Acoustics Technical Note

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Copies to	File	**Date**	28.07.2011
Subject	Devonport EfW Facility: Additional Construction Noise Predictions and Assessment.		

Introduction

In a memo from PCC titled "North Yard proposed EfW plant (11/00750/FUL) Views of PCC Public Protection Service –21st June 2011", the following query, concerning the construction noise impact assessment, as provided in the Environmental Statement, was included;-

14.6.11 and 18.6.6. This discusses the impact of construction noise on residents in Talbot Gardens. We would like to see more detail of how much of time construction would be close to these properties as construction is likely to last 2 years. This is a significant time period, and is a high impact. Mitigation measures proposed are only suggesting may be possible or if practical, and as a result, further measures need to be provided and detailed.

The construction noise assessment reported in the Environmental Statement provided worst-case noise levels to surrounding receptors, with construction activities being carried out at the closest approach. It did not consider, in any significant detail, the changing locations and durations of the construction activities, and the consequent reductions in noise impacts to the surrounding receptors.

This technical note provides additional information and analysis for the construction noise impacts during various phases of the construction programme in answer to the above query. It is based on the detailed construction schedule and further information from the contractor on the type of piling rigs to be employed.

Assessment Methodology

The calculation and assessment methodologies for construction noise are given in detail in the Environmental Statement. These methodologies have also been employed in this addendum assessment. The receptor locations used in this technical note are shown in Figure 1 (taken from the Environmental Statement) appended to this technical note.

Predictions have been made for the construction of the workshop located in the south-western area of the site close to Talbot Gardens, and also for six periods during the two year construction duration. These periods represent worst-case situations when a number of construction activities are being undertaken simultaneously, and therefore represent the periods of time when construction noise levels will be at their highest. The periods in question are provided in Table 1. Works during all other times during the construction duration should result in lower noise levels.

Table D.14.1: Details of Selected Assessment Periods

Assessment Period	Construction Year	Construction Period	Activities
1	2012	May - June	Earthworks Piling – Turbine Building Piling - Bunker
2	2012	August	Piling – Bale Store Piling – Boiler House Piling – Waste Bunker Floor slab – Turbine Building External surfaces
3	2012	October - November	Piling – ACC Piling – Tipper Hall Floor Slab – Waste Bunker Floor Slab – Turbine Building External Surfaces
4	2013	January	Floor Slab – Tipping Hall Steelwork – APC External Surfaces

5	2013	August	Cladding Roof – Tipper Hall Cladding Roof – Boiler House Cladding Walls – Boiler House Install ACC Install Plant – Boiler House Install Electrics – APC External Surfaces
6	2013	November	Cladding Walls – Bunker Cladding Walls – Turbine Building Cladding Roof – Turbine Building Install ACC External Surfaces

Predicted Noise Levels

As a worst-case, construction noise levels have been predicted for a 10 hour construction day assuming no mitigation (inspection of the results in the ES shows that the 10 hour period provides the most significant effects, compared to the 3 hour or 5 minute periods as defined by PCC Public Protection Service).

Construction of Workshop

With regards to noise from the construction of the workshop, the range of noise levels likely to be experienced for each construction activity has been predicted assuming activities at the nearest approach and at the furthest approach. There will be no piling in the workshop area. The calculated noise levels are provided in Table 2.

Table D.14.2: Predicted Façade Noise Levels During Workshop Construction

Activities	Predicted Noise Level $L_{Aeq,10hr}$ dB				
	C1	C2	C3	C4	C5
Earthworks	69-73	68-69	57-58	53-54	53-54
Workshop foundations	68-72	65-68	55-56	51-52	51-52
Workshop – floor slab	64-68	60-63	51-52	47	47
Workshop steelwork/cladding	71-75	67-70	57-58	53-54	54
Workshop - finishing	66-70	61-65	52-53	48-49	48-49

Inspection of the results in Table 2 shows that noise levels at C1 and C2 will generally be above 65 dB(A) and will be up to 75 dB(A) at C1 during steelwork and cladding works. The noise levels at C3, C4 and C5 will be much lower, at less than 58 dB(A).

The provision of 3 metre high mobile noise barriers to the ground level works (earthworks, foundations, floor slab) will provide approximately 6 dB(A) attenuation to the ground floors of C1 and C2, reducing for higher floors to zero at the top floors. Thus, noise levels to the lower floors will be reduced to below 70 dB(A) for these construction activities, whilst the upper floors will likely be exposed to worst-case noise levels above 70 dB(A).

