Public

Ingevity New Boiler Plant – Environmental Noise Report

Ingevity UK Ltd, Warrington

February 2022

ENG/22/PSP/EC/2534/R

Engineering Energy

past - now - future

Title:	**Ingevity New Boiler Plant – Environmental Noise Report**		
Report Number:	**ENG/22/PSP/EC/2534/R**	**Revision:**	
Classification:	**Public**	**Publication date:**	**February 2022**
Lead Author:	Brown K, Environmental Compliance		
Lead Contributors:			
Approver:	Griffiths S J, Environmental Compliance		
Customer:	**Ingevity UK Ltd, Warrington**		
Addressee:	Tony Garnett, Project Engineer		
Purchase Order Number:	4500687723/U04/5904	**Contract Terms:**	Std. UTL T&C's
IP Contracted Out:	No	**Indemnity Provided:**	No
Job Number:	2122.C12303.001		
Revision Notes:			

Authored by:

Kevin Brown Digitally signed by Kevin Brown Date: 2022.02.18 14:25:02 Z

Environmental Compliance

Approved by:

Dr. Steve Griffiths Digitally signed by Dr. Steve Griffiths Date: 2022.02.18 15:14:04 Z

Environmental Compliance

Executive Summary

This report has considered the environmental noise levels that are likely to arise due to operation of the New Boiler Plant proposed for the Baronet Road site. The assessment is primarily based on a baseline noise survey carried out in January 2022, in conjunction with noise model predictions. Consideration is also given to historic boundary, residential receptor levels and established site noise control requirements.

An operational noise model has been developed for the New Boiler Plant and an assessment has been undertaken in line with the BS 4142 approach which considers the magnitude of the predicted rating noise level relative to the current sound level. In addition, as the proposed development can be considered to be a modification to the existing plant, potential changes to the overall noise level at the perimeter and in the community are assessed.

The results from the recent noise survey at selected positions are in close agreement with past measurements around the site (+/- 1dB). This suggests that the environmental noise emissions from the site have remained largely consistent with historic levels and it is appropriate to consider any New Boiler Plant noise in relation to previous boundary and residential receptor results.

A worst-case assumption has been made that the boiler plant being additive to the current ambient noise level. This approach ignores the likely changes that will arise from future modifications to the local road layout and any decrease in site noise emission due to the existing boiler plant being taken out of operation.

The majority of the noise from the New Boiler Plant will be contained within the associated plant building, which should ensure that any environmental noise emission does not contain any aural features that would raise public attention and attract a rating penalty. Rating levels for the New Boiler Plant are estimated to range between 28 and 33 dB L_{Ar} at relevant residential receptor locations. These levels are 8 to 20 dB below the current late evening L_{A90} level and, at worst, could give rise to an increase in ambient L_{Aeq} level of only 0.5dB. The modelling suggests that the New Boiler Plant operational noise will be minor in relation to the current ambient sound levels and is unlikely to be perceptible or give rise to an adverse effect.

The consequence of locating new plant in the south-west corner of the site in relation to the site's requirement for no increase in established boundary L_{Aeq} levels has also been considered. No change in sound level is anticipated along the majority of the site's boundary. However, because of the New Boiler Plant 's proximity to the south-west boundary, local boundary levels are predicted to rise by 2-3dB. Whilst this doesn't align with the site's aim of limiting boundary levels, any increases will be relatively localised and can be classified as insignificant, since it is has been possible to demonstrate that no adverse impact would be expected at residential receptors.

For the construction phases, noise levels are predicted to be 51 dB L_{Aeq} or less at residential locations, which are below BS 5228 threshold levels and therefore an indication that construction noise effects would not be significant. Only very low levels of vibration will be generated during construction and operational phases and will not be discernible at any sensitive receptor.

Report Distribution

Mr T Garnett	Project Engineer, Ingevity UK Ltd
Mr S Brandwood	Environment & Quality Co-Ordinator, Ingevity UK Ltd

CONTENTS

1 Introduction

An assessment study has been completed of the environmental noise contribution from the New Boiler Plant proposed for the south-west corner of the Baronet Road site. The assessment compares estimates from a plant noise model with current and pre-existing off-site sound levels at the site boundary and key noise sensitive receptors. See Appendix A for a glossary of acoustic terminology.

2 Context

BS 4142:2014 (1) provides methods for rating and assessing industrial and commercial sound. The impact of the industrial sound is assessed in terms of the rating level, L_{Ar} (the specific L_{Aeq} sound level plus any adjustment for the characteristic features of the sound) and the background sound level, L_{A90}. If the industrial sound contains certain acoustic features then the significance of the impact can be increased. Presence of tonality, impulsivity or intermittency in the specific sound at the receptors attracts a rating penalty. Extract of BS4142:2014 Section 11, Assessment of Impacts:

> *The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.*
>
> *Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9).*
>
> *NOTE 1 More than one assessment might be appropriate.*
>
> *a) Typically, the greater this difference, the greater the magnitude of the impact.*
>
> *b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
>
> *c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
>
> *d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*
>
> *NOTE 2 Adverse impacts may include but not be limited to annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.*

Any assessment of the New Boiler Plant sound needs to take into account the BS 4142 approach but also recognise the context of the proposed plant being integrated onto the Baronet Road site and its corresponding additive effect.

2.1 Existing Noise Requirements

An environmental assessment was completed as part of Solvay's Baronet Road site's Pollution Prevention and Control permit (2). In support of that application, a noise survey was undertaken at four residential locations and eleven boundary locations to characterise the ambient sound level and establish a baseline.

An extract of the Section B2.9 Noise assessment page which shows L_{Aeq} results and associated observations is give in Figure 2-1. Those locations where past residential and boundary measurements could be potentially relevant to this current assessment are shown by the grey labels in Figure 2-2. The labels also contain the measured L_{Aeq} levels in brackets. Other key noise sensitive receptor areas are also labelled, and this includes an area to the north of the River Mersey that is being developed for future new housing.

