



ABERDEEN HARBOUR  
EXPANSION PROJECT  
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Appendices*

# APPENDIX 20-D OPERATIONAL NOISE LEVEL CALCULATIONS



## **20-D OPERATIONAL NOISE LEVEL CALCULATIONS**

Operational noise level calculations have been undertaken based on existing operations at Aberdeen Harbour. It is not known at this stage which operations will form part of the Aberdeen Harbour Extension Project, or indeed where they will be undertaken within the AHEP site boundary. On this basis calculations have been undertaken for 'worst-case' and 'typical' scenarios. Worst case assumes that the operation/plant is located at the shortest distance to the sensitive receptor and typical case assumes that the operation/plant is located at a central distance within the nearest zone (quay or berthing area).

Prediction of sound power of the various plant and operations were estimated from the following equation:

$$L_{AW} = L_{Aeq} + 20 \text{ Log } r + 8$$

Where:

- $L_{WA}$  - Sound Power Level (dB(A))
- $R$  - Distance from microphone to operation/plant

The predicted noise level from movement of HGVs on the internal access road are based on current flow distribution to the existing Aberdeen Harbour and the haul road calculation methodology within BS5228:1999+A1:2014.

### **BS5228 Haul Road Calculation Method**

$$L_{Aeq,T} = L_{WA} - 33 + 10 \text{ Log } Q - 10 \text{ Log } V - 10 \text{ Log } d$$

Where:

- $L_{WA}$  - Sound Power Level (taken as 105.5dB(A))
- $Q$  - Number of vehicles per hour
- $V$  - Average vehicle speed kph (assumed to be 16 kph)
- $D$  - Distance in meters of receiving position from the centre of haul road.

**Table 20D.1: Measured operational noise levels at Aberdeen Harbour**

Operation	Measurement setup			LAeq	LAmax	LA1	LA10	LA90	LW from (LAeq)	Tonal Frequencies	Notes
	Ref.	Dist. (m)	Time (sec.)								
Tank cleaning	1501	15	300	76.1	89.0	78.8	76.5	75.6	107.6	63Hz	
Cargo and chain handling	1502	15	300	75.9	98.7	88.9	76.8	67.3	93.4	-	Loading large pipes onto lorries via mobile forklift
	1512	20	300	72.5	94.9	79.9	75.8	62.9	106.5	-	Cargo unloading. Moving containers from boat
	1503	15	50	78.3	96.1	88.4	83.4	65.7	109.8	-	Forklift lifting pipes
	1504	20	97	68.5	79.9	74.6	72.0	65.0	102.5	-	Crane lifting pipes off boat including dismantling chains from pipes
	1505	15	15	71.0	80.5	75.8	73.3	69.0	102.5	800Hz, 1.25KHz	Forklift reverse beeper
	1507	15	19	74.9	84.9	79.8	78.0	71.4	106.4	-	Forklift reverse beeper
	1513	10	11	78.1	80.6	79.8	79.8	77.0	106.1	2500Hz, 10000Hz	Forklift reverse beeper
	1511	10	7	74.6	77.4	76.4	76.4	73.5	102.6	-	Large forklift reverse beeper
Mobile cranes	1506	20	91	70.6	86.7	81.2	73.9	64.3	104.6	-	Mobile crane lifting
	1508	40	60	76.5	82.8	81.0	78.8	73.8	116.5	800Hz, 1KHz, 1.6KHz, 2KHz	Large mobile crane moving
	1509	30	52	78.6	87.5	82.4	80.1	77.1	116.1	-	Large mobile crane moving (issues during measurement)
	1510	20	60	87.5	92.0	90.2	89.5	83.9	121.5	800Hz, 1KHz	Large mobile crane moving
Vessel generator	1514	25	50	67.9	81.6	75.8	70.1	63.8	103.9	-	
Grain elevator	1517	7	60	68.7	70.4	69.7	69.4	68.2	93.6	-	Generator only
Tugboat berthing and manoeuvring	1516	6	60	63.4	66.9	64.6	63.9	63.0	87.0	-	Waiting tugboat engine
	1515	10	300	66.4	71.9	70.3	68.8	62.3	94.4	-	Tugboat pulling away from dock