However, the main works associated with the construction of the workshop will be completed within a two month period from 12th February 2013 to 12th April 2013. Hence, these noise impacts will be temporary and short-term.

A significant part of the cladding works will be carried out on the side of the workshop facing away from the receptors on Talbot Gardens. Provided the side facing Talbot Gardens is clad first, much of the cladding works will be shielded from the receptors by the workshop skin itself, and noise levels to C1 and C2 will be reduced accordingly to below 70 dB(A).

Regarding finishing, much of this work will be carried out on the side of the workshop facing away from the receptors on Talbot Gardens, or inside the workshop itself. Hence, resultant noise levels to C1 and C2 will be significantly lower than those provided in Table 2 for this activity.

In summary, noise levels to properties on Talbot Gardens will generally be below 70 dB(A) during construction of the workshop. Where 70 dB(A) is exceeded, this will be for short periods of time only, within the overall construction time of 2 months. A facade noise level of 70 dB(A) translates to an internal noise

level of 40 dB(A), assuming a closed window provides 30 dB(A) attenuation. BS8233 defines an internal noise level of 40 dB L_{Aeq} as "reasonable" for living rooms. Thus, if residents can maintain closed windows during times of elevated noise levels from workshop construction, internal noise levels should prove acceptable.

Construction of Main Building and ACC

With regards to noise from the construction of the main EfW buildings and ACC, the predicted noise levels are the likely noise levels to be experienced from each activity at each receptor, based on the representative distance the activity will be undertaken from the receptor. The calculated noise levels are provided in Table 3.

The construction activities have been implemented in the ground computer model for the site and surroundings employed for the operational noise model. In this way, the shielding effects of the railway embankment to residential properties to the east of the railway, represented by C4 and C5, have been taken into account in the calculations.

Table D.14.3: Predicted Façade Noise Levels During Main Building and ACC Construction – No Mitigation

Assessment Period	Activities	Predicted Noise Level $L_{Aeq,10hr}$ dB				
		C1	C2	C3	C4	C5
1	Earthworks	60	68	60	50	48
	Piling – Turbine Building	63	66	66	56	53
	Piling - Bunker	63	68	63	56	53
	TOTAL	**67**	**72**	**68**	**60**	**57**
2	Piling – Bale Store	63	66	63	53	53
	Piling – Boiler House	63	61	66	46	51
	Piling – Waste Bunker	63	66	63	53	51
	Floor slab – Turbine Building	55	58	58	48	45
	External surfaces	54	57	55	45	44
	TOTAL	**68**	**70**	**70**	**57**	**57**
3	Piling – ACC	60	62	64	58	54
	Piling – Tipper Hall	66	68	63	50	49
	Floor Slab – Waste Bunker	55	63	58	48	45
	Floor Slab – Turbine Building	55	58	58	48	45
	External Surfaces	54	57	55	45	44
	TOTAL	**68**	**70**	**68**	**59**	**56**
4	Floor Slab – Tipping Hall	59	63	55	42	41
	Steelwork – APC	62	60	64	62	59
	External Surfaces	54	57	55	45	44
	TOTAL	**64**	**65**	**65**	**62**	**59**
5	Cladding Roof – Tipper Hall	65	67	62	56	56
	Cladding Roof – Boiler House	58	60	64	62	58
	Cladding Walls – Boiler House	58	60	64	62	58
	Install ACC	54	57	57	51	48
	Install Plant – Boiler House	60	65	59	50	46
	Install Electrics – APC	53	56	56	56	44
	External Surfaces	57	60	55	45	44

	TOTAL	**68**	**71**	**69**	**66**	**63**
6	Cladding Walls – Bunker	62	67	62	59	58
	Cladding Walls – Turbine Building	62	65	64	59	58
	Cladding Roof – Turbine Building	62	65	64	59	58
	Install ACC	54	57	57	51	48
	External Surfaces	53	56	55	45	44
	TOTAL	**67**	**71**	**69**	**64**	**63**

Inspection of the noise levels in Table 3 shows that resultant noise levels to receptors C1, C3, C4 and C5 are at or below 70 dB(A). At C2, the 70 dB(A) limit is exceeded for some activities by a maximum of 2 dB(A).