Within the PPC report, the following commitment is made to controlling both local noise levels and boundary levels:

> *……Noise emissions are considered during design and procurement of new equipment. For example, any externally located equipment, such as electrical drives, are designed to produce a noise level of no more than 79 dBA at 1 metre and not to exceed existing boundary noise levels. All internally located equipment is purchased to produce a noise level of no more than 79 dBA at 1 metre to ensure that noise regulations will be adhered to.*
>
> *Where it is not technically feasible to achieve such inherently low noise levels, equipment is installed within a building or dedicated acoustic enclosure…..*

Overall, adopting noise limits at source and requiring that boundary levels do not exceed pre-existing levels, should ensure that any impact at off-site noise sensitive receptors is controlled. These noise emission requirements have been taken into account in this noise assessment study for the New Boiler Plant, see Section 4.1.2.

Environmental Impact of Noise Emissions

As described earlier, the number and proximity of sensitive noise receptors to the site indicates that the receiving environment may be considered to be sensitive to emissions of noise from the installation. However, the low number of noise complaints levied against the normal operations of the installation provides an indicator that the receiving environment has not been sensitised to noise emissions from the installation.

Table 2.9.4.2 Boundary & Sensitive Receptor Evening-time L_{eq} Noise Levels – Survey undertaken 13 July 2005 (*see also Figure 2.9.4*)

	Location and Description	dBA Leq	Comment
1.	**Sensitive Receptor** - By Baronet Mews residential properties on border of Morely Common	48	General hiss of plant in background. Intermittent passing train noise.
2.	**Sensitive Receptor** - On canal bank just off Morely Road by South West emergency site entrance.	46	Noise of water cascading into canal.
3.	**Sensitive Receptor** – by No 14 Baronet Rd, Company owned residential property	51	General hiss of plant in background. Intermittent passing train noise. Centre band frequency measurement shows no tonal qualities to noise.
4.	**Site Boundary** – North East end of warehouse area by car park.	48	General hiss of plant in background. Intermittent passing train noise.
5.	**Site Boundary** – South East end of warehouse area by car park.	46	General hiss of plant in background. Intermittent passing train noise.
6.	**Site Boundary** – South of PCS silos	61	Effluent pit extraction fan noise predominant. Occasional Redler conveyor screech.
7.	**Site Boundary** – South of PCS H2O2 storage tanks.	64	Whine of Howden compressors predominant noise. Centre band frequency measurement shows no tonal qualities to noise.
8.	**Site Boundary** – South East end of main H2O2 tankfarm.	55	General hiss from Caprolactone Monomer plant perceptible.
9.	**Site Boundary** – ca 50m east of gas high pressure let down station	47	General hiss from Caprolactone Monomer plant perceptible. Intermittent passing train noise. Centre band frequency measurement shows no tonal

B2.9 NOISE

	Location and Description	dBA Leq	Comment
			qualities to noise.
10.	**Site Boundary** – ca 100m short of site far east boundary.	39	No plant noise perceptible. Intermittent passing train noise.
11.	**Site Boundary** – North East corner of roadways 4 & 8, near Capa Monomer plant.	64	General hiss from Caprolactone Monomer plant perceptible
12.	**Site Boundary** – North East corner of AO Crude plant.	64	General hiss from AO plant perceptible.
13.	**Site Boundary** – North West end of Caprolactone Polymer plant by Morley Common.	49	General hiss of plant in background. Intermittent passing train noise.
14.	**Site Boundary** – South West end of Caprolactone Polymer plant by Morley Common.	63	Polymer plant fridge fans, plant polymer plant his and electricity substation noise perceptible.
15.	**Sensitive Receptor** - Mill Lane farm	42	Very faint whine of Howden compressors perceptible. Intermittent passing train noise.

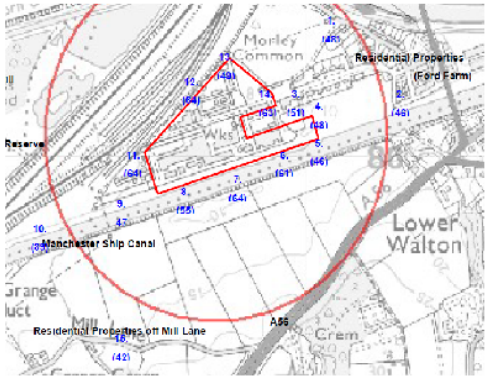

Figure 2-1 Extract of Measurement table from sites' PPC environmental Noise impact assessment (2)