**Table 20D.2: Predicted worst-case noise levels day**

Operation	L <sub>AW</sub>	Notes	Predicted Noise Level AHEP dB LAeq			Predicted Overall Noise Level (AHEP + Prevailing) dB LAeq			Predicted Change in Noise Level		
			A	B	C	A	B	C	A	B	C
Tank cleaning	108		38	59	47	54	59	53	0	12	2
Cargo and chain handling	107	Loading large pipes onto lorries via mobile forklift	38	59	47	54	59	52	0	12	1
	107	Cargo unloading. Moving containers from boat	37	58	46	54	58	52	0	11	1
	110	Forklift lifting pipes	40	61	49	54	62	53	0	15	2
	103	Crane lifting pipes off boat including dismantling chains from pipes	33	54	42	54	55	52	0	8	1
	103	Forklift reverse beeper	33	54	42	54	55	52	0	8	1
	106	Forklift reverse beeper	37	58	46	54	58	52	0	11	1
	106	Forklift reverse beeper	36	58	46	54	58	52	0	11	1
Mobile cranes	103	Large forklift reverse beeper	33	54	42	54	55	52	0	8	1
	105	Mobile crane lifting	35	56	44	54	57	52	0	10	1
	117	Large mobile crane moving	47	68	56	55	68	57	1	21	6
Vessel generator	104		35	46	42	54	50	51	0	3	0
Grain elevator	94	Generator only	24	45	33	54	49	51	0	2	0
Tugboat berthing and manoeuvring	87	Waiting tugboat engine	17	29	25	54	47	51	0	0	0
	94	Tugboat pulling away from dock	26	37	32	54	47	51	0	0	0

**Table 20D.3: Predicted worst-case noise levels night**

Operation	LW (LAeq)	Notes	Predicted Noise Level AHEP dB LAeq			Predicted Overall Noise Level (AHEP + Prevailing) dB LAeq			Predicted Change in Noise Level		
			A	B	C	A	B	C	A	B	C
Tank cleaning	108		38	59	47	48	59	48	0	18	8
Cargo and chain handling	107	Loading large pipes onto lorries via mobile forklift	38	59	47	48	59	48	0	18	8
	107	Cargo unloading. Moving containers from boat	37	58	46	48	58	47	0	17	7
	110	Forklift lifting pipes	40	61	49	49	61	50	1	20	10
	103	Crane lifting pipes off boat including dismantling chains from pipes	33	54	42	48	54	44	0	13	4
	103	Forklift reverse beeper	33	54	42	48	54	44	0	13	4
	106	Forklift reverse beeper	37	58	46	48	58	47	0	17	7
	106	Forklift reverse beeper	36	58	46	48	58	47	0	17	7
Mobile cranes	103	Large forklift reverse beeper	33	54	42	48	54	44	0	13	4
	105	Mobile crane lifting	35	56	44	48	56	46	0	15	6
	117	Large mobile crane moving	47	68	56	50	68	56	2	27	16
Vessel generator	104		35	46	42	48	47	44	0	6	4
Grain elevator	94	Generator only	24	45	33	48	47	41	0	6	1
Tugboat berthing and manoeuvring	87	Waiting tugboat engine	17	29	25	48	41	40	0	0	0
	94	Tugboat pulling away from dock	26	37	32	48	42	41	0	1	1

**Table 20D.4: Worst Case Distance Source to SR**

Operation	LW (LAeq)	Notes	Distance [m]		
			A	B	C
Tank Cleaning	108		1230	105	420
Cargo and chain handling	107	Loading large pipes onto lorries via mobile forklift	1230	105	420
	107	Cargo unloading. Moving containers from boat	1230	105	420
	110	Forklift lifting pipes	1230	105	420
	103	Crane lifting pipes off boat including dismantling chains from pipes	1230	105	420
	103	Forklift reverse beeper	1230	105	420
	106	Forklift reverse beeper	1230	105	420
	106	Forklift reverse beeper	1230	105	420
	103	Large forklift reverse beeper	1230	105	420
Mobile Cranes	105	Mobile crane lifting	1230	105	420
	117	Large mobile crane moving	1230	105	420
Vessel generator	104		1050	310	505
Grain elevator	94	Generator only	1230	105	420
Tugboat berthing and manoeuvring	87	Waiting tugboat engine	1200	310	505
	94	Tugboat pulling away from dock	1050	310	505

