P626 Clarification Note – Noise

Introduction

A background noise survey was first carried out at the proposed Donich Water hydroelectric scheme on 6th March 2013 and the results of this survey were presented in Report No. P626/Noise Survey r1.

A further survey was then carried out in order to establish the night-time background noise level at the dwellings. This survey was carried on 24th and 25th July 2013 and the results are available in the attached report.

This clarification note should be considered as an addendum to these earlier reports.

Predicted Noise Levels – no mitigation

The predicted noise level at the nearest dwelling without any specific mitigation measures (60m away from the proposed powerhouse) is 44dBA (please refer to P626/Noise Survey r1).

Although these predicted figures are lower than the background figures recorded on the day of the survey, they are still above the World Health Organisation (WHO) recommendation of 35dBA for restorative sleep, hence it was proposed that a number of mitigation measures could be employed to ensure the noise at the dwellings as a result of the scheme would be less than the WHO limit.

The report stated that it was likely that the majority of the mitigation measures listed in Section 5 would be applied to the powerhouse, but it was not made clear, precisely what would be done or what the likely effect would be.

This note considers the effects of the proposed mitigation measures and considers which of these will be used on the Donich Water powerhouse to ensure that noise at the nearby dwellings is kept to an acceptable level.

Mitigation Measures

Eight possible mitigation measures were listed in Section 5 of the noise report. Of these, four have been employed at a recently constructed ‘acoustically sealed’ powerhouse:

1. Acoustic baffles on ventilation intake louvres.
2. Close fitting, acoustic grade doors with weather seals on the main equipment access and the personnel entrance.
3. Sealing of potential apertures at the roof eaves with semi-rigid medium density mineral wool.
4. A louver system that extends to below the water surface to acoustically seal the tailrace.

In order to assess the effect of using these four measures, noise readings were taken this powerhouse and the results are presented overleaf.

The powerhouse in question houses a 750kW Pelton turbine (slightly smaller than what is proposed at Donich Water, but the same turbine type) and is finished with grey render and a slate roof. The building is located close to a steep river and is dug down in to the landscape but not buried in any way.

A photo of the powerhouse is shown overleaf in Figure 1.

Figure 1 – Acoustically sealed powerhouse

Results of mitigation

Readings were taken with and without the turbine running and with the acoustic doors open and closed. The weather conditions on the day were dry and sunny but there had been rain overnight so the turbine was running at medium - low power.

Table 1 below shows the Leq results for the readings taken.

Table 1 – Readings from PH with selected mitigation measures

Reference No.	Location	Turbine on / off	Doors open / closed	Leq (dBA)
Mem 3	1m from turbine	On	Open	87
Mem 4	1m from double doors	On	Open	81
Mem 5	1m from double doors	On	Closed	55
Mem 6	1m from tailrace	On	Closed	61
Mem 7	1m from blank wall (riverside)	On	Closed	55
Mem 8	1m from blank wall (transformer)	On	Closed	51
Mem 9	10m from double doors	On	Closed	50
Mem 10	10m from double doors	On	Open	67
Mem 11	20m from double doors	On	Open	61
Mem 12	20m from double doors	On	Closed	48
Mem 13	1m from double doors	Off	Closed	46
Mem 14	10m from double doors	Off	Closed	48
Mem 15	20m from double doors	Off	Closed	47
Mem 16	20m from double doors (repeat)	On	Closed	48

The calculations presented in P626/Noise Survey r1 show that the average reduction achieved in a standard powerhouse is approximately 28dBA. Therefore, assuming a pessimistic scenario of a 90dBA turbine and generator noise, the average noise outside a standard powerhouse building would be 62dBA.

In order to assess the effect of the selected mitigation measures, the average of all the readings from Table 1 (at 1m from the powerhouse with the turbine running and the doors closed) should be taken.

This equates to: (55+61+55+51) / 4 = 55.5

To calculate the effect of the measures: 87 – 55.5 = 31.5, which is rounded up to 32dBA.

This equates to an average reduction of 32dBA, 1m outside the powerhouse compared to inside. This therefore suggests that the average effect of the selected mitigation measures is in the order of 4dBA in comparison to a standard powerhouse (i.e. 32 – 28 = 4).

Taking in to account the 5dBA allowance, this suggests that the Sound Pressure Level (SPL) just outside the powerhouse will be in the order of 63dBA for a powerhouse with the selected mitigation measures as opposed to 67dBA for a standard powerhouse.

Applying this new figure to the attenuation calculations yields the following results for each of the dwellings:

Predicted SPL at the nearest dwelling

Maximum source SPL			58dBA
BS4142 (1997) allowance			5dBA
Design SPL			63dBA
Attenuation	= (20 log 60) – 8	=	28dBA
Predicted SPL at the dwelling (B)	= 63 – 28	=	35dBA

Further mitigation

Although this figure is equal to the WHO practical threshold for restorative sleep, the scheme developer has specifically instructed additional work beyond the normal base level in order to further address residents' concerns in relation to noise suppression. To this end it is confirmed that the remaining four recommended noise suppression measures will also be incorporated in to the powerhouse design and build.

Therefore, in effect adding all eight possible noise reduction methods to the powerhouse should ensure that the powerhouse is much more noise efficient than the standards required for restorative sleep as determined by the WHO.

For reference, the additional four measures that will be included are as follows:

1. Outlet louvres and fans orientated to minimise the impact of noise.
2. A false ceiling or insulated roof within the depth of the rafters.
3. Cavity wall construction.
4. Heavy duty covers on the swab extraction chamber and tailrace chamber to attenuate any noise emanating from the tailrace.