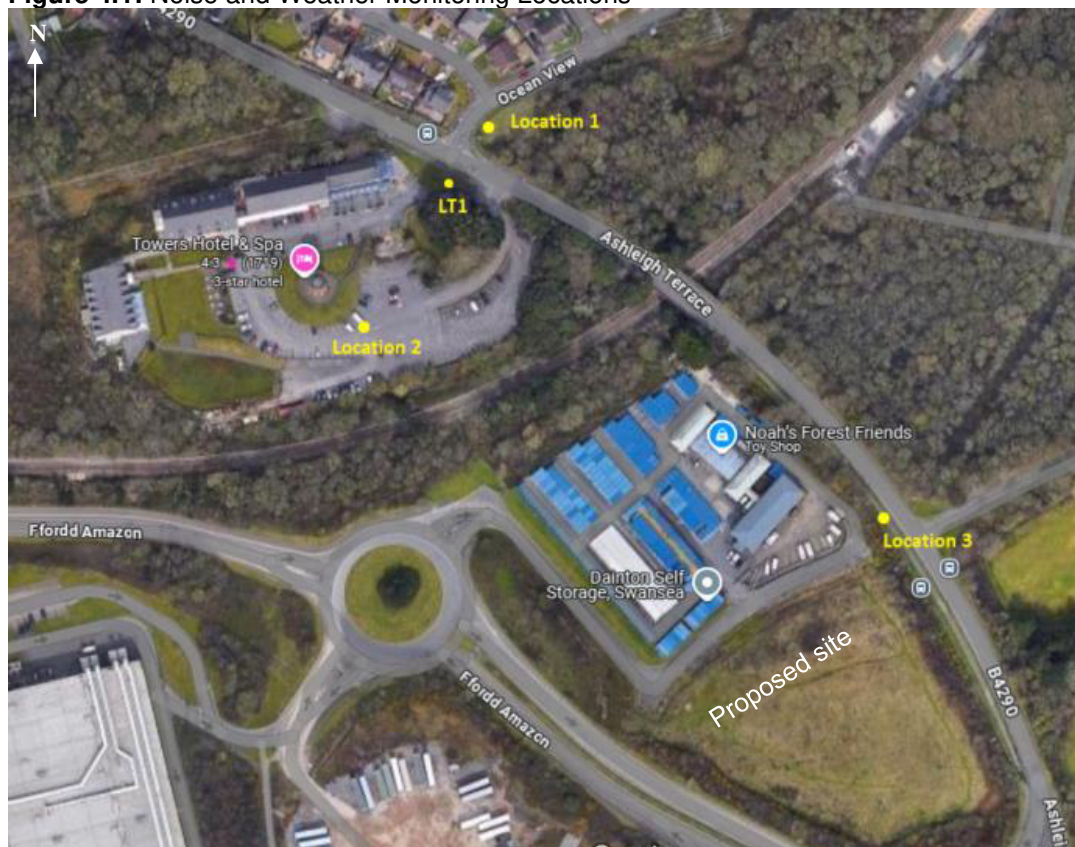
ISO 9613-2:2024 ‘Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation’

- 3.19 ISO 9613-2:1996 specifies methods for the description of sound outdoors in community environments. ISO 9613 can be applied to a wide variety of sound sources and includes methods to determine most of the major mechanisms of sound attenuation, such as:
- Geometric divergence (A_{div}) – spherical spreading of sound energy;
 - Atmospheric absorption (A_{atm}) – attenuation of sound due to interaction with the air (dependant on frequency of sound and negligible at short distances);
 - Ground effect (A_{gr}) – sound reflecting by the ground surface interfacing with the sound propagating directly from source to receiver;
 - Reflection from surfaces (image source method, included in A_{gr} calculation) – sound is reflected from hard surfaces such as building facades due to atmospheric impedance of the surface. This effect increases the sound level when compared to a location free of buildings (i.e., free field); and
 - Screening by obstacles (A_{bar}) – Hard obstacles such as close-boarded timber fences and varying topography, including hills attenuate the sound from a source due to the insertion loss properties of the obstacle. However, there is an element of the sound which will diffract around the obstacle, especially at lower frequencies. The diffraction effect is determined using the path differences between the direct and diffracted sound. It should be noted that the screening effect provided by trees and foliage is negligible in the majority of cases; the exception is large areas of dense forest or plantations.

