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Glyn Rhonwy Pumped Storage Development Consent Order

PINS Reference EN010072

REVIEW OF NOISE AND VIBRATION REPORTS AND RESPONSES
7 June 2016

This note has been prepared by Rupert Thornely-Taylor of Rupert Taylor Ltd, consultants in acoustics, noise and vibration. He is a Fellow of the Institute of Acoustics and has specialised in the subjects for 52 years, and is an expert in the subject of vibration and groundborne noise. He has carried out a large number of projects involving the prediction of vibration and groundborne noise, including low frequency noise, from industrial and construction sources. He is the author of a 3-dimensional Finite-Difference-Time-Domain numerical modelling package, which has been used for, as examples, a waste-to-energy facility, a heavy industrial steel-cutting shear, tunnelling, piling and other sources affecting residential receptors, marine species and geological features such the risk of vibration-induced landslides. He is a member of BS and ISO standards committees and working groups devoted to the subject of groundborne noise and vibration.

This review, while encompassing the topic of noise and vibration, is particularly concerned with groundborne noise and vibration and low frequency noise, for the reasons explained below. These topics have already been raised in the DCO proceedings, not least because of the history of the Dinorwig Power Station and the noise problems acknowledged and compensated for by the former CEGB.

Groundborne noise and low frequency noise are not independent effects, in that while low frequency noise may be a purely airborne phenomenon, it may also result from radiation of sound by the ground surface in response to transmission of vibration through the ground.

The Environmental Statement

The Environmental Statement for the Glyn Rhonwy project identifies potential noise and vibration effects from construction and operation. It reports baseline survey measurements for airborne noise at a set of receptor locations. It assumes that there currently no significant sources of vibration in the area. It sets assessment criteria for construction noise and vibration, for building damage from vibration, for low frequency noise, blasting vibration and air overpressure, construction traffic. No assessment criteria are presented with respect to groundborne noise.

The ES considers the topic of groundborne noise from the penstock excavation and from TBM operation and finds that the effects will be negligible, although the

criteria used to reach this finding are not stated. Groundborne vibration from traffic is found to be a potential issue. No predictions of blasting vibration or air overpressure are made. With regard to operation, no prediction of likely levels is made, and instead reliance is placed on an expectation that unspecified mitigation by design will take place so as to achieve levels no worse than the assessment criteria at the Noise Sensitive Receivers (NSRs). With regard to the turbine Hall ventilation, no prediction of likely noise levels is made, and the assumption is made that design details will be finalised in due course to achieve operational noise limits. A prediction of transformer noise is made on the basis of an assumed sound power level, but no prediction of vibration or groundborne noise from the transformers is made. Airborne noise from the pumping station is considered in qualitative terms, but vibration and groundborne noise are not considered. Reliance is placed on BS4142 although that standard expressly states that it is not intended for the assessment of indoor sound levels, and groundborne noise by its nature can only be assessed as an indoor sound level. The ES explains (13.8.13) also that LFN can be amplified by the geometry of receptor buildings, again meaning that indoor sound levels need to be assessed for which BS 4142 cannot be applied.

Mitigation of construction effects is discussed, with emphasis on control through the S61 process. The noise limits introduced by the ES are found to be exceeded (13.7.29 and Table 13-27) and there will be major significance of effects at high sensitivity NSRs. For operation, likely turbine sound power levels are given, but these are not converted into sound pressure levels at the receiver, nor are predictions of low frequency or groundborne noise made, although the conclusion is reached that there will be a localised, minor adverse effect.

Commentary on the approach adopted in the Environmental Statement

There is heavy reliance on an approach which overcomes a failure to report the magnitude of effects by relying on a future design process aimed at achieving appropriate criteria or limits. This is in place of a description of the likely significant effects, and in place of a description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects. The requirement in NPSE (EN-1) to include a prediction of how the noise environment will change with the proposed development and measures employed in mitigating noise is not fulfilled with regard to groundborne noise and low frequency noise.

The legal requirements of Environmental Assessment are outside the scope of this note, but from a technical point of view, where the prediction, assessment and mitigation of noise or vibration is a well-established process, with source information and mitigation technology well understood, available, and costed, there is no great risk in relying on an intention to assess and mitigate in the future. It must be borne in mind that where the S61 process is relied upon, this is capable of no more than securing best practicable means and if after applying best practicable means there remains a significant effect this needs to be foreseen at the environmental assessment stage and reported.

In the case of both groundborne noise and low frequency noise, if reliance is placed on a future design process then in the event of actual levels of groundborne noise and/or low frequency noise proving to be in excess of acceptable limits,

retrospective mitigation may prove to be impracticable because of the radical nature of necessary re-engineering of the installation and/or excessively high cost or programme implications. The ES does not take account of this risk, for which reason it is not possible for the decision maker to know from the ES what the likely significant effects due to groundborne noise and/or low frequency noise will be.