Noise levels have also been predicted assuming that 3 metre high mobile noise barriers are installed around the piling rigs (at a distance of 5 to 10 metres from the piling rigs). These have only be applied to C1 to C3, as the railway embankment already provides attenuation to C4 and C5. The predicted 'with mitigation' noise levels are given in Table 4.

Table D.14.4: Predicted Façade Noise Levels During Main Building and ACC Construction – With Mitigation

Assessment Period	Activities	Predicted Noise Level $L_{Aeq,10hr}$ dB		
		C1	C2	C3
1	Earthworks	60	68	60
	Piling – Turbine Building	58	62	62
	Piling - Bunker	58	64	58
	TOTAL	**64**	**70**	**65**
2	Piling – Bale Store	58	62	58
	Piling – Boiler House	58	57	62
	Piling – Waste Bunker	58	62	58
	Floor slab – Turbine Building	55	58	58
	External surfaces	54	57	55
	TOTAL	**64**	**67**	**66**
3	Piling – ACC	55	58	60
	Piling – Tipper Hall	59	64	59
	Floor Slab – Waste Bunker	55	63	58
	Floor Slab – Turbine Building	55	58	58
	External Surfaces	54	57	55
	TOTAL	**63**	**68**	**65**
4	Floor Slab – Tipping Hall	59	63	55
	Steelwork – APC	62	60	64
	External Surfaces	54	57	55
	TOTAL	**64**	**65**	**65**
5	Cladding Roof – Tipper Hall	65	67	62
	Cladding Roof – Boiler House	58	60	64
	Cladding Walls – Boiler House	58	60	64
	Install ACC	54	57	57

	Install Plant – Boiler House	60	65	59
	Install Electrics – APC	53	56	56
	External Surfaces	57	60	55
	TOTAL	**68**	**71**	**69**
6	Cladding Walls – Bunker	62	67	62
	Cladding Walls – Turbine Building	62	65	64
	Cladding Roof – Turbine Building	62	65	64
	Install ACC	54	57	57
	External Surfaces	53	56	55
	TOTAL	**67**	**71**	**69**

Inspection of the noise levels in Table 4 shows that resultant noise levels to all receptors are at or below 70 dB(A), except during cladding works when noise levels at C1 will be up to 71 dB(A). However, as mentioned previously for the workshop, a large part of these cladding works will be shielded from surrounding receptors when working on the façade facing away from the receptors. Thus, resulting noise levels to all receptors will generally be below 70 dB(A) and internal noise levels will be below 40 dB(A) assuming closed windows.

Assessment of Significance

The significance of effect for the construction of the workshop and each of the assessment periods are given below. With regards to the significance of effect for the construction of the workshop, the worst-case predicted level for each receptor has been used.

Construction of Workshop

The main construction works associated with the construction of the workshop (floor slab, steelwork and cladding) will be undertaken over a two month period from 12th February 2013 to 12th April 2013. Hence, any significant noise impacts will be of relatively short duration.

Assessments of the significance of effects are provided in Tables 5 to 9.

Table D.14.5: Significance of Effect, Workshop Construction - Receptor C1

Construction Activity	Earthworks	Workshop foundations	Workshop slab	Workshop Steelwork and cladding	Workshop finishing
Ambient noise levels (façade) L_{Aeq} dB			57		
Rounded L_{Aeq} dB			55		
Acceptable L_{Aeq} (10 hrs)			70		
Predicted Noise Level $L_{Aeq,10h}$ dB	73	72	68	75	70
Level Above Acceptable L_{Aeq} dB	+3	+2	-2	+5	0
Significance of Effect	Low/Med	Low	None	Med/H	None

Table D.14.6: Significance of Effect, Workshop Construction - Receptor C2

Construction Activity	Earthworks	Workshop foundations	Workshop slab	Workshop Steelwork and cladding	Workshop finishing
Ambient noise levels (façade) L_{Aeq} dB			57		
Rounded L_{Aeq} dB			55		
Acceptable L_{Aeq} (10 hrs)			70		
Predicted Noise Level $L_{Aeq,10h}$ dB	69	68	63	70	65
Level Above Acceptable L_{Aeq} dB	-1	-2	-7	0	-5
Significance of Effect	None	None	None	None	None

Table D.14.7: Significance of Effect, Workshop Construction - Receptor C3

Construction Activity	Earthworks	Workshop foundations	Workshop slab	Workshop Steelwork and cladding	Workshop finishing
Ambient noise levels (façade) L_{Aeq} dB			59		
Rounded L_{Aeq} dB			60		
Acceptable L_{Aeq} (10 hrs)			75		
Predicted Noise Level $L_{Aeq,10h}$ dB	58	56	52	58	53
Level Above Acceptable L_{Aeq} dB	-17	-19	-23	-17	-22
Significance of Effect	None	None	None	None	None