4. Baseline Noise Survey

- 4.1 Attended and unattended noise surveys were undertaken close to the nearest noise sensitive receptors to establish typical baseline noise levels during the daytime and night-time.
- 4.2 Noise measurements were undertaken between the 16th and 17th December 2024, in free-field conditions with the sound level meter mounted on a pole approximately 1.3m above local ground level.
- 4.3 The noise monitoring equipment was calibrated before and after the measurement survey using an acoustic calibrator, which had itself been calibrated against a reference set traceable to National and International Standards. It is considered that no unusual events occurred during the survey period and the measurement data is considered to be a true and a fair representation of the ambient noise levels. No significant drift in calibration level was observed.
- 4.4 The sound level meter was set to record in 1-hour interval values for the daytime and 15-minute interval values for the night-time period, for the L_{A90} and L_{Aeq} indices.
- 4.5 Meteorological conditions during the noise survey period were dry, with winds not exceeding 5m/s. The conditions were considered to be conducive to carrying out ambient sound level measurements.
- 4.6 The location of the baseline noise surveys can be seen in Figure 4.1. The full results of the noise monitoring can be found in Table 4.1 and Figure 4.2 overleaf.

Figure 4.1: Noise and Weather Monitoring Locations

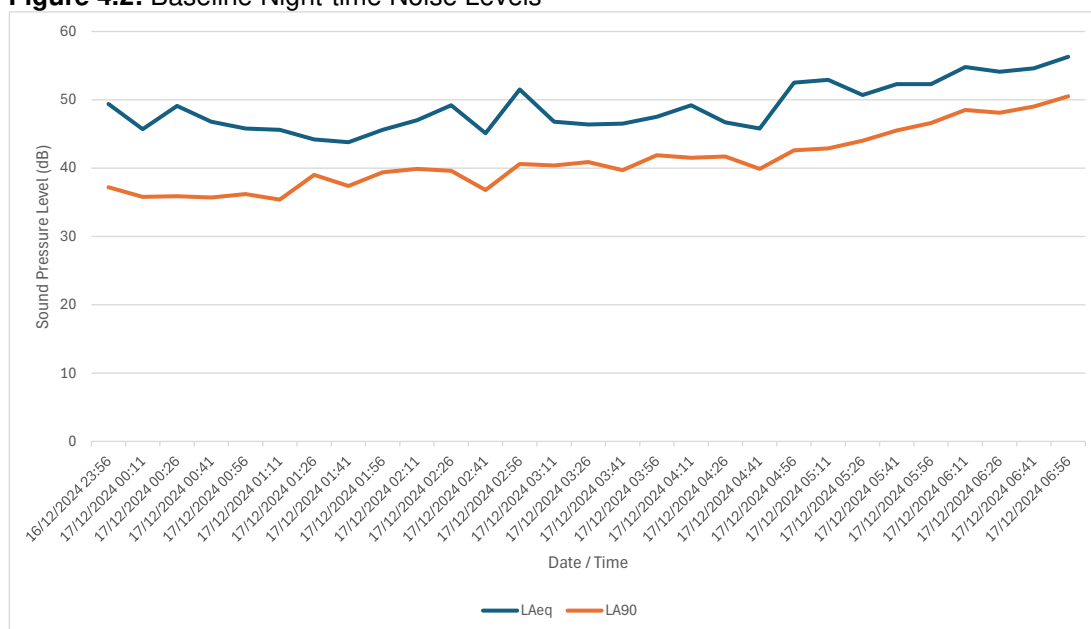


4.7 Attended noise measurements were made at:

- Location 1 - representative of residential dwellings on Ocean View;
- Location 2 - representative of the Towers Hotel & Spa; and,
- Location 3 - representative of the golf course.

4.8 Unattended baseline monitoring was also undertaken (at location LT1) to obtain additional data for the night-time period. It is considered that the monitoring location close to the hotel is representative of the nearest dwelling at Ocean View as well as the hotel. The results of the noise monitoring are summarised below. It was found that the area was dominated by local road and distant road traffic noise as well as noise from the nearby railway line and sporadic industrial noise.

