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ACOUSTIC CONSULTANTS

WYLFA NEWYDD
VIBRATION ASSESSMENT REVIEW

architectural

environmental

occupational

industrial

noise control at source

project management

planning

legal services

expert witness

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1.0 SUMMARY

A review has been carried out with regard to the assessment of construction vibration submitted with the planning application for the Wylfa Newydd power station, with particular reference to vibration affecting the National Trust properties at Felin Gafnan, Anglesey.

The criterion for vibration assessment within the reports for construction is reasonable. Initial assessments indicate the potential for significant vibration effects at Felin Gafnan and a commitment to carry out detailed Section 61 assessments, including detailed prediction of vibration and monitoring during construction is given.

The criterion for blasting, and the initial assessment of blasting vibration is less clear and it will need to be ensured that:

- appropriate vibration criteria (at Felin Gafnan) are set for blasting, if necessary taking into account any structural weakness, or difficulty to repair the buildings;

- The blasting contractor carries out Section 61 assessments and ensures that appropriate predictions and monitoring of blast vibrations are carried out.

We would recommend that The National Trust ensures that the appropriate Section 61 submissions are made for each phase of construction and that vibration at Felin Gafnan is properly accounted for in accordance with the Environmental Statement proposed criteria. We would recommend that The Trust ensures that appropriate real-time vibration monitoring is carried out during any high risk activities including the provision to halt activities immediately if the criteria set out in the Environmental Statement are exceeded until a suitable alternative method can be determined.

2.0 BRIEF FOR CONSULTANCY

PDA Ltd. was engaged to carry out the following:

A) Consulting - Review of submitted reports

We will review the reports submitted in support of the Wylfa Newydd Project with respect to the assessment of vibration impact on Felin Gafnan mill at Cemlyn due to the construction of the Wylfa Newydd power station.

The results of the report will be presented in a technical review report.

3.0 INTRODUCTION

The Wylfa Newydd project involves the construction of a new nuclear power station at Wylfa in Anglesey.

The proposed development includes the power station itself, marine works to serve the power station and other related developments including off-site facilities, site campus, park and ride facility, logistics centre, highway improvements and creation of compensatory wetland habitat.

The Felin Gafnan mill is a substantially intact 19th Century watermill with associated mill house and grain store. The mill buildings are listed as Grade II historic buildings and are owned by The National Trust. This report has been commissioned to review the vibration assessment submitted in support of the Wylfa Newydd Project with respect to the assessment of vibration impacts of the power station and associated works construction.

4.0 SUBMITTED DOCUMENTS

A number of documents have been submitted in support of the planning application for the Wylfa Newydd scheme and a specific report presented to The National Trust.

4.1 Horizon Nuclear Power National Trust Assessment Report

This document summarises the likely significant effects and relevant mitigation relating specifically to National Trust property due to the Wylfa Newydd development.

Table 4-5 of the report summarises the assessment of vibration on Felin Gafnan Mill and notes that the sensitivity of the receptor is considered to be ‘high’ and the potential magnitude of change is ‘Large’ resulting in a ‘Major’ significance of effect.

Mitigation is proposed in the form of ‘Vibration safe working distances, the use of alternate working methods and vibration monitoring.’ The residual magnitude of change following mitigation is noted as ‘Small’ with the significance of the residual effect noted as ‘Moderate adverse impact which is significant.’

4.2 Horizon Nuclear Power Wylfa Newydd Project 6.2.6 ES Volume B – Introduction to the environmental assessments B6 - Noise and Vibration

This document details: the Legislation, policy and guidance; the consultation undertaken; and the methodologies and assessment criteria with respect to noise and vibration assessment.

With regard to vibration assessment it is stated;

"The prediction of vibration propagation through the ground is complex and, for a detailed analysis, a large number of physical factors characterising the ground conditions and the different types of vibrational waves have to be taken into account. As a result of these factors, the accurate prediction of vibration propagation requires complex computational models populated with detailed input data, and this process is beyond the scope of a vibration assessment at this stage of the Wylfa Newydd Project. Simple empirical prediction methods have been used in conjunction with currently available basic data relating to equipment. These empirical prediction methods have a tendency to overestimate vibration levels and hence provide a conservative method of establishing potential vibration magnitude."