Table D.14.8: Significance of Effect, Workshop Construction - Receptor C4

Construction Activity	Earthworks	Workshop foundations	Workshop slab	Workshop Steelwork and cladding	Workshop finishing
Ambient noise levels (façade) L_{Aeq} dB			53		
Rounded L_{Aeq} dB			55		
Acceptable L_{Aeq} (10 hrs)			70		
Predicted Noise Level $L_{Aeq,10h}$ dB	54	52	47	54	49
Level Above Acceptable L_{Aeq} dB	-16	-18	-23	-16	-21
Significance of Effect	None	None	None	None	None

Table D.14.9: Significance of Effect, Workshop Construction - Receptor C5

Construction Activity	Earthworks	Workshop foundations	Workshop slab	Workshop Steelwork and cladding	Workshop finishing
Ambient noise levels (façade) L_{Aeq} dB			53		
Rounded L_{Aeq} dB			55		
Acceptable L_{Aeq} (10 hrs)			70		
Predicted Noise Level $L_{Aeq,10h}$ dB	54	52	47	54	49
Level Above Acceptable L_{Aeq} dB	-16	-18	-23	-16	-21
Significance of Effect	None	None	None	None	None

Construction of Main Building and ACC

Assessments of the significance of effects, with no mitigation in place, are provided in Tables 10 to 14.

Table D.14.10: Significance of Effect, Main Building and ACC Construction - Receptor C1, No Mitigation

Assessment Period	1	2	3	4	5	6
Ambient noise levels (façade) L_{Aeq} dB				57		
Rounded L_{Aeq} dB				55		
Acceptable L_{Aeq} (10 hrs)				70		
Predicted Noise Level $L_{Aeq,10h}$ dB	67	68	68	64	68	67
Level Above Acceptable L_{Aeq} dB	-3	-2	-2	-6	-2	-3
Significance of Effect	None	None	None	None	None	None

Table D.14.11: Significance of Effect, Main Building and ACC Construction - Receptor C2, No Mitigation

Assessment Period	1	2	3	4	5	6
Ambient noise levels (façade) L_{Aeq} dB				57		
Rounded L_{Aeq} dB				55		
Acceptable L_{Aeq} (10 hrs)				70		
Predicted Noise Level $L_{Aeq,10h}$ dB	72	70	70	65	71	71
Level Above Acceptable L_{Aeq} dB	+2	0	0	-5	+1	+1
Significance of Effect	Low	None	None	None	Neg	Neg

Table D.14.12: Significance of Effect, Main Building and ACC Construction - Receptor C3, No Mitigation

Assessment Period	1	2	3	4	5	6
Ambient noise levels (façade) L_{Aeq} dB				59		
Rounded L_{Aeq} dB				60		
Acceptable L_{Aeq} (10 hrs)				75		
Predicted Noise Level $L_{Aeq,10h}$ dB	68	70	68	65	69	69
Level Above Acceptable L_{Aeq} dB	-7	-5	-7	-10	-6	-6
Significance of Effect	None	None	None	None	None	None

Table D.14.13: Significance of Effect, Main Building and ACC Construction - Receptor C4, No Mitigation

Assessment Period	1	2	3	4	5	6
Ambient noise levels (façade) L_{Aeq} dB				53		
Rounded L_{Aeq} dB				55		
Acceptable L_{Aeq} (10 hrs)				70		
Predicted Noise Level $L_{Aeq,10h}$ dB	60	57	59	62	66	64
Level Above Acceptable L_{Aeq} dB	-10	-13	-11	-8	-4	-6
Significance of Effect	None	None	None	None	None	None

Table D.14.14: Significance of Effect, Main Building and ACC Construction - Receptor C5, No Mitigation

Assessment Period	1	2	3	4	5	6
Ambient noise levels (façade) L_{Aeq} dB				53		
Rounded L_{Aeq} dB				55		
Acceptable L_{Aeq} (10 hrs)				70		
Predicted Noise Level $L_{Aeq,10h}$ dB	57	57	56	59	63	63
Level Above Acceptable L_{Aeq} dB	-13	-13	-14	-11	-7	-7
Significance of Effect	None	None	None	None	None	None

Assessments of the significance of effects at C1, C2 and C3, with mitigation in place (3 metre mobile noise barriers to piling rigs), are provided in Tables 15 to 17.