Figure 4.2: Baseline Night-time Noise Levels



4.9 A statistical analysis was carried out in order to determine the typical Residual and Background sound levels during night-time (23:00 – 07:00). The mode of these descriptors, as described in BS 4142, was calculated during these time periods. The results can be seen in Table 4.1 below.

Table 4.1: Residual and Background Noise Levels

Meas. Location	Period	Start Time	Meas. Time	L_{Aeq} (dB)	L_{A90} (dB)	Notes
Location 1	Day	11:35	15min	57	52	Road traffic noise dominant from B4290 & A483. Slight hum of power lines slightly audible in background lulls.
	Night	23:12	15min	52	40	
Location 2	Day	11:18	15min	57	55	Traffic noise dominant from A483. Activity from Amazon also slightly audible
	Night	23:30	15min	46	43	
Location 3	Day	11:55	15min	65	56	Road traffic noise dominant from B4290 & A483.
LT1	Night	23:00-07:00	8hr	46	40	Noise climate dominated by road traffic (representative of Ocean View and Hotel).

5. Noise Model

- 5.1 An acoustic model has been created showing the impact of the proposed new Hydrogen Refuelling Station using CadnaA noise mapping software (Version 2024). The software calculates the contribution from sources, input as a point, line or area source at defined locations.
- 5.2 The model predicts noise levels based on hemispherical propagation, atmospheric absorption, ground effects, in plant reflections, screening and directivity based on the procedure detailed in ISO 9613-2, "Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation".
- 5.3 The model has been run using a receiver height of 1.5 metres above grade, equivalent to ear level at standing height for the daytime and 4.0m above grade for the night-time to account for first floor bedrooms. The model accounts for equal sound radiation of noise sources in all directions.
- 5.4 ISO 9613-2 gives the estimated accuracy of the noise model as ± 3 dB, for the calculation of broadband A-weighted sound levels, for receiver distances of up to 1 km. The standard also states that errors in the calculation of individual octave bands may be somewhat larger than the estimated errors given for broadband A-weighted sound levels.

Acoustic Model Inputs

- 5.5 Noise data from manufacturer's technical data sheets has been included for the identified equipment associated with the Hydrogen Plant. A summary of the data used for the noise model can be seen in Figures 5.1 and 5.2 below.

Table 5.1: Acoustic Model Inputs

Equipment	No.	Status	Duration	Time of Day	Description	Noise Level (dB)
Compressors (part of container unit)	2	Active	4hrs	0600 - 1000	1 MP booster + 1 HP booster. Active to fuel 10 buses in 4-hour window.	95 L_p @ 1m from container
Compressors (part of container unit)	2	Active	4hrs	1800 - 2200	1 MP booster + 1 HP booster. Active to fuel 10 buses in 4-hour window.	95 L_p @ 1m from container
Compressors (part of container unit)	2	Active	20mins - Intermittent	0700 - 2300	1 MP booster + 1 HP booster. Active to fuel circa 10 HGVs whenever they arrive. Circa 20min fill time expected.	95 L_p @ 1m from container
Compressors (part of container unit)	2	Active	Unknown	1800 - 0600	Used to re-fill MP and HP storage tanks overnight after depletion during the day.	95 L_p @ 1m from container
Compressors (part of 2nd container unit)	2	Dormant	-	-	Used as backup or emergency	-
Compressors (part of 2nd container unit)	2	Dormant	-	-	Used as backup or emergency	-
Compressors (part of 2nd container unit)	2	Dormant	-	-	Used as backup or emergency	-

