ENVIRONMENTAL STATEMENT – VOLUME 3 – APPENDIX 7.2

Operational Noise Assumptions

Drax Bioenergy with Carbon Capture and Storage

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations, 2009 – Regulation (5(2)(a))

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1. NOISE SOURCE INFORMATION

1.1. CARBON DIOXIDE COMPRESSOR BUILDINGS

1.1.1. The following assumptions were made with regards to the compressor buildings, their materials and compressor units:

- **a.** There are two compressor units per compressor building;
- **b.** Compressor units operate 100% on-time;
- **c.** Two carbon dioxide compressor buildings are located to the west of northern cooling towers; and
- **d.** Compressor unit components are shown in **Table 1.1** along with their associated Sound Pressure Levels at 1 m:

Table 1.1 – Noise Levels for Each Compressor Unit Component - Unmitigated

Component	Octave Band Frequency (dBA)										dB(A)
	32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
Compressor Casing	56	75	86	95	101	105	109	107	93	83	113
Main Motor Casing	-	55	71	78	77	74	69	63	51	-	82
LO Console	-	72	71	76	75	76	76	80	77	-	85
1st Intercooler	55	70	78	84	89	92	95	94	83	75	99
2nd Intercooler	55	70	78	84	89	92	95	94	83	75	99
3rd Intercooler	55	70	78	84	89	92	95	94	83	75	99
4th Intercooler	55	70	78	84	89	92	95	94	83	75	99
5th Intercooler	55	70	78	84	89	92	95	94	83	75	99
Recycle Cooler	55	70	78	84	89	92	95	94	83	75	99

1.2. PUMPS

1.2.1. The following assumptions were made with regards to the pumps:

a. 96 Pumps in total, the majority of which are located to the immediate south-west of the northern cooling towers

b. A noise spectrum from Noise Control in Building Services, Sound Research Laboratories was assumed for pump noise. **Table 1.2** shows mitigated sound pressure level frequencies at 1 m from each pump.

Table 1.2 – Pump Noise Levels – Unmitigated

Component	Octave Band Frequency (dBA)										dB(A)
	32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
Pump Type 1	77	77	79	83	83	79	76	73	78	-	85
Pump Type 2	82	82	84	88	88	84	81	78	83	-	90
Pump Type 3	87	87	89	93	93	89	86	83	88	-	95

a. Pumps are set at a height of 1.5 m above ground level; and

b. Pumps operate 100% on-time.

1.3. COMBINED POWER TURBINE BUILDINGS

1.3.1. The following assumptions were made with regards to the combined power turbine buildings:

a. There are two steam turbines housed within one combined power turbine buildings;

b. The steam turbines operate 100% on-time;

c. There is one combined power turbine building located immediately west of the turbine hall**; and**

d. A noise spectrum adopted from Engineering Noise Control: Theory and Practice, 4th Edition, Bies & Hansen has been used, shown in **Table 1.3**, values correspond to noise levels at 1 m from the turbine.

Table 1.3 – Steam Turbine Noise Levels - Unmitigated

Component	Octave Band Frequency (dB)										dB(A)
	32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
Steam Turbine	79	83	84	81	80	80	78	77	73	-	85

1.4. FLUE GAS BOOSTER FANS

1.4.1. The following assumptions were made with regards to the flue gas booster fans:

a. There are four flue gas booster fans;

b. Flue gas booster fans operate 100% on-time;

c. Flue gas booster fans are located west of combined power turbine building and turbine hall; and

d. The noise levels at 1m from the flue gas booster fans casing is shown in **Table 1.4**.

Table 1.4 – Flue Gas Booster Fans Noise Levels – Unmitigated

Component	Octave Band Frequency (dB)										dB(A)
	32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
Flue Gas Booster Fans	-	94	99	111	103	98	89	76	63	-	105

2. MODEL CONFIGURATION

2.1. MAPPING

2.1.1. The following assumptions were made with regards to mapping:

- **a.** Topographical data input was DTM at a 2 m resolution from Defra Survey Data;
- **b.** Drax Power Station buildings were included in accordance with **Figure 2.2 (Indicative Plant Equipment Layout Plan)** (document reference 6.2.2.2); and
- **c.** Buildings in areas surrounding Drax were from OS OpenMap Local.

2.2. MODEL SETTINGS

2.2.1. The following assumptions are with regards to CadnaA configuration settings:

- **a.** Calculations were set to ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors;
- **b.** Default ground absorption setting was set to 50%; and
- **c.** The maximum order of reflections was set to a value of two.

3. PRIMARY MITIGATION

3.1. OPERATIONAL MITIGATION - EXAMPLE

3.1.1. The assumed noise levels presented in **Section 4** will be achieved through mitigation that will be defined at detailed design stage of the Proposed Scheme. This section presents an example of the measures that could be implemented to achieve this: :

- **a.** A single acoustic enclosure has been assumed for the combined power turbine building;
- **b.** A single acoustic enclosure has been assumed for the pumps such that the noise level at 1 m from each pump does not exceed 80 dB(A);
- **c.** Double acoustic enclosures have been assumed for the carbon dioxide compressor buildings;
- **d.** Carbon dioxide compressor buildings with mechanical ventilation and appropriate noise silencing on air louvres have been assumed;
- **e.** Double acoustic enclosures have been assumed for the flue gas booster fans;
- **f.** Acoustic cladding has been assumed for the ducting of the flue gas booster fans; and
- **g.** The acoustic performance for the cladding on the carbon dioxide compressor buildings is shown in **Table 3.1**.