Table D.14.15: Significance of Effect, Main Building and ACC Construction - Receptor C1, With Mitigation

Assessment Period	1	2	3	4	5	6
Ambient noise levels (façade) L_{Aeq} dB				57		
Rounded L_{Aeq} dB				55		
Acceptable L_{Aeq} (10 hrs)				70		
Predicted Noise Level $L_{Aeq,10h}$ dB	64	64	63	64	68	67
Level Above Acceptable L_{Aeq} dB	-6	-6	-7	-6	-2	-3
Significance of Effect	None	None	None	None	None	None

Table D.14.16: Significance of Effect, Main Building and ACC Construction - Receptor C2, With Mitigation

Assessment Period	1	2	3	4	5	6
Ambient noise levels (façade) L_{Aeq} dB				57		
Rounded L_{Aeq} dB				55		
Acceptable L_{Aeq} (10 hrs)				70		
Predicted Noise Level $L_{Aeq,10h}$ dB	70	66	65	65	69	69
Level Above Acceptable L_{Aeq} dB	0	-4	-5	-5	-1	-1
Significance of Effect	None	None	None	None	None	None

Table D.14.17: Significance of Effect, Main Building and ACC Construction - Receptor C3, With Mitigation

Assessment Period	1	2	3	4	5	6
Ambient noise levels (façade) L_{Aeq} dB			59			
Rounded L_{Aeq} dB			60			
Acceptable L_{Aeq} (10 hrs)			75			
Predicted Noise Level $L_{Aeq,10h}$ dB	65	66	65	65	69	69
Level Above Acceptable L_{Aeq} dB	-10	-9	-10	-10	-6	-6
Significance of Effect	None	None	None	None	None	None

Mitigation

In addition to the employment of mobile barriers to piling works addressed above, it is expected that the contractor will follow Best Practicable Means to minimise the noise impact upon the local community. Best Practicable Means will include the following:

- All construction plant and equipment should comply with EU noise emission limits.
- Proper use of plant with respect to minimising noise emissions and regular maintenance. All vehicles and mechanical plant used for the purpose of the works should be fitted with effective exhaust silencers and should be maintained in good efficient working order.
- Selection of inherently quiet plant where appropriate. All major compressors should be 'sound reduced' models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use and all ancillary pneumatic percussive tools should be fitted with mufflers or silencers of the type recommended by the manufacturers.
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum.
- Plant and equipment such as flat bed lorries, skips and chutes should be lined with noise attenuating materials. Materials should be handled with care and be placed, not dropped. Materials should be delivered during normal working hours.
- All ancillary plant such as generators, compressors and pumps should be positioned so as to cause minimum noise disturbance, i.e. furthest from receptors or behind close boarded noise barriers. If necessary, acoustic enclosures should be provided and/or acoustic shielding.
- Construction contractors should be obliged to adhere to the codes of practice for construction working and piling given in BS 5228 and the guidance given therein minimising noise emissions from the site.
- Reference should be made to the Building Research Establishment, BRE 'Pollution Control' guidelines, Parts 1-5.

Conclusions

Predicted worst-case unmitigated levels during the construction of the workshop illustrate that the acceptable level is likely to be exceeded by up to 5 dB at the closest receptor to the works (C1). This is during the installation of the steelwork and external cladding, a significance of impact of medium/high. During earthworks the acceptable criterion is exceeded by 3 dB and 2dB during the laying of foundations, a significance of impact of medium. During all other construction activities at location C1, and during all activities at all other receptors, predicted noise levels result in no significance of impact.

During the construction of the main buildings and ACC, unmitigated noise levels are predicted to result in no impact at all but one receptor location. A significance of impact of low is predicted at C2 during construction periods 1 and negligible during periods 5 and 6. Exceedance of the acceptable criterion can be expected at this location due to the close proximity of this receptor to the construction site.

If mitigation is employed, in the form of mobile noise barriers around the piling rigs, noise levels at location C2 are predicted meet the acceptable criterion, with no significant noise impact.

Due to the topography of the area, the installation of permanent noise barriers is unlikely to provide adequate attenuation of noise. It must be noted that the predicted levels are worst-case predictions and noise levels will be lower for the majority of the time. Where noise levels are high, these will only occur for short periods of time.