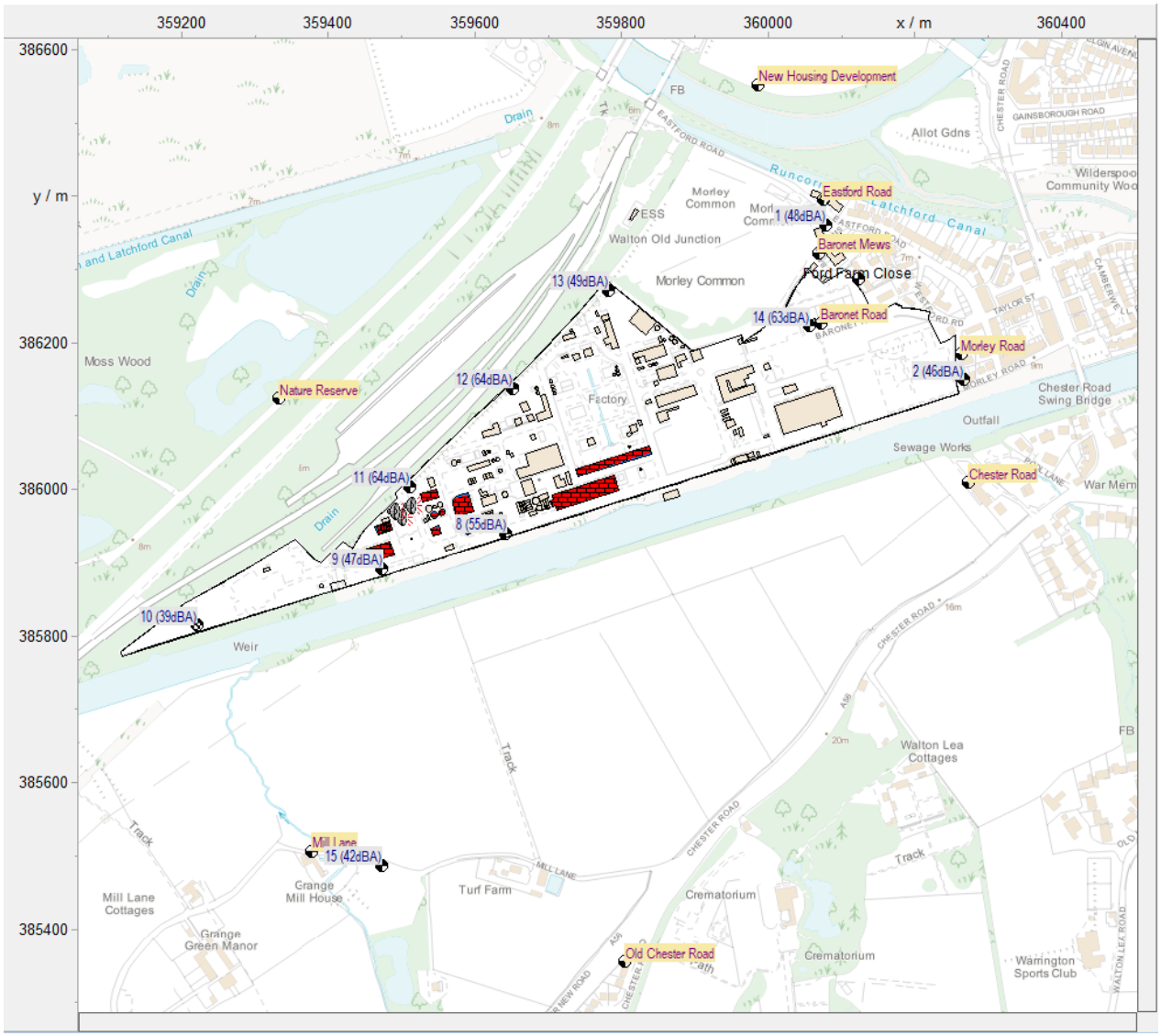

Figure 2-2 Map showing site map and key residential receptor locations and historic noise assessment locations (L_{Aeq} values in brackets from survey completed to support PPC permit)

3 Noise Measurements

An attended noise measurement survey was completed in January 2022 at selected locations that are representative of key noise receptor locations and near to previous survey positions. Four locations were specifically selected based on their proximity to the Baronet Road site, the likely future population and also possible sensitivity to additional plant sound from the south-west of the site. The positions are shown in Figure 3-1.

In recognition of likely changes to the road infrastructure and residential areas, measurements were not made at the nearest residence [Location 14 in Figure 2-2] Baronet Road, however measurements were made at [Location 16] Eastford Road (W) which is relatively close to the new housing development area.

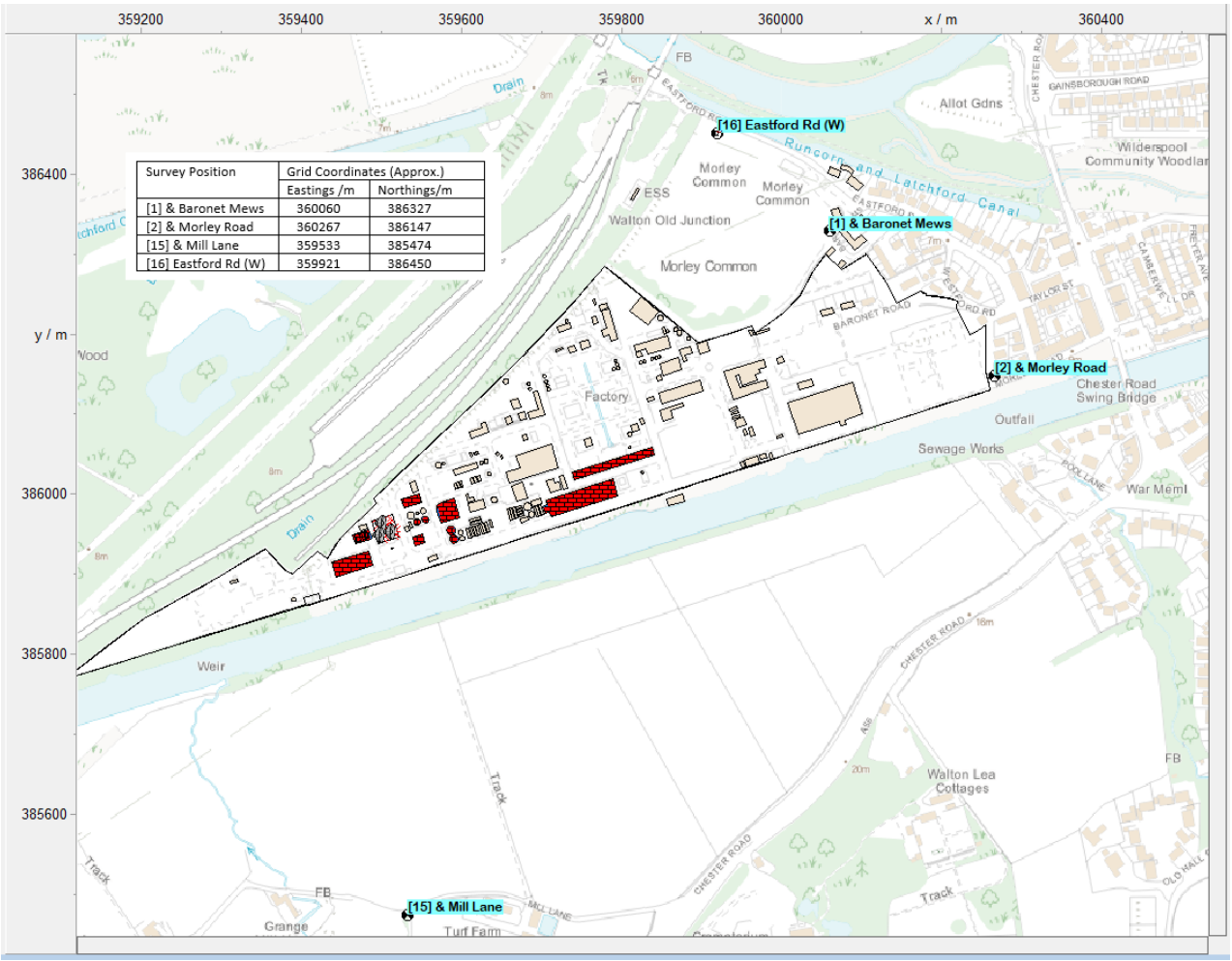

Figure 3-1 Map showing site and January 2022 survey locations

The sound level meter used during the survey was a precision grade Type 1 meter to IEC 651 or IEC 61672-1 standard and accuracy; the acoustic calibrator conforms to Class 1 Standard of IEC 60942. The settings used were:

- Calibration Setting: 94 dB;
- Meter Setting: A-weighting and “Fast” response.
- Typically 15-minute duration L_{Aeq} , L_{A10}, L_{A50}, LA_{90} etc (reduced to 5minutes for the last evening sample)
- The meter was calibrated before and after monitoring and no significant drift in calibration response was detected.