Equipment	No.	Status	Duration	Time of Day	Description	Noise Level (dB)
Compressors (part of 2nd container unit)	2	Dormant	-	-	Used as backup or emergency	-
Process Cooler (Compression Chiller)	1 cooler unit	Active	Intermittent	24h	Used to cool compressors as required.	59 L_p @ 1m
Process Cooler (Compression Chiller), Adjacent to 2nd container unit	1 cooler unit	Dormant	-	-	-	-
Dispenser vents	4x dispensers	Active	Intermittent	During fill events	Intermittent vent noise during fill events. Approximately 1 second at end of fill event.	96 L_w
Hydrogen Chiller	1 chiller unit	Active	20mins - Intermittent	0700 - 2300 window	Active during HGV 700bar refuelling events.	80 L_p @ 1m
Hydrogen Chiller, Adjacent to 2nd container unit	1 chiller unit	Dormant	20mins - Intermittent	-	-	-
Tube Trailer Deliveries	2x deliveries/day	Active	30mins per delivery and changeover	e.g 0800 – 0830 & 1700 - 1730	Tube trailer delivered and connected up to refuelling infrastructure. Spent trailer swapped out and removed.	105 L_w
Air Compressor	1x unit	Active	Intermittent	24h	Used to compress air for distribution through instrument panels	73 L_w
Hydrogen Bus	24/day	Active	Intermittent	24 buses / day (0600 - 2200 window)	Offtakers of hydrogen	85 L_w
HV substation ('DNO' building)	1	Active	Continuous	24h	Power intake and distribution from Grid to site.	75 L_w
Hydrogen HGVs	10/day	Active	Intermittent	0700 - 2300 window	Offtakers of hydrogen	85 L_w

- 5.6 In addition to the noise sources above, non-noise generating structures have also been modelled such as an admin building, driver's rest room, stores and concrete fire wall (3.5m high).

Assumptions and Limitations

- 5.7 All machinery was modelled to be operational for both the daytime and night-time periods, thus representing a worst-case scenario.
- 5.8 In terms of ground effect, a low ground absorption was used, i.e. hard terrain.
- 5.9 Conservative climatic conditions, favourable to noise propagation were selected i.e. downwind conditions. It is envisaged however that due to the short propagation distance to which the receptors lie, atmospheric conditions will have very little impact of projected noise levels.

6. Assessment

Results

- 6.1 The results of the noise model have been used to generate colour contour noise plots (see Appendix D) which aid the assessment of the suitability of the site for the new Hydrogen Refuelling Station.
- 6.2 Table 6.1 below shows the calculated worst-case noise levels at the façades of the nearest sensitive receptors to the new Hydrogen Refuelling Station.

Table 6.1: Predicted Noise Levels at Nearest Receptors

Location	Period	Noise Level $L_{Aeq,T}$ (dB)
Ocean View (private dwellings)	Daytime	38
	Night-time	36
Towers Hotel & Spa	Daytime	40
	Night-time	37
Dainton Self Storage (first floor offices)	Daytime	56
Swansea Bay Golf Club	Daytime	46

BS 4142 Assessment (For the Assessment of Residential)

Establishment of Rating Level

- 6.3 According to BS 4142, where certain acoustic features of the Specific Sound Level can increase the significance of impact, a character correction should be applied to provide a Rating Level. The characteristics of a sound that are likely to cause an increase in the significance of impact are tonality, impulsivity, intermittency or other characteristic features such “where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment”. Taking the above acoustic features into consideration, the rating penalties is as follow

- Tonality: the noise emitted by the Hydrogen Refuelling Station is likely to be characterised by the compressors, and is therefore considered to be broadband, and non-tonal.
- Impulsivity: no impulsive characterises are anticipated from the Hydrogen Refuelling Station and machinery will run smoothly and continuously. It is possible that the HGV movements may be impulsive, however, they are unlikely to be audible at the nearest residential receptor and the noise climate is already completely dominated by vehicular traffic, therefore, no additional correction is required.
- Intermittency: some plant will have identifiable on / off conditions; therefore, a correction of +3 dB for intermittency is required.
- Other sound characteristics: The predicted Specific Level due to the Development is low, and the primary sources of noise (compressors) are broadband, meaning the Residual Noise at the residential receptors is likely to dominate over any new industrial noise such that it is masked.

- 6.4 Based on the above, a +3 dB character correction for acoustic features has been applied to the Specific Sound Level for the purposes of calculating a Rating Level. The methodology outlined in BS 4142 is only intended to be used to assess the impact on residential receptors. We have therefore undertaken this BS4142 assessment for the impact of industrial noise on residential dwellings of Ocean View.

Daytime Assessment

- 6.5 Based on the daytime noise modelling output, the Specific Sound Level has been calculated to be 38 dB at the closest residential dwelling on Ocean View. Using a character correction of +3 dB as discussed above, a Rating Level for these residential receptors has been established and compared with the representative background sound level. Based on this information, a daytime BS 4142 assessment was carried out and the outcome is displayed in the table below.