**Table 20D.5: Predicted typical-case noise levels day**

Operation	L <sub>AW</sub>	Notes	Predicted Noise Level AHEP dB LAeq			Predicted Overall Noise Level (AHEP + Prevailing) dB LAeq			Predicted Change in Noise Level		
			A	B	C	A	B	C	A	B	C
Tank cleaning	108		36	46	45	54	49	52	0	2	1
Cargo and chain handling	107	Loading large pipes onto lorries via mobile forklift	36	46	45	54	49	52	0	2	1
	107	Cargo unloading. Moving containers from boat	35	45	44	54	49	52	0	2	1
	110	Forklift lifting pipes	38	48	48	54	51	53	0	4	2
	103	Crane lifting pipes off boat including dismantling chains from pipes	31	41	40	54	48	51	0	1	0
	103	Forklift reverse beeper	31	41	40	54	48	51	0	1	0
	106	Forklift reverse beeper	35	45	44	54	49	52	0	2	1
	106	Forklift reverse beeper	35	44	44	54	49	52	0	2	1
Mobile cranes	103	Large forklift reverse beeper	31	41	40	54	48	51	0	1	0
	105	Mobile crane lifting	33	43	42	54	48	52	0	1	1
	117	Large mobile crane moving	45	55	54	55	55	56	1	8	5
Vessel generator	104		35	41	40	54	48	51	0	1	0
Grain elevator	94	Generator only	22	32	31	54	47	51	0	0	0
Tugboat berthing and manoeuvring	87	Waiting tugboat engine	18	24	23	54	47	51	0	0	0
	94	Tugboat pulling away from dock	25	32	31	54	47	51	0	0	0



**Table 20D.6: Predicted typical-case noise levels night**

Operation	LW (LAeq)	Notes	Predicted Noise Level AHEP dB LAeq			Predicted Overall Noise Level (AHEP + Prevailing) dB LAeq			Predicted Change in Noise Level		
			A	B	C	A	B	C	A	B	C
Tank cleaning	108		36	46	45	48	47	46	0	6	6
Cargo and chain handling	107	Loading large pipes onto lorries via mobile forklift	36	46	45	48	47	46	0	6	6
	107	Cargo unloading. Moving containers from boat	35	45	44	48	46	46	0	5	6
	110	Forklift lifting pipes	38	48	48	48	49	48	0	8	8
	103	Crane lifting pipes off boat including dismantling chains from pipes	31	41	40	48	44	43	0	3	3
	103	Forklift reverse beeper	31	41	40	48	44	43	0	3	3
	106	Forklift reverse beeper	35	45	44	48	46	46	0	5	6
	106	Forklift reverse beeper	35	44	44	48	46	45	0	5	5
Mobile cranes	103	Large forklift reverse beeper	31	41	40	48	44	43	0	3	3
	105	Mobile crane lifting	33	43	42	48	45	44	0	4	4
	117	Large mobile crane moving	45	55	54	50	55	54	2	14	14
Vessel generator	104		35	41	40	48	44	43	0	3	3
Grain elevator	94	Generator only	22	32	31	48	41	41	0	0	1
Tugboat berthing and manoeuvring	87	Waiting tugboat engine	18	24	23	48	41	40	0	0	0
	94	Tugboat pulling away from dock	25	32	31	48	42	40	0	1	0