Calibration details of the instrumentation used during survey are provided in Table 3-1 and copies of the current certificates are available on request.

Table 3-1 Instrumentation Used During Survey

Device	Manufacturer	Model	Series Number	Calibration Date
Sound level meter	Bruel & Kjaer	2250	2717740	24 Jan 2021
Acoustic Calibrator	Bruel & Kjaer	4231	1883787	24 Jan 2021

A summary of the survey results and subjective observations relating to the relative magnitude of ambient sound contributions are provided in Table 3-2.

For operational and lone-worker safety reasons, measurements were only taken during day and evening periods. Whilst the overnight sound climate remains unquantified by the survey, subjectively it is considered that the late evening monitoring was sufficiently representative of the specific sound level from the existing site that it can be used as a baseline for assessment of the new Boiler.

The various industrial plant and processes on the Baronet Road site are presumed to have been operating normally during the survey. Furthermore, as the wind was very light, with a slight south-west sector component, the measurement circumstances are considered to be representative of sound propagation conditions that might commonly arise.

Although the survey was primarily to quantify the level of ambient sound, if contributions from other sources are sufficiently low then the results also provide an indication of the specific sound level contribution from the existing plant and activities at the Baronet Road site. Those L_{Aeq} and L_{A90} levels that subjectively appeared to be unaffected by contributions from residual sound sources are highlighted in bold in Table 3-2. These L_{Aeq} and L_{A90} levels are considered to be a fair indication of the steady continuous sound from the site activities and have been have adopted as the baseline against which the additional sound from the proposed new boiler building is compared.

Table 3-2 Evening and Day Survey Results from 25 Jan 2022 6pm to 26 Jan 2022 11am

Position	Start	L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}	L_{A99}	Comment
[1] Baronet Mews	19:04	49.3	55.0	49.3	48.3	47.5	46.8	Evening: Nearby site plant processes are main contributor - General broadband process sound, high frequency gas flow sound, vehicle movements on site. Faint reciprocating sound and intermittent relief valve operation (minor). Distant Traffic apparent from the North and South, subsiding throughout the period. Intermittent train movements: 2-4 per sample. Daytime: Train in shunting/siding area dominates low frequency spectra. Site sound is mainly broadband high frequency. Train Movements: 6. Minor site construction and vehicle contributions. Distant traffic sound. Birdsong and domestic activities (minor). -> Ambient sound from a multitude of sources.
	20:59	50.4	62.1	50.5	48.2	47.2	46.6	
	22:47*	**48.0**	51.7	48.8	47.7	**47.1**	46.7	
	10:28	53.4	59.7	55.2	52.5	50.9	50.1	
[2] Morley Road	20:08	49.5	52.8	50.7	49.3	48.0	46.8	Evening : Initially, plant process sound is minor compared to traffic contributions from vehicles to the North, East and South. Later in the period, broadband sound from site becomes the most prominent steady sound source. Intermittent train movements, 2-4 per sample. Daytime: Distant traffic on roads to North and South account for the greatest contribution (no movements near to meter). Discernible low frequency is spectra - believed Train origin. Steady broadband high frequency sound from nearest site plant. Minor HGV, reversing alarms and construction activities. Birdsong. -> Ambient sound from a multitude of sources.
	21:57	**47.1**	50.0	47.9	46.9	**45.8**	45.2	
	10:51	50.3	55.8	51.4	49.6	48.6	48.0	
[15] Mill Lane	19:40	46.1	53.9	47.6	44.8	43.2	42.4	Evening: Traffic sound from the South is the main ambient source, subsiding gradually throughout the period. High frequency broadband site process sound becoming more prominent as traffic subsides (plant in SW corner most discernible). Intermittent train movements: 2-4 per sample. Daytime: Traffic sound from the South is main sound source. Site contribution is minor. Distant agricultural activity (Minor). Train movements: 1 .
	21:25	**45.5**	54.3	46.6	43.4	42.3	41.2	
	23:05*	46.6	54.9	48.9	44.8	**41.1**	40.4	
	09:52	47.9	54.6	50.4	46.5	45.1	44.3	
[16] Eastford Road (W)	18:39	51.7	60.6	52.7	49.9	48.9	48.2	Evening: Nearby site plant processes are main contributor - General broadband process sound. Distant Traffic apparent from the North and South, subsiding throughout the period. Intermittent train movements. Daytime: No measurements taken due to sound climate being dominated by train idling in the sidings
	20:39	**50.0**	58.1	51.5	48.6	**47.7**	47.1	

Meteorological Conditions Evening: the wind was very light and from SW quadrant. 4 degC, 90% RH. Daytime: Light wind from SW quadrant. 6 degC, 90% RH.

Note: values in bold are subjectively considered to be the most robust representation of the specific steady sound level from the existing site activities, however will still contain some contribution from other residual/background sources.

4 Noise Assessment

4.1 Operational Noise

A noise model has been developed to predict the likely environmental sound level from the proposed plant. Precise details of the new boiler plant are not known this stage in the design process, so industry-standard assumptions have been made for internal sound levels, building construction, ventilation and access requirements. These generic sound power levels and insertion/transmission losses for plant/building construction are given as octave and band overall data in Table 4-1. Overall the noise model contains 12 separate point and area representations of sound sources.

Predictions made with ISO 9613/2 methodology take account of the following sound attenuation mechanism: geometric spreading, air absorption, ground effect reflections, barrier attenuation, source directivity and reflections.

- Ground has been assumed to be hard (G=0) across the site and then mixed (G=0.5) for the intervening area between the site and receptors.
- Downwind propagation assumed to occur in all directions (conservative estimate), atmospheric conditions 10°C, 70% RH.
- Predictions have been made at a receptor height of 1.5 m (for site boundary) and 4m (for residential receptors)
- Plant noise emissions have been specified in octave band sound power or pressure levels.
- No off-site buildings have been included within the model – therefore any screening benefit is unquantified (i.e. a conservative estimate, properties with obscured line of sight to the new boiler plant may experience considerably lower sound level contributions than estimated by the model).