Table 6.2: BS 4142 assessment (Daytime)

Results	Noise Level (dB)	Notes
Residual Sound Level ($L_{Aeq,1h}$)	57	Taken from Table 4.1
Specific Sound Level ($L_{Aeq,1h}$)	38	Specific sound level calculated from the CadnaA noise model (see Table 6.1 & Appendix D)
Character Correction	+3	Correction added for intermittency
Rating Level ($L_{A,T}$)	41	
Background Sound Level (L_{A90})	52	Modal background taken from Table 4.1
Excess of rating over background sound level	-11	Assessment indicates low impact due to context, see below.
Context	Noise from road traffic is significant at the nearest residential receptors, and the Rating Level is predicted to be significantly below the Background Sound Level. Additionally, the Residual Noise Level is high and will help to mask noise from these new sources. During the daytime, the desirable noise level for garden amenity as stipulated in BS8233 is 50 dB and it can be seen that the Specific Noise Level of the Hydrogen Refuelling Station (38 dB) is expected to meet this threshold at the nearest dwelling.	

- 6.6 It can be seen from the table above, that the Rating Level is predicted to be -11 dB below the Background Sound Level for the nearest dwelling during the daytime. BS 4142 suggests that, *"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context"*.
- 6.7 It is therefore considered that because the Background Sound Level is not being exceeded the impact will be low during the daytime.

Night-time Assessment

- 6.8 Based on the night-time noise modelling output, the Specific Sound Level has been calculated to be 36 dB at the nearest houses on Ocean View. Using a character correction of +3 dB as discussed above a Rating Level for nearest receptors has been established and compared with the representative background sound level. Based on this information, a night-time BS 4142 assessment was carried out and the outcome is displayed in the table below.

Table 6.3: BS 4142 assessment (Night-time)

Results	Noise Level (dB)	Notes
Residual Sound Level	46	Taken from Table 4.1
Specific Sound Level ($L_{Aeq,1h}$)	36	Specific sound level calculated from the CadnaA noise model at ground level (see Appendix D)
Character Correction	+3	Correction added for intermittency
Rating Level (L_{ArT})	39	
Background Sound Level (L_{A90})	40	Modal background taken from Table 4.1
Excess of rating over background sound level	-1	Assessment indicates low impact due to context, see below.
Context	Noise from road traffic is significant at the sensitive receptors, and the Rating Level is predicted to be below the Background Sound Level by -1 dB at the nearest dwelling. Additionally, the Residual Noise Level of 46 dB is significantly greater than the Specific Sound level hence this will help to mask noise from these new industrial sources. Additionally, the sensitive receptor is indoors at night. BS8233 stipulates that bedroom noise levels should not exceed 30 dB. Allowing for a partially open windows (i.e. -13 dB) internal levels from noise associated with these new sources are predicted to be 23 dB, thus meeting the criterion.	

- 6.9 It can be seen from the table above, that the Rating Level is predicted to be -1 dB below the Background Sound Level during the night-time. BS 4142 suggests that, *"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context"*.
- 6.10 It is therefore considered that because the Background Sound Level is not being exceeded at the nearest dwelling and the fact that the sensitive receptor is indoor at night, with the criterion of BS8233 being met, the impact of the new development will be low during the night-time.

Internal Levels (Assessment of Hotel & Offices)

- 6.11 Internal noise levels have been calculated based on the performance of a partially open window. Information on this is contained within the now surpassed, BS 8233:1999, which stated that a window which allows for ventilation provides approximately 10 – 15 dB(A) attenuation. For the purpose of this assessment, we have assumed -13 dB(A) attenuation.
- 6.12 The criteria provided in BS 8233:2014 has been used to benchmark the predicted internal noise levels for the nearby offices and hotel. BS 8233:2014 stipulates that noise levels in open plan offices should not exceed $L_{Aeq,T}$ 45-50 dB and for hotel bedrooms, internal ambient noise levels should be between $L_{Aeq,T}$ 35-45 dB during the daytime and $L_{Aeq,T}$ 25-35 dB at night. The internal noise levels calculated are displayed in Table 6.4.