4.3 Horizon Nuclear Power Wylfa Newydd Project 6.2.21 ES Volume B … Noise and Vibration Modelling and Assessment Methodology Report

This report details the methodology for the noise and vibration assessment. In terms of vibration from construction activities the document states that models used spreadsheet calculations performed in accordance with BS 5228-2 empirical methods with scaling factors associated with the conservative (95%) confidence interval. For vibration sensitivity the limits of the above standard for cosmetic damage to buildings are quoted. These are 15mm/s PPV at 4Hz increasing to 20mm/s at 15Hz for unreinforced or light framed structures, and BS 5228-2 states that cosmetic damage may be expected at twice the levels quoted in this table. It is also stated that for structurally unsound buildings the levels may need to be reduced. From this a table of 'Magnitude of Change' limits is derived as follows;

Table 5-4 Adopted magnitude scale for plant and machinery vibration effects

Magnitude of change	Vibration level (peak particle velocity, mm/s)
Large	≥10
Medium	5.0 – 9.9
Small	1.0 – 4.9
Negligible	<1.0

We note that the 'Negligible' and 'Small' magnitude of change categories are below the value of BS 5228-2 when it has been reduced by 50% (to account for structurally vulnerable buildings). Hence, we would recommend for historic properties that the 'Small' magnitude of change category is not exceeded.

With respect to vibration limits from blasting operations, the values from BS 5228-2 are again cited, being 15mm/s PPV at 4Hz increasing to 20mm/s at 15Hz for unreinforced or light framed structures. We would note that these quoted limits are stated to be appropriate for buildings, *"including those of historic value that are considered structurally sound."* It is also stated (cited from BS 5228-2) that, *"Important buildings which are difficult to repair, or those thought to be structurally unsound, shall require special consideration on a case-by-case basis."*

We note that the stated limits for blasting vibration are not as conservative as those given for the construction plant and it will need to be ensured that appropriate limits are set by the blasting contractor for the National Trust properties. We note that the above limits are predicted to be suitable if the properties are considered to be structurally sound and are not considered to be 'difficult to repair'. We would recommend that if this cannot be demonstrated as applicable to the National Trust buildings then reduced limits derived as indicated in BS 5228-2, *'on a case-by-case basis,'* will be required.

4.4 Horizon Nuclear Power Wylfa Newydd Project 6.4.6 ES Volume D – Noise and Vibration

Table D6-22 summarises the equipment to be used in the construction phase and indicates horizontal distances from the equipment where ground-borne vibration levels are predicted to be below criteria for 'Large', 'Medium', 'Small' and 'Negligible' magnitude of change. The thresholds for magnitude of change (for buildings without any known or suspected structural weaknesses) are 10mm/s PPV for 'Large', 5mm/s PPV for 'Medium', 1mm/s PPV for 'Small' and ≤ 1mm/s for 'Negligible'.

Distances from the specified plant for 'Negligible' magnitude of change range from 73m for vibratory pile hammer) up to 245m for Dawson Pile Hammer (model HPH6500).

The proposed operating location of each piece of specified plant is then discussed and the potential impact is indicated. The impacts predicted to affect Felin Gafnan mill are;

- Potential use of Vibratory Pile Hammer in construction Zone 2 within 66m of Felin Gafnan, which would be a small magnitude of change resulting in a moderate adverse effect, which is considered significant. Note that the conclusion for the Vibratory Pile Hammer is also valid for the Crusher and Screen and Tracked Screen when used in Zone 2.
- Potential use of the Dawson Pile Hammer in zones 2 or 10 would result in a large magnitude of change at Felin Gafnan Mill resulting in major adverse effect which would be considered significant. Note that the vibration magnitude criteria have been reduced by 50% in the case of the mill assessment due to the potential for structural weakness of the building.

It is reported that there would be negligible magnitude of change for blasting vibration resulting in minor effect for high sensitivity receivers which is not significant.

