WHITE FISH AUTHORITY

Industrial Development Unit

NOISE REDUCTION METHODS IN THE FLUME TANK

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TABLES

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1. INTRODUCTION

An investigation was launched into methods of reducing noise levels from the flume tank pumproom following complaints by some users that noise levels were a source of annoyance. An assessment of the noise transmission modes was made and a method proposed for attenuating the noise levels. The method was applied to one pump set to check its effectiveness and the attenuation achieved is reported here.

2. EXISTING NOISE LEVELS

Table 1 shows the noise levels which existed in the flume tank prior to application of noise control methods. Table 2 contains recommended limits to steady background noise level in different indoor areas. If the flume tank is considered to be a lecture theatre then the recommended limit in table 2 is 47 dB(A). Clearly this limit is exceeded in all parts of the flume tank. Furthermore levels above NC60 (roughly corresponding to 60 dB(A) in this case) are not recommended for any office or communication situation. It would clearly be an advantage, therefore, to reduce noise levels below 60 dB(A) and preferably down to 47 dB(A). The prime causes of the existing noise levels are noise radiated from the hydraulic pipework and airbourne noise escaping from the pumproom via bulkhead penetrations.

3. NOISE ATTENUATION METHODS

3.1 In Line Hydraulic Attenuators

These are available commercially and can offer attenuation of upto 25 dB according to the manufacturer. To fit this equipment to the Flume Tank hydraulics would cost about £1130.

3.2 Replace Steel Hydraulic Pipes by High Pressure Hose

This method might not succeed in damping out the pressure pulsations which cause the noise to be radiated from the pipes since short pieces of hydraulic hose are already fitted and seem to have little effect. The modification would, however, eliminate structure borne noise transmission and eliminate a possible flanking path for airbourne noise. This method would cost about £650.

3.3 Lag Pipes and Bulkhead Penetrations with Barrier Material

Using this method a mean sound reduction index of 15.5 dB should be achievable using 0.8mm lead sheet according to the suppliers information sheets and this degree of attenuation should be achieved at the dominant frequency (240 Hz). The total cost of lagging all the hydraulic pipes would be about £700.00.

4. NOISE ATTENUATION PROGRAMME

The decision was taken to implement the third method described above i.e. to lag the pipes which are the dominant noise source.

Before this was done the interior of the pumproom was lined with noise absorbent foam to eliminate reverberation and thus reduce noise intensification inside. The noise levels present after this treatment are given in Table 3. Comparison

of Tables 1 and 3 shows that measure resulted in a general decrease in noise levels in most areas of the flume tank. An exception was the tank top area where some marginally higher levels were recorded due to intermittent noise from the heating and ventilation equipment.

To date only one pumpset has been treated with noise absorbent foam and lead cladding and this has allowed a comparison of the results before and after treatment. A summary of the noise levels achieved at the different stages of treatment is given in Table 6.

5. RESULTS

Tables 4 and 5 contain the noise measurements recorded when running pumpsets numbers 4 (treated) and 3 (untreated) respectively. A comparison of the two tables shows clear benefits are derived from the acoustic treatment. The attenuation is greatest at points close to the noise source and least at points furthest away where other noises have a more significant effect. The attenuation achieved at the closest measurement station to the noise source (on the pump house roof) is 18 dB and that achieved at the furthest point away (the net loft) is 4 dB. It was apparent during the survey that the dominant noise close to the pump is now airbourne noise transmitted through the pump room wall. This could be further reduced by increasing the mass of the wall (by cladding with lead or other material) but overall attenuation in the vicinity of the pump-room is unlikely to improve by more than 3 or 4 dB because noise transmitted via some other path would then become the dominant factor. The cost of extra lead cladding for the pump house walls and doors would be about £240. This should also be done on the grounds that the measure would reduce noise levels below the NC 60 recommended limit mentioned in paragraph 2. This is important in tank top areas and at the control station because communication is necessary in these areas during operation of the tank.

6. CONCLUSIONS AND RECOMMENDATIONS

The noise control measures applied to the flume tank hydraulic system were effective and should be extended to cover all the exposed hydraulic pipework outside the pumproom. If, after this treatment, pumproom noise is still a source of annoyance, then the pumproom walls and doors should be clad with lead to effect a further general reduction in noise levels of the order of 3dB.