Table 6.4: Predicted Internal Noise Levels at Hotel & Offices

Location	Period	Criterion $L_{Aeq,T}$ (dB)	External Level L_{Aeq} (dB)	Internal Level (-13 dB with an open window)	Criterion Met?
Dainton Self Storage (first floor offices)	Daytime	45-50	56	43	✓
Towers Hotel & Spa (first floor rooms)	Day	30-40	40	27	✓
	Night	25-35	37	24	✓

6.13 It can be seen from the results above, that internal noise levels arising from the Hydrogen Refuelling Station at the nearest first floor offices of Dainton Self Storage and the Towers Hotel, with windows partially open, are likely to meet the BS 8233 noise limits.

6.14 Furthermore, it should be reiterated that the predicted noise levels from the proposed Hydrogen Refuelling Station are significantly below the existing ambient noise levels at both receptor locations, for the respective assessment periods.

Assessment of Golf Course

6.15 At the most exposed part of Swansea Bay Golf Club, the predicted noise level from the Hydrogen Refuelling Station will be $L_{Aeq,16h}$ 46 dB during the daytime. For the purpose of this assessment, the Golf Course sensitivity has been classed as “Medium”. Table 6.5 below shows the significance of effect for noise arising from the new Hydrogen Refuelling Station.

Table 6.5: Swansea Bay Golf Club Degree of Effect Noise Assessment

Receptor	Baseline without Development $L_{Aeq,T}$ dB	Predicted Plant Noise $L_{Aeq,T}$ dB	Future with Plant Noise $L_{Aeq,T}$ dB	Change in dB	Relative Change	Degree of Effect
Swansea Bay Golf Club	65	46	65.1	+0.1	Negligible	None

6.16 The table above indicates that the Swansea Bay Golf Club is likely to experience a ‘negligible’ impact in terms of noise increase with the operation of the new Hydrogen Refuelling Station as only a 0.1 dB increase in noise is expected. The degree of effect was found to be ‘none’ and it is likely that there will be no perceivable change in noise level due to the operation of the new development.

7. Conclusions

- 7.1 Bureau Veritas have undertaken a noise impact assessment for a proposed new Hydrogen Refuelling Station on brownfield land east of Amazon Ffordd, Crymlyn Burrows, Neath Port Talbot.
- 7.2 A baseline noise survey was undertaken between the 16th and 17th December 2024 to establish the typical Residual and Background sound levels at the nearest identified sensitive receptors. These were identified as residential dwellings on Ocean View, the Towers Hotel & Spa, the offices of Dainton Self Storage and Swansea Bay Golf Club.
- 7.3 A noise model was prepared using the modelling software CadnaA to predict the impact of the noisy equipment associated with the Hydrogen Refuelling Station. Manufacturers and library noise data was used to build the noise model. The noise model predicted daytime and night-time levels at the nearest noise sensitive receptors.
- 7.4 A conservatively robust assessment was undertaken with equipment set to be running for longer than what is considered to be typical for the daytime and night-time periods.
- 7.5 Using the results of the noise modelling study at the nearest dwellings on Ocean View, an assessment of the operational Hydrogen Refuelling Station was undertaken with respect to the guidance contained within BS 4142. The results indicated that during the daytime, noise levels would be -11 dB below the Background Sound Level. This would therefore indicate a low adverse impact due to the dominance of existing (residual) road traffic noise.
- 7.6 At night, the BS 4142 assessment indicates that the Rating Level is predicted to be -1 dB below the Background Sound Level at the nearest receptors. Once again, this would represent a low adverse impact.
- 7.7 In respect of Dainton Self Storage offices and the Towers Hotel & Spa, noise from the operational Hydrogen Refuelling Station was assessed based on the internal noise criteria stipulated in BS 8233. It was calculated that internal levels would meet the $L_{Aeq,T}$ 45-50 dB criterion during the daytime for the offices with windows partially open. Furthermore, calculations found that the $L_{Aeq,T}$ 30-40 dB criterion during the daytime and $L_{Aeq,T}$ 25-35 dB criterion at night would also be met within the hotel with windows partially open.
- 7.8 Finally, the noise impact on Swansea Bay Golf Club was assessed in line with the Guidelines for Noise Impact Assessment (IEMA) by classing the golf course's sensitivity as "High". The calculations indicated that the golf course is likely to experience a 'negligible' impact in terms of noise increase once the Hydrogen Refuelling Station becomes operational. The increase in noise was calculated to be 0.1 dB. The degree of effect was found to be 'none' and it is likely that there will be no perceivable change in noise level at the golf course due to the operation of the new plant.