It follows (NPSE EN-1 5.11.9) that development consent should not be granted because the Examining Authority cannot be satisfied that the proposal will avoid significant adverse impacts on health and quality of life from noise and that the proposals will mitigate and minimise other adverse impacts on health and quality of life.

Responses to the Examining Authority's written questions

Applicant's response to the Examining Authority's First Written Questions

Among the list of questions is 7.22 which is relevant to the concern outlined in the preceding paragraph above. There is no response on the question as to how compliance measures will be identified and approved and the only response relates to the measurement and assessment procedure to be found in the Defra NANR45 report, which does not address mitigation measures.

Applicant's response to the Examining Authority's Action Points for Issue Specific Hearing on 17th May 2016

Among the list of questions is 8.4 (a) asking the applicant to summarise the limits proposed for noise (including low frequency noise), vibration and dust deposition. The response states:

"The Applicant also notes Mr Vitkovitch's further comment about how construction noise, low frequency noise and ground borne noise from generators is different and how this had not been addressed in the ES. The Applicant wishes to clarify that this has been outlined in Chapter 13 of the ES and in the previous responses to First Written Questions, Responses to Relevant Representations and also previous responses to Written Representations. The potential for low frequency noise during operation will be considered during the detailed design stage using appropriate methods such as the University of Salford NANR45. The proposed assessment methodology of LFN will be provided in the updated operational NMP to be issued at Deadline 5. With reference to comments about noise from Dinorwig, potential noise effects should not be compared between the Development and Dinorwig, as technology has advanced significantly since 1984, and that as a result of this advancement, greater opportunity now exists to manage LFN through detailed design."

Commentary on the responses

The notable content of the responses relates to the advancement of technology with regard to noise from Dinorwig since 1984. That statement must be based on information which is not provided, and not used for the purpose of predicting likely significant effects and consideration of mitigation measures.

Further information necessary for the decision making process

Groundborne noise

It is possible to predict, assess and design mitigation measures for groundborne noise. The necessary process is as follows:

1) Obtain measurements from an existing site where sources relevant to the proposed installation are in operation. The measurements should include amplitudes of vibration and sound together with, in the case of vibration (which may be a source of groundborne noise and low frequency noise) sufficient data concerning the dynamic behaviour of the foundations of the relevant items. This will include measurements of the driving point impedance of the ground or foundation using an instrumented force hammer.
2) Establish comparative engineering specifications of (a) the measured sources and (b) the proposed sources and make corrections to the measured data to allow for differences in power, speed and other characteristics.
3) Carry out a geotechnical study including measurement of wave propagation through the terrain at the existing and proposed sites, for example using the techniques explained in ISO/TS 14837-32:2015.
4) Create a numerical model (a) of the existing site and (b) for the proposed site including receptor buildings. Use a comparison between modelled output for the existing site with actual measurements at the existing site to calibrate the model of the proposed site.
5) Calculate the uncertainty associated with the model predictions by varying assumptions according the magnitude of uncertainty associated with them and the probability of those variations occurring.
6) Set acceptability criteria for groundborne noise in addition to those selected for low frequency noise and establish any predicted excess.
7) Design mitigation measures – for example spring-mounted inertia blocks for vibration sources.
8) Iteratively rerun the model of the proposed site incorporating mitigation measures to establish required properties for the measures, after taking into account the uncertainty.

Low Frequency Noise

The ES states (13.8.13) that "LFN can be very difficult to predict with a high level of certainty and similarly hard to identify and resolve if present. This is because it can be generated by the unexpected interactions between system components and can be amplified by the geometry of the site and receptor buildings. However there are several risk factors that are known to make the generation of LFN more likely. The potential issue of LFN will be considered throughout the detailed design for the Development and mitigated through design."

Informed assumptions concerning the likely features of the detailed design should be made so that the consideration which is foreseen in the ES can be brought forward to the present stage. Uncertainty should be evaluated by varying the assumptions within the known likely range. Local climate data should be used to

predict the effects of long-distance propagation in meteorological conditions known to cause such effects.

Conclusions

For a scheme of this type and size, with which is associated a clear risk of adverse effects due to groundborne and low frequency noise, a full assessment of GBN and LFN should have been carried out.

The decision maker in this case does not have sufficient information to conclude whether the proposals will avoid significant adverse impacts on health and quality of life from noise, nor whether they adequately mitigate and minimise other adverse impacts on health and quality of life from noise. There is no information to enable the decision maker to consider specifying the mitigation measures to be put in place to ensure that noise levels do not exceed any limits specified in the development consent.

The Examining Authority is requested not to recommend approval without requiring the applicants to carry out the work identified above and receiving satisfactory responses.

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