**Table 20D.7: Typical case distance source to SR**

Operation	LW (LAeq)	Notes	Distance [m]		
			A	B	C
Tank cleaning	108		1500	490	520
Cargo and chain handling	107	Loading large pipes onto lorries via mobile forklift	1500	490	520
	107	Cargo unloading. Moving containers from boat	1500	490	520
	110	Forklift lifting pipes	1500	490	520
	103	Crane lifting pipes off boat including dismantling chains from pipes	1500	490	520
	103	Forklift reverse beeper	1500	490	520
	106	Forklift reverse beeper	1500	490	520
	106	Forklift reverse beeper	1500	490	520
	103	Large forklift reverse beeper	1500	490	520
Mobile cranes	105	Mobile crane lifting	1500	490	520
	117	Large mobile crane moving	1500	490	520
Vessel generator	104		1130	530	600
Grain elevator	94	Generator only	1500	490	520
Tugboat berthing and manoeuvring	87	Waiting tugboat engine	1130	530	600
	94	Tugboat pulling away from dock	1130	530	600

**Table 20D.8: Existing Aberdeen Harbour HGV flows**

Time	Arrivals			Departures		
	Total	HGV	%HGV	Total	HGV	%HGV
00:00 - 01:00	3	1	34.90%	5	2	46.70%
01:00 - 02:00	5	2	44.60%	3	1	38.10%
02:00 - 03:00	1	0	0.00%	8	4	59.10%
03:00 - 04:00	4	0	0.00%	5	1	24.40%
04:00 - 05:00	4	0	11.50%	8	2	26.60%
05:00 - 06:00	11	1	8.50%	13	6	44.10%
06:00 - 07:00	35	3	7.50%	12	8	68.00%
07:00 - 08:00	61	12	14.80%	27	18	66.60%
08:00 - 09:00	43	11	48.80%	31	14	46.00%
09:00 - 10:00	49	17	34.90%	40	13	32.00%
10:00 - 11:00	56	23	40.70%	54	22	40.40%
11:00 - 12:00	65	25	38.40%	78	22	28.60%
12:00 - 13:00	55	17	30.80%	55	17	30.50%
13:00 - 14:00	51	22	43.60%	45	15	33.60%
14:00 - 15:00	70	41	58.70%	63	32	50.70%
15:00 - 16:00	53	32	60.40%	60	34	57.00%
16:00 - 17:00	43	25	58.30%	45	20	44.10%
17:00 - 18:00	17	14	81.80%	65	22	34.30%
18:00 - 19:00	17	10	59.70%	25	6	24.60%
19:00 - 20:00	19	8	42.00%	24	8	31.90%
20:00 - 21:00	10	4	43.20%	13	4	34.80%
21:00 - 22:00	7	3	37.70%	10	3	34.50%
22:00 - 23:00	8	3	39.10%	7	0	0.00%
23:00 - 24:00	5	2	41.00%	4	0	0.00%
<b>00:00 - 24:00</b>	<b>693</b>	<b>278</b>	<b>40.10%</b>	<b>700</b>	<b>277</b>	<b>39.60%</b>

**Table 20D.9: Data used in haul road calculations**

Item	Value
Sound Power Level: dB(A)	105.5
Average Vehicle Speed (kph):	16
Distance From SR A (m):	1500
Distance From SR B (m):	330
Distance From SR C (m):	380

**Table 20D.10: Predicted HGV noise from haul road**

Time	dB LAeq			
	10 m	SR A	SR B	SR C
00:00 - 01:00	55	33	40	39
01:00 - 02:00	55	33	40	39
02:00 - 03:00	56	35	41	41
03:00 - 04:00	50	29	35	35
04:00 - 05:00	53	32	38	38
05:00 - 06:00	59	37	44	43
06:00 - 07:00	61	39	46	45
07:00 - 08:00	65	43	50	49
08:00 - 09:00	64	43	49	49
09:00 - 10:00	65	43	50	49
10:00 - 11:00	67	45	52	51
11:00 - 12:00	67	45	52	51
12:00 - 13:00	66	44	51	50
13:00 - 14:00	66	44	51	50
14:00 - 15:00	69	47	54	53
15:00 - 16:00	69	47	53	53
16:00 - 17:00	67	45	52	51
17:00 - 18:00	66	44	51	50
18:00 - 19:00	63	41	47	47
19:00 - 20:00	63	41	47	47
20:00 - 21:00	59	38	44	44
21:00 - 22:00	58	36	43	42
22:00 - 23:00	55	33	40	39
23:00 - 24:00	53	32	38	38