Appendix A

Glossary of Acoustic Terminology

"A" Weighting (dB(A))	The human ear does not respond uniformly to different frequencies. "A" weighting is commonly used to simulate the frequency response of the ear. It is used in the assessment of the risk of damage to hearing due to noise.
Decibel (dB)	The range of audible sound pressures is approximately 2×10^{-5} Pa to 200 Pa. Using decibel notation presents this range in a more manageable form, 0 dB to 140 dB. Mathematically: Sound Pressure Level (dB) = $20 \log \{p(t) / P_0\}$ where $P_0 = 2 \times 10^{-5}$ Pa
Frequency (Hz)	The number of cycles per second, for sound this is subjectively perceived as pitch.
Frequency Spectrum	Analysis of the relative contributions of different frequencies that make up a noise.
$L_{eq}(T)$	The equivalent continuous sound level. It is that steady sound level which would produce the same energy over a given time period T as a specified time varying sound.
$L_{Amax}(T)$	The maximum RMS A-weighted sound pressure level occurring within a specified time period.
L_{AE} or SEL	A measure of A-weighted sound energy used to describe noise events such as the passing of a train or aircraft; it is the A-weighted sound pressure level which, if occurring over a period of one second, would contain the same amount of A-weighted sound energy as the event. The relationship between $L_{Aeq,(T)}$ and SEL is as follows: $L_{Aeq,(T)} = 10 \log [\text{antilog } SEL_1/10 + \text{antilog } SEL_2/10 + \dots]$ Total time period in seconds where SEL_n is the measured single event level for a given event
$L_{A10,T}$	Road traffic noise level. The A-weighted sound pressure level of the residual noise in decibels exceeded for 10% of a given time interval.
$L_{A90,T}$	Background noise level. The A-weighted sound pressure level of the residual noise in decibels exceeded for 90% of a given time interval.
Noise	Unwanted sound.
Octave Band	A range of frequencies defined by an upper limit which is twice the lower limit. Octave bands are identified by their centre frequency.
R_{TRA} (dB)	The Traffic Noise Reduction Sound Insulation is derived by taking into account a typical spectrum of road traffic in town and city centres

R_w (dB)	The weighted sound reduction incorporates a correction for the ear's response and has been derived in accordance with BS 5821:1984.
Specific Noise	The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval.
Rating Level, $L_{Ar,T}$	The specific noise level plus any adjustment for the character of the noise.
Ambient Noise	Totally encompassing sound in a given situation at any given time composed of noise from many sources, near and far.
Residual Noise	The ambient noise remaining at a given position in a given situation when the specific noise source is suppressed to a degree such that it does not contribute to the ambient noise.