In the additional mitigation section of the report the following additional mitigation is proposed with respect to construction vibration in order to ensure that vibration from construction does not exceed a small magnitude of impact at receptors;

> *"Horizon would undertake a vibration risk assessment as part of the Section 61 application for any construction activity involving vibratory or impact equipment to be used on the Main Site. This assessment would establish safe working distances for receptors in relation to construction vibration. This would ensure that any equipment that is identified as having potentially adverse vibration effects can be located sufficiently away from any sensitive receptors, so that any effects on such receptors can be reduced to negligible. Where works are required within the safe working distances, alternative equipment or working methods would be investigated and vibration levels would be reduced to the greatest extent practicable. The Section 61 applications would also describe appropriate vibration monitoring to be carried out at the closest receptors to determine the success of these requirements, as per the Wylfa Newydd CoCP (Application Reference Number: 8.6)."*

4.5 Horizon Nuclear Power Wylfa Newydd Project – Site Preparation and Clearance – Code of Construction Practice

This document details the instructions for the construction contractors with respect to environmental management of the project.

Section 8 covers Noise and Vibration Management Strategy for the project. The document states that Section 61 applications will be submitted for 'noisy works' under Section 61 of the Control of Pollution Act 1974. We have assumed that this also includes any works likely to produce significant levels of vibration. It is further stated that, *"Horizon shall undertake predictions of noise and vibration levels in accordance with BS 5228 Parts 1*

and 2." "Horizon shall provide proposed noise/vibration limits applicable to normal operations described in the Section 61." "Where required, Horizon shall propose limits for predicted short-term higher noise/vibration effects and associated durations, for consideration by the IACC."

5.0 DISCUSSION

5.1 Classification of impact and sensitivity of receivers

The Horizon Nuclear Power submitted documents take a reasonably conservative approach to setting limits for construction vibration. Vibration magnitude of effects classified 'small' or 'negligible' are unlikely to cause cosmetic damage.

With regard to blasting, the limits are less conservative and do not appear to set out a specific limit for potentially structurally unsound or difficult to repair buildings.

5.2 Assessment of construction vibration impact

The Environmental Statement indicates that there is potential for 'small' magnitude of change at Felin Gafnan for use of Vibratory Pile Hammer, Crusher and Screen and Tracked Screen and also that there is potential for 'large' magnitude of change for use of the Dawson Pile Hammer.

We note that a 'large' magnitude of change is likely to be unacceptable and mitigation is proposed in the form of use of Section 61 submissions to provide detailed calculations and mitigation as necessary to reduce levels of vibration using distance, or alternative methods of construction where appropriate.

It is reported that there would be negligible magnitude of change for blasting vibration resulting in minor effect for high sensitivity receivers which is not significant. However, there does not appear to be any detail given to demonstrate why blasting would result in a 'minor' effect, or how a minor effect is classified.

6.0 CONCLUSION

The criterion for vibration assessment within the reports for construction is reasonable. Initial assessments indicate the potential for significant vibration effects at Felin Gafnan and a commitment to carry out detailed Section 61 assessments, including detailed prediction of vibration and monitoring during construction, is given.

The criterion for blasting, and the initial assessment of blasting vibration is less clear and it will need to be ensured that;

- appropriate vibration criteria (at Felin Gafnan) are set for blasting, if necessary taking into account any structural weakness, or difficulty to repair of the buildings
- The blasting contractor carries out Section 61 assessments and ensures that appropriate predictions and monitoring of blast vibrations are carried out.

We would recommend that The National Trust ensures that the appropriate Section 61 submissions are made for each phase of construction and that vibration at Felin Gafnan is properly accounted for in accordance with the Environmental Statement proposed criteria. We would recommend that The Trust ensures that appropriate real-time vibration monitoring is carried out during any high risk activities including the provision to halt activities immediately if the criteria set out in the Environmental Statement are exceeded until a suitable alternative method can be determined.

A similar approach is recommended for any proposed blasting and again we would recommend that vibration monitoring should be carried out by the contractor at Felin Gafnan during any blasting activity.