TABLE 1

Noise Levels in dB(A) Before Acoustic Treatment

Measurement Station	Impeller Speed (RPM)			
	0	80	100*	130
Control Panel	64	73	76	81
outside pump room door	75	82	84	87
pumphouse roof	72	82	85	89
inside pumphouse	94	99	100	102
West end of Net platform	63	73	75	79
Net Setting position	62	70	73	78
Trolley	67	75	77	80

* estimated noise levels

TABLE 2

Recommended Category Classification and Suggested Noise Criteria Range for Steady Background Noise as Heard in Various Indoor Functional Activity Areas

Type of space (and acoustical requirements)	NC or PNC curve (see Table 18.3 or Table 18.4)	Approximate L_A, dBA
Concert halls, opera houses, and recital halls (for listening to faint musical sounds)	10 to 20	21 to 30
Broadcast and recording studios (distant microphone pickup used)	10 to 20	21 to 30
Large auditoriums, large drama theaters, and large churches (for very good listening conditions)	Not to exceed 20	30
Broadcast, television, and recording studios (close microphone pickup used only)	Not to exceed 25	34
Small auditoriums, small theaters, small churches, music rehearsal rooms, large meeting and conference rooms (for very good listening), or executive offices and conference rooms for 50 people (no amplification)	Not to exceed 35	42
Bedrooms, sleeping quarters, hospitals, residences, apartments, hotels, motels, etc. (for sleeping, resting, relaxing)	25 to 40	34 to 47
Private or semiprivate offices, small conference rooms, classrooms, libraries, etc. (for good listening conditions)	30 to 40	38 to 47
Living rooms and drawing rooms in dwellings (for conversing or listening to radio and television)	30 to 40	38 to 47
Large offices, reception areas, retail shops and stores, cafeterias, restaurants, etc. (for moderately good listening conditions)	35 to 45	42 to 52
Lobbies, laboratory work spaces, drafting and engineering rooms, general secretarial areas (for fair listening conditions)	40 to 50	47 to 56
Light maintenance shops, office and computer equipment rooms, kitchens and laundries (for moderately fair listening conditions)	45 to 55	52 to 61
Shops, garages, power-plant control rooms, etc. (for just acceptable speech and telephone communication). Levels above NC- or PNC-60 are not recommended for any office or communication situation	50 to 60	56 to 66
For work spaces where speech or telephone communication is not required, but where there must be *no risk* of hearing damage	60 to 75	66 to 80

From "Noise and Vibration Control" by Beranek

TABLE 3

Noise Levels in dB(A) After Application of Noise Absorbent Foam inside Pumproom to Reduce Reverberation

Measurement Station	Impeller Speed (RPM)			
	0	80	100*	130
Control Panel	63	71	73	79
Outside Pumproom door	71	77	80	86
Pumphouse Roof	73	84	86	89
Inside Pumphouse	87	94	95	97
West End of Net Platform	63	69	72	77
Net Setting Point Position	64	71	73	78
Trolley	65	74	76	81

* Estimated Noise levels

TABLE 4

Noise levels in dB(A) Running Pumpset No. 4 at 100 RPM after Acoustic Treatment

Measurement station	Noise level dB(A)	Attenuation dB
Outside pumproom directly under pipes	71	14
On Pumphouse roof	68	18
Outside pump room door	68	12
Inside pump room	96	-
Nearest Lecture Theatre	45	6
Furthest Lecture Theatre	43	5
Nearest Office	47	8
Net Loft	50	4
Control Station	62	10
Tank Top (Net setting position)	62	13

TABLE 5

Noise Levels in dB(A) Running Pump No. 3 at 100 RPM prior to Acoustic Treatment

Measurement station	Noise Level dB(A)
Outside pumproom directly under pipes	85
On Pumphouse Roof	86
Outside Pumproom Door	80
Inside Pumproom	95
Nearest Lecture Theatre	51
Furthest Lecture Theatre	48
Nearest Office	55
Net Loft	54
Control Station	72
Tank Top (Net setting Position)	75

TABLE 6

SUMMARY OF NOISE LEVELS ACHIEVED IN dB(A)

(all readings at 100 RPM)

Measurement Station	Acoustic Treatment			
	None. All pump sets running.	Absorbent foam in pump room. All pump sets running.	Absorbent foam in pump room. Pump set No.3 only running.	Absorbent foam in pump room + pipework cladding. Pump set No. 4 only running.
Outside pump room directly under pipes.	-	-	85	71
On Pumphouse roof.	85	86	86	68
Outside Pump room door.	84	80	80	68
Inside Pump room.	100	95	95	96
Nearest Lecture Theatre.	-	-	51	45
Furthest Lecture Theatre.	-	-	48	43
Nearest Office.	-	-	55	47
Net Loft.	-	-	54	50
Control Station.	76	73	72	62
Net Setting Position.	73	73	75	62