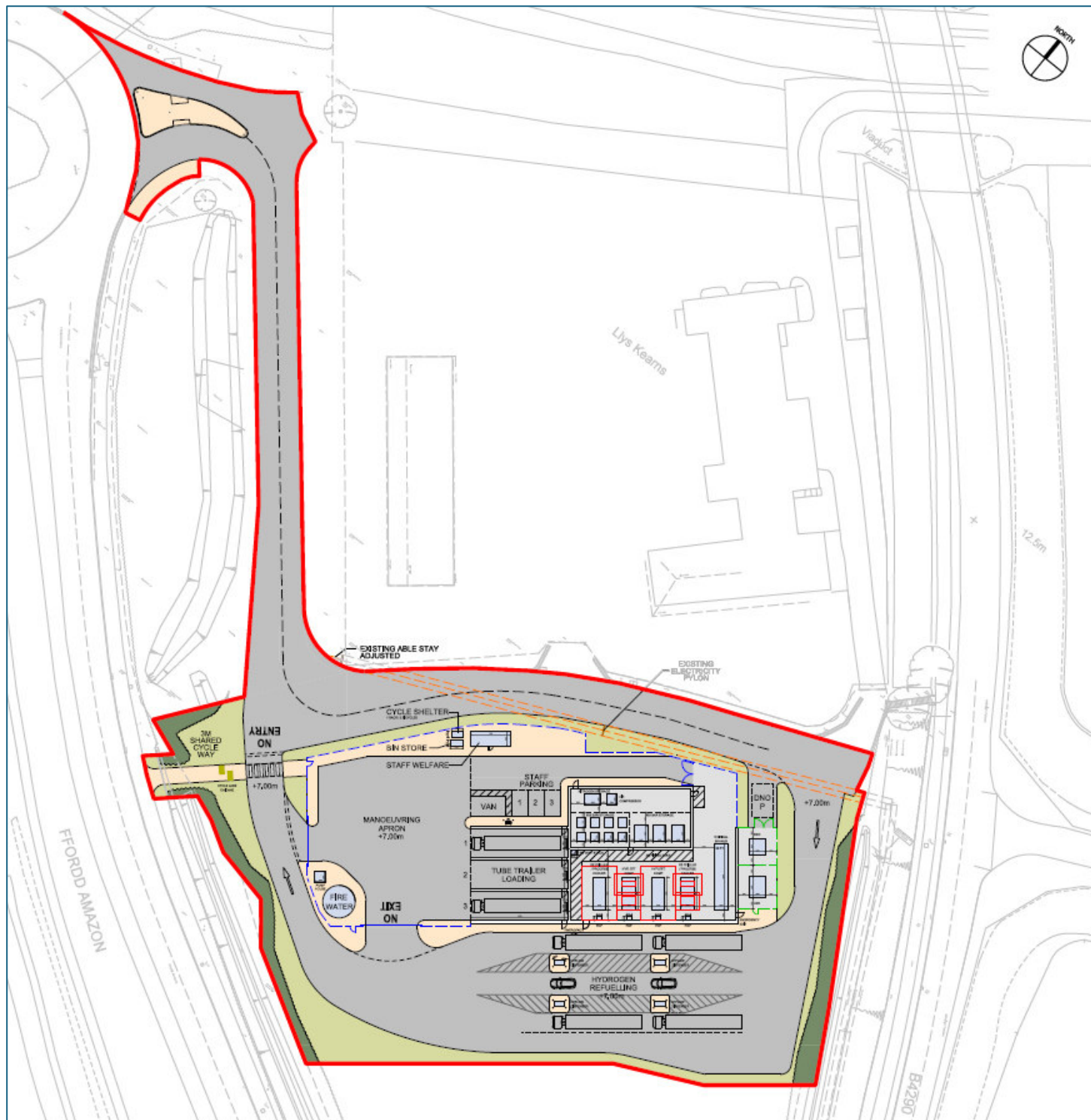
Appendix B

Schedule of Monitoring Equipment

Brüel and Kjær Sound Analyser Type 2260	Serial Number 2520445
Brüel and Kjær Microphone Type 4189	Serial Number 2719881
Brüel and Kjær Sound Level Calibrator Type 4231	Serial Number 2524804
Rion NL-52 Sound Analyser	Serial Number 01054193
Rion UC-59 Microphone	Serial Number 54266

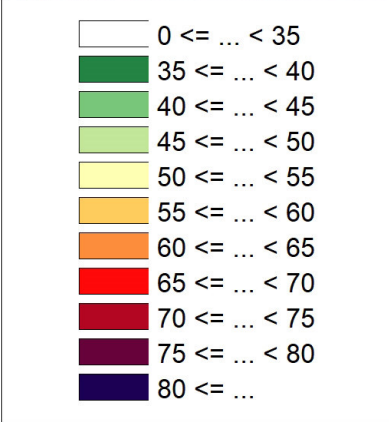
Appendix C

Site Plan



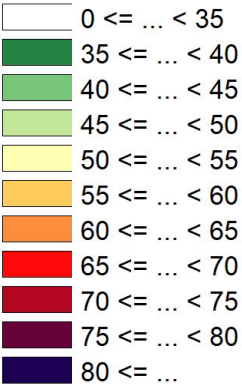
Appendix D

Colour Contour Noise Plots



Project:	Hydrogen Refuelling Station, Swansea - NM
Description:	Proposed Development - Day
Condition:	V01
Modelled:	Y Hoa
Reviewed:	R Giudice
Date:	24.01.25





Project:	Hydrogen Refuelling Station, Swansea - NM
Description:	Proposed Development - Night
Condition:	V02
Modelled:	Y Hoa
Reviewed:	R Giudice
Date:	24.01.25