Table 4-1 Assumed sound emission and building attenuation data.

Source Description	Emission Spectra Type	Source Sound Emission Level (each)										
		Linear Octave Band Levels – dBZ										
		31.5	63	125	250	500	100	200	400	800	Overall dBA	Comment
Steam Vent	Lw	56	56	70	74	73	73	81	89	88	**92**	x1
Roof Ventilation	Lw	93	92	91	90	87	82	77	71	65	**88**	x2 Units
Access Doors (25m²)	Lw per m²	82	76	76	71	58	51	44	41	39	**65**	x1, Internal 85 dB L_{PA} & R'w of 25 dB assumed
Air Inlets (60m²)	Lw per m²	82	76	76	71	58	51	44	41	39	**65**	Internal 85 dB L_{PA} & Inlet Silencer R'w/I.L. of 25 dB assumed
Stack Exhaust	Lw	119	115	107	98	85	64	61	60	68	**95**	x1
Boiler House Walls & Roof (1822m²)	Lw per m²	80	71	71	66	53	46	39	36	34	**60**	Internal 85 dB L_{PA} & R'w of 30 dB assumed

Source Description	Emission Spectra Type	Source Sound Emission Level (each)										
		Linear Octave Band Levels – dBZ										
		31.5	63	125	250	500	100	200	400	800	Overall dBA	Comment
Internal Boiler House	L_P	87	85	85	89	83	79	73	70	68	**85**	Generic measured "Boiler House" spectra

Key	L_P	Sound Pressure Level (Internal, re 20 uPa)
	L_W	Sound Power Level (re: 1pW)
	L_W per m^2	Sound Power Level per unit area (re: 1pW)

A worst case assumption has been made for the internal sound pressure level within the building (85dB). The selection of appropriate performance cladding should ensure that sound emissions in the environment are attenuated to much lower levels (noise model suggests a surface sound power level emission of approximately 60 dB per m^2 from the external building façade) which is consistent with the site's requirement for levels to be less than 79 dB L_{Aeq} at 1m.

It should be noted that the noise model is based on assumed emissions and it is possible that final details may be different than presented. However, contractual specifications will be placed with the plant supplier, requiring the operational plant and building to be supplied to the necessary standard to ensure any future noise impact at residential locations is consistent with this assessment.

4.1.1 Other Assumptions

The following assumptions have been made about the future operation of the New Boiler Plant.

- Steam pipework/valve sound is expected to be largely unchanged compared to current levels. Any emissions from any new pipework to connect to the existing steam circuits will be minor and offset by decommissioning of any redundant pipework associated with the existing boiler.
- The new Boilers are expected to operate continuously to provide steam for the various industrial process plant, hence it is not anticipated that the environmental sound emission from the plant will vary significantly. Consequently, the New Boiler Plant's specific sound level at key receptor locations would be expected to be steady and not have an intermittent character.
- Regarding other aural features that might attract attention, since all potentially tonal or intermittent plant are contained within the new boiler house building, their sound emissions will be attenuated to appropriate levels by the building design, air inlet silencers or stack exhaust silencers. In the context of the industrial plant, the additional boiler plant sound will not have any discernible tonal character at any existing residential location and therefore a 0dB Rating penalty is appropriate.
- To ensure safe operation of the new boilers, the system will be protected with steam pressure relief valves which will vent in an emergency. Unlike the normal running of the plant, operation of a safety vent is highly likely to give rise to an increase in sound level at noise receptor locations. However, this will be limited by the use of appropriate exit silencers which will act to reduce the sound emission whilst also not compromising the inherent safety of the pressure valve.
- The most common reason for a steam pressure relief valve to operate would be a sudden and uncontrolled change in the steam demand. Since the likelihood of this happening will remain unchanged, the impact from sudden increases in sound due to steam discharges is likely to remain similar to existing levels, so have not been consider further.

4.2 Noise Model Results

Contours of the estimated specific sound level from the steady operation of the new Boiler plant are given in the following maps. Figure 4-1 shows the L_{Aeq} level solely from the New Boiler Plant across the community and Figure 4-2 shows more detail of the sound level in the south-west corner of the Baronet Road site. For comparison, the original PPC residential and boundary survey locations and associated L_{Aeq} levels are shown in brackets.