Table 3.1 - Cladding Acoustic Performance

SRI (dB) Frequency																	
100 Hz	**125 Hz**	**160 Hz**	**200 Hz**	**250 Hz**	**315 Hz**	**400 Hz**	**500 Hz**	**630 Hz**	**800 Hz**	**1000 Hz**	**1250 Hz**	**1600 Hz**	**2000 Hz**	**2500 Hz**	**3150 Hz**	**4000 Hz**	**5000 Hz**
13	14	16	17	21	22	24	26	28	28	29	31	33	35	37	37	35	32

3.1.2. The acoustic performance assumed for the masonry on the carbon dioxide compressor buildings is shown in **Table 3.2**.

Table 3.2 – Masonry Acoustic Performance

SRI (dB) Frequency																	
100 Hz	**125 Hz**	**160 Hz**	**200 Hz**	**250 Hz**	**315 Hz**	**400 Hz**	**500 Hz**	**630 Hz**	**800 Hz**	**1000 Hz**	**1250 Hz**	**1600 Hz**	**2000 Hz**	**2500 Hz**	**3150 Hz**	**4000 Hz**	**5000 Hz**
24	25	27	28	32	33	35	37	39	39	40	42	44	46	48	48	46	43

4. ASSUMED NOISE LEVELS

4.1. OPERATIONAL NOISE LEVELS ASSUMPTIONS

4.1.1. This section presents the assumed noise levels that will be achieved within short distance to the main operational plant items. These values have been obtained through the noise modelling process.

FLUE GAS BOOSTER FANS

4.1.2. The tables below show the assumed noise levels within short distance of the Flue Gas Booster Fans:

4.1.3. **Table 4.1** shows the octave band noise levels at 5 m from the flue gas booster fans casing attributable to a mitigated single gas flue blower only with no other item of plant operational.

Table 4.1- Mitigated Noise Levels at 5 m from Flue Gas Booster Fans Only Operational

Plant	Octave Band Frequency (dBA)										dB(A)
	32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
Gas Flue Blower Only	-	51	59	68	59	53	40	28	30	-	69

4.1.4. **Table 4.2** shows the octave band noise levels at 5 m from the south-west flue gas booster fans casing with all plant operational:

Table 4.2 – Mitigated Noise Levels at 5 m From Flue Gas Booster Fans All Plant Operational

Plant	Octave Band Frequency (dB)										dB(A)
	32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
All Operational	91	78	76	78	63	54	40	29	31	-	71

CARBON DIOXIDE COMPRESSOR BUILDINGS

4.1.5. The tables below show the assumed noise levels within short distance of the carbon dioxide compressor buildings:

4.1.6. **Table 4.3** shows the octave band noise levels at 5 m from the west façade of the west carbon dioxide compressor building attributable to a single mitigated compressor building only with no other item of plant operational.

Table 4.3 – Mitigated Noise Levels at 5 m from West Façade of Single Carbon Dioxide Compressor Building Only

Plant	Octave Band Frequency (dBA)										dB(A)
	32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
Carbon Dioxide Compressor Building Only	-	47	47	41	50	32	27	25	30	-	53

4.1.7. **Table 4.4** shows the octave band noise levels at 5 m from the west façade of a mitigated carbon dioxide compressor buildings with all plant operational:

Table 4.4 – Mitigated Noise Levels at 5 m from West Façade of Carbon Dioxide Compressor Building All Plant Operational

Plant	Octave Band Frequency (dB)										dB(A)
	32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
All Operational	87	74	64	51	54	34	28	25	32	-	55

PUMPS

4.1.8. The tables below show the assumed noise levels within short distance of the Pumps:

a. Noise level at 5 m west of pump area with mitigated pumps only with no other plant item operational: 63.6 dB(A); and

b. A noise spectrum from Noise Control in Building Services, Sound Research Laboratories was assumed for pump noise. **Table 4.5** shows mitigated sound pressure level frequencies at 1 m from each pump.

Table 4.5 – Pump Noise Levels – Mitigated

Component	Octave Band Frequency (dB)										dB(A)
	32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
Pump	72	72	74	78	78	74	71	68	73	-	80

4.1.9. **Table 14** shows the octave band noise levels at 5 m west of pump area with mitigated pumps with all plant operational.

Table 4.6 – Mitigated Noise Levels at 5 m from Pump Area All Plant Operational

Plant	Octave Band Frequency (dB)										dB(A)
	32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
All Operational	72	59	59	62	62	59	56	52	55	-	65

COMBINED POWER TURBINE BUILDING

4.1.10. The tables below show the assumed noise levels within short distance of the combined power turbine building:

a. Noise level at 5 m west of the combined power turbine building with no other plant item operational: 45.1 dB(A); and

b. **Table 4.7** shows the octave band noise levels at 5 m west of the combined power turbine building with all plant operational.

Table 4.7 – Mitigated Noise Levels at 5 m West of Combined Power Turbine Building with All Plant Operational

Plant	Octave Band Frequency (dB)										dB(A)
	32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
All Operational	82	69	67	69	57	53	49	45	45	-	63