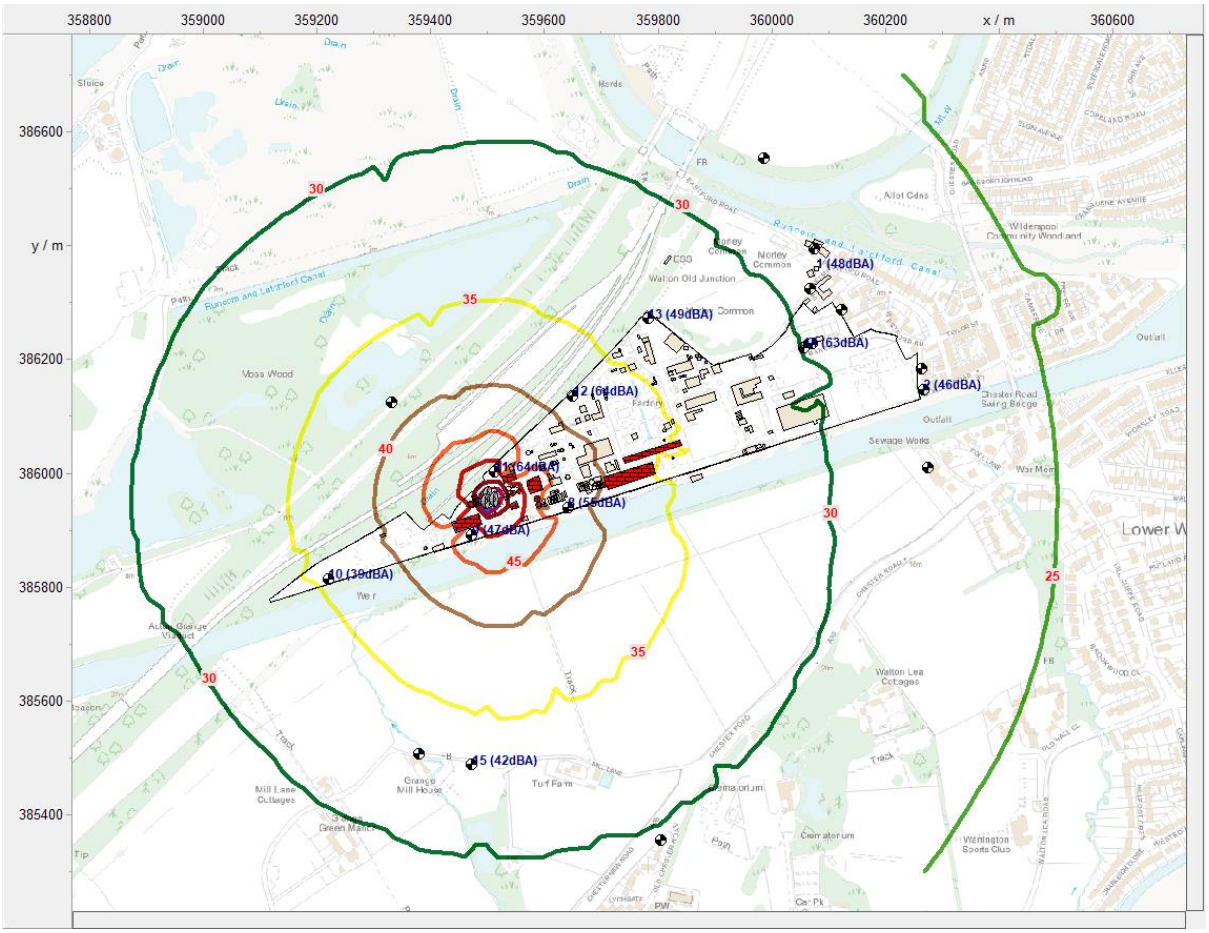

Figure 4-1 Noise contour map showing estimated New Boiler Plant specific L_{Aeq} level across the wider community

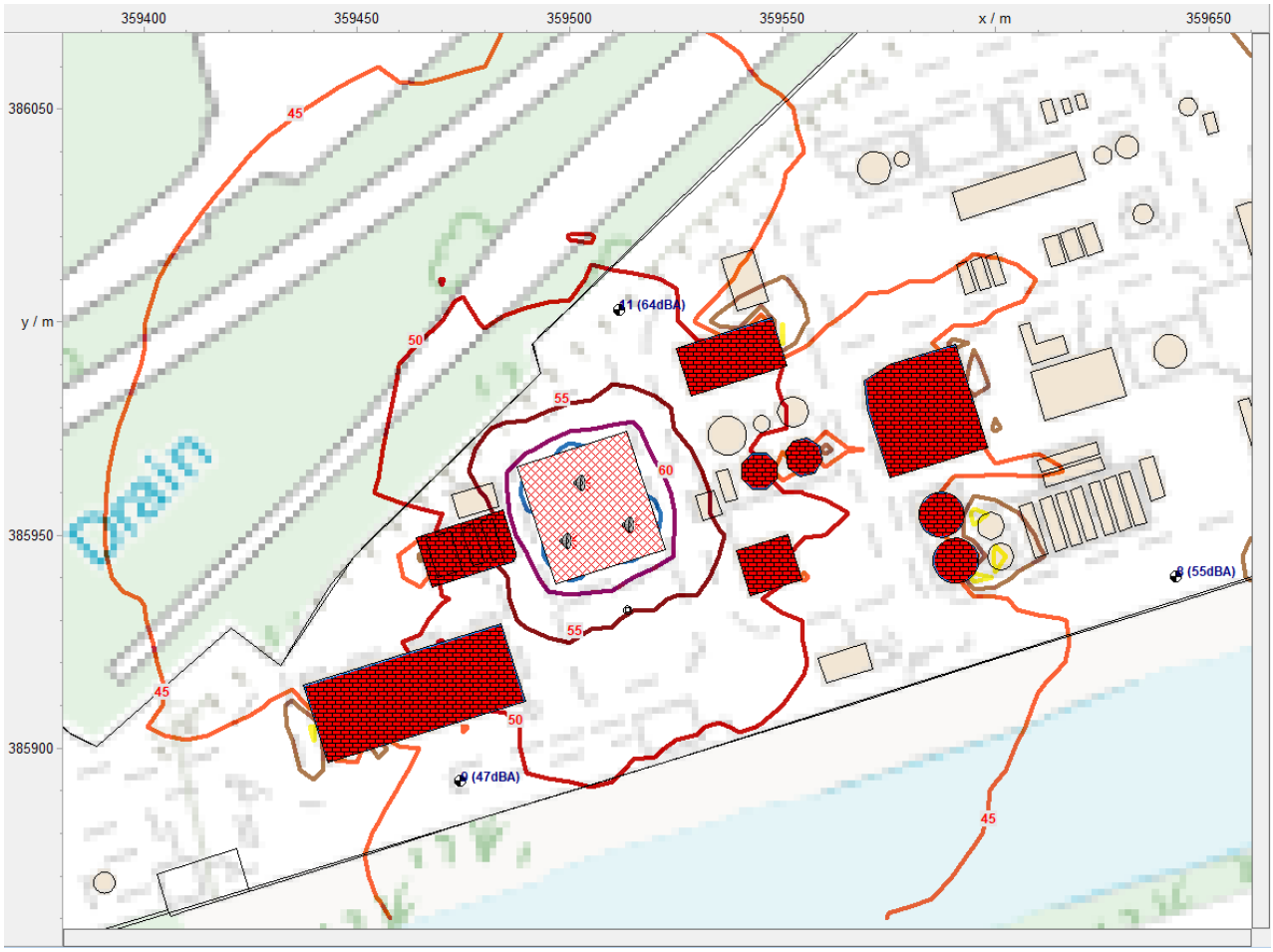

Figure 4-2 Noise contour map showing estimated New Boiler Plant specific L_{Aeq} levels across local site area

A comparison between the predicted new boiler L_{Aeq} level and the L_{Aeq} / L_{A90} levels from the recent survey at the four selected positions [Locations 2, 3, 15 and 16] are provided in Table 4-2, below.

Table 4-2 Comparison Of Historic and Recent Survey Levels with Predicted Specific L_{Aeq} For New Boiler Plant

	Receptor	2005 PPC L_{Aeq} dB	Jan 2022 Representative Measurement results		Estimated Specific level steady site L_{Aeq} dB	New Boiler Plant (Rating & Specific Level) L_{Aeq} dB	Future combined specific level from site. L_{Aeq} dB	Increase dB	New Boiler L_{Aeq} Rating Level minus current L_{A90} dB
			L_{Aeq} dB	L_{A90} dB					
[1]	Baronet Mews	48	48.0	47.1	48	30	48.1	0.1	-17

	Receptor	2005 PPC L_{Aeq} dB	Jan 2022 Representative Measurement results L_{Aeq} dB	Jan 2022 Representative Measurement results L_{A90} dB	Estimated Specific level steady site L_{Aeq} dB	New Boiler Plant (Rating & Specific Level) L_{Aeq} dB	Future combined specific level from site. L_{Aeq} dB	Increase dB	New Boiler L_{Aeq} Rating Level minus current L_{A90} dB
[2]	Morley Road	46	47.1	45.8	46	28	46.1	0.1	-18
[15]	Mill Lane	42	45.5	41.1	42	33	42.5	0.5	-8
[16]	Eastford Road (W)	--	50.0	47.7	48	28	48.0	0.0	-20

The recent sound levels are in very close agreement with the L_{Aeq} levels given in the 2005 PPC report (within +/-1dB) – which suggests that the site's sound emission has remained largely unchanged.

By considering the New Boiler Plant sound to be additive (i.e. ignoring any decrease that may arise from the existing Boilers being decommissioned), the specific New Boiler Plant sound level estimates can be added to the current L_{Aeq} to give an indication of a worst case future sound level from the site. The calculation suggests either no increase in level, or at worst, an increase of 0.5 dB. This magnitude of sound level increase is unlikely to be perceptible and it is unlikely that any sound character from the New Boiler Plant would be discernible within the ambient sound. The New Boiler Plant rating level is predicted to be 8 to 20dB below the current late evening L_{A90}. Hence, if the New Boiler Plant were treated as a new independent source of sound, a BS 4142 type approach would deem the associated sound to have a low impact in the context of the current sound climate.

In Table 4-3, L_{Aeq} predictions at the relevant boundary positions are compared to the levels identified in the PPC assessment.

Table 4-3 Comparison of specific L_{Aeq} from New Boiler Plant with previous site boundary levels

Boundary Position	New Boiler Plant Specific L_{Aeq} dB	Pre-Existing L_{Aeq} dB	Boiler Specific L_{Aeq} Level minus Previous L_{Aeq} dB	Future L_{Aeq} Sum dB	dB increase
8	44	55	-11	55	0
9	47	47	0	50	3
10	36	39	-3	41	2
11	52	64	-12	64	0
12	40	64	-24	64	0
13	33	49	-16	49	0
14	31	63	-32	63	0

At the majority of the boundary positions, the new Boiler plant level is estimated to be 10dB or more below previous levels – hence future operation of the new Boilers will not result in an increase the sound level at these boundary locations to the east of the plant. Since the proposed new Boiler plant will be located in the

south-west corner of the Baronet Road site, where lower boundary L_{Aeq} levels have previously been measured, some elevation from those baseline levels could be anticipated. Increases of +3dB at position 9 and +2 dB at position 10 are predicted. This is to be expected as the introduction of any new plant into a previously unused area which is relatively close to the site boundary, will inevitably increase sound levels in the local vicinity.

Whilst this increase is not consistent with the site's boundary limit aspiration, it is not considered to be a material change in the environmental emission from the site. The contours in Figures 4-1 and 4-2 show the New Boiler Plant sound to be relatively localised and Table 4-2 demonstrates that no adverse change will arise at residential receptors.

4.3 Context

For the purpose of this assessment, the introduction of the New Boiler Plant is assumed to add to the overall sound emitted from the site. However, once the New Boiler Plant is successfully put into operation, the existing boiler plant will be turned off and decommissioned. As the existing boiler plant's contribution to the overall sound emission from the site is not known, it is not possible to quantify its contribution at noise sensitive receptors. However, since the new boilers will be contained within a modern building, it is likely that the switch will give rise to an reduction in overall sound emission from the site, albeit with a change in emission "footprint".

A new road scheme is planned and the route will pass north-south through the existing Baronet Road site, between the existing process plant and the nearby residential receptors. Once this is completed, vehicles using the road will generate increased traffic noise levels across the easterly residential receptor locations considered in this assessment. As a result, the relative contribution to the ambient sound level from the Baronet Road industrial site is likely to reduced. Against this likely increased residual L_{Aeq} and background L_{A90} sound level, the low impact from the New Boiler Plant will be further reduced in comparison to that indicated here.

For completeness, the predicted levels from the Boiler noise model at identified residential locations are shown in Table 4-4, and range from 28 to 32 dB L_{Aeq} (recent measurement positions in bold, plus see also the contour map in Figure 4-1).

Table 4-4 New Boiler Plant Specific L_{Aeq} estimates across residential receptors

(R)esidential/ (B)oundary/ (W)ildlife	Position	New Boiler Plant Specific L_{Aeq} dB
R	Chester Road	29
R	**Morley Road**	**28**
R	Ford Farm Close	29
R	**Baronet Mews**	**30**
R	Eastford Road	29
R	**Mill Lane**	**33**
R	Old Chester Road	31
W	Nature Reserve	38
R	Baronet Road	30
R	New Housing Development	28

4.4 Construction Noise

BS 5228-1 (3) is the relevant Code of Practice for Noise and Vibration Control on Construction and Open Sites. An example of noise limits is given in Annex E of the guidance, which sets out cut-off limits between 65 dB(A) and 75 dB(A) or 5 dB(A) above the ambient noise, whichever is the greater. The recent noise survey shows day time ambient levels at the residential receptors below 55dB L_{Aeq}, therefore the threshold level for a potential significant observable adverse effect during the day is 65dB L_{Aeq}.

The construction noise threshold scale, set out in Table 4-5, is based on the ABC method of assessment described in Annex E of BS5228.

Table 4-5 Impact Magnitude Category – Construction Noise

Time period	Threshold Value L_{Aeq1hr} dB
Day (07:00–19:00 Weekday and 07:00–12:00 Saturdays)	65
Night (23:00–07:00)	45
Evening and weekends (time periods not covered above)	55

4.4.1 Noise Prediction

At this stage in the project development, the precise details of the construction plant, activities and techniques is not known. To assess the potential construction levels some noise generating activities have been assumed to arise at various points across the site. For illustrative purposes, the activity equivalent BS 5228 sources that could be used for the earth works, piling, general site and building fabrication phases of the work are show in Table 4-6.

Table 4-6 Assumed construction plant noise sources and activity during construction

Construction Phase	Sound Power Level L_{WA} dB	% Operating Time	Activity Equivalent Sound Power L_{WA} dB
Earthworks:			
Dozer	106	80	105
Excavator/Loader	103	80	102
Lorry	103	10	93
	Combined Activities		**107**
Piling:			
Piling Rig (Auger)	107	60	105
Truck Mixer	107	100	107
Concrete Pump	110	100	110
Lorry	103	20	96
	Combined Activities		**113**

Construction Phase	Sound Power Level L_{WA} dB	% Operating Time	Activity Equivalent Sound Power L_{WA} dB
General Site Activities:			
HGV	98	20	91
Dumper	104	100	104
Telehandler	105	100	105
Compressor	95	100	95
Generator	103	100	103
Mobile Crane	94	100	94
	Combined Activities		**109**
Building Construction:			
Excavator	106	100	106
Steelwork Erection	108	100	108
Concrete Pump	103	100	103
HGV	103	50	100
Cutting/Grinding	107	100	107
Hydraulic Pump	106	100	106
	Combined Activities		**113**

4.4.2 Construction Noise Assessment

The site noise model has been used to estimate the L_{Aeq} sound pressure level from construction that might arise at the various noise receptors around the site. See results in the Table 4-7 below.

Table 4-7 Estimated L_{Aeq} levels are noise receptors areas during construction phases

Noise Receptor areas	Estimated L_{Aeq} dB during construction phase			
	Initial Ground Works	Non-impact Piling	General Site activities	Building Fabrication
Chester Road	34	43	39	44
Morley Road	38	42	37	42
Ford Farm Close	40	41	41	47
Baronet Mews	36	44	41	48
Eastford Road	32	47	39	46
Mill Lane	44	51	48	51
Old Chester Road	42	48	45	48
Nature Reserve	52	57	54	58

Noise Receptor areas	Estimated L_{Aeq} dB during construction phase			
	Initial Ground Works	Non-impact Piling	General Site activities	Building Fabrication
Baronet Road	41	44	44	48
New Housing Development	37	38	40	46
Maximum (residential)	**44**	**51**	**48**	**51**

At residential locations, it is estimated that, at worst, residential receptors might experience a L_{Aeq} of approximate 51 dB (Mill Lane). This is 14 dB below the lowest daytime threshold level (65dB L_{Aeq}) at which a significant observed effect might be expected

The nearest part of the Nature Reserve may experience L_{Aeq} levels in the region of 52-58 dB L_{Aeq} throughout the build programme, plus peak levels will be significantly in excess of this due to the inherent nature of construction techniques. However, it is also worth noting that ground terrain profiles have not been included in the noise model, and in reality the elevated rail embankment will provide the Nature reserve area with significant screening from noise emitted by low to medium elevation construction and operational activities. Overall it is considered that construction activities will not give rise to an adverse noise impact on the reserve, since fauna will have presumably become habituated to comparable levels of intermittent noise from the mainline railway and sidings nearby.

Only very low levels of vibration will be generated during the construction and operational phases and will not be discernible at any sensitive receptor.

5 Conclusions

An environmental noise survey has been completed at selected residential properties around the Baronet Road site.

The L_{Aeq} levels have been found to be within 1 dB of previous results – indicating that sound levels in the community have remained largely unchanged.

A noise model has been developed for the proposed New Boiler Plant and predictions have been compared to current or previous levels at residential and boundary positions.

The additional sound from the New Boiler Plant has been shown to significantly less than current ambient/ background levels at all residential receptors locations – suggesting a low impact. Moreover, any increase in ambient L_{Aeq} level is considered to be minor (maximum +0.5 dB) and unlikely to be discernible.

Once the New Boiler Plant is operational, the existing boiler plant can cease operation and it is likely that the total sound being emitted from the Baronet Road site will actually reduce. A corresponding reduction in noise level at noise sensitive receptors is therefore also anticipated.

Some local increases in boundary levels are inevitable, however these are considered to be insignificant because no adverse impact would arise at residential receptors.

For the construction phases, noise levels are predicted to be 51 dB L_{Aeq} or less at residential locations, These are below BS 5228 threshold levels and broadly comparable to ambient levels, so construction noise is not considered to give rise to an significant adverse impact.

Only very low levels of vibration will be generated during the construction and operational phases and will not be discernible at any sensitive receptor.

References & Bibliography

1. **British Standands Institute.** *BS4142: 2014+A1:2019 Methods for rating and assessing industrial and commercial sound.* 2019.

2. **Solvay Interox.** *IPPC Permit Application BS3824IJ Chapter B2.9 Noise And Vibration.* 2005.

3. **British Standards Institute.** *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Part 1: Noise.* 2014.

APPENDIX A
Acoustic Terminology

Acoustic Terminology

1/3 octave band analysis:

Frequency analysis of sound such that the frequency spectrum is subdivided into bands of one–third of an octave each. An octave is taken to be a frequency interval, the upper limit of which is twice the lower limit (in Hertz).

Ambient sound

The totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far. Unlike the residual sound, the ambient sound includes the contribution from the specific sound.

Background sound level, $L_{A90,T}$

The 'A'-weighted sound pressure level of the residual sound in decibels exceeded for 90 per cent of a given time.

dB (decibel)

The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and the reference pressure (20×10^{-6} Pa). 0 dB is the threshold of hearing, 140 dB is the threshold of pain. A change of 1 dB is detectable only under laboratory conditions. A change of 10 dB corresponds approximately to halving or doubling the loudness of sound.

dBA

A measure of the overall level of sound across the audible frequency range (20Hz - 20,000Hz) with a frequency weighting (i.e. 'A' –weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies. The background sound level in a living room may be about 40 dBA, normal conversation about 60 dBA, heavy road traffic at 60mph about 80 dBA, the level near a pneumatic drill about 100 dBA.

dBC

A measure of the overall level of sound across the audible frequency range with the 'C' frequency which is virtually linear between 50Hz and around 5kHz.

Façade level

Sound levels at locations 1m from the façade of a building are described by the term Façade Levels and are subject to higher sound levels than those in open areas (free-field conditions) due to reflection effects.

Hz (Hertz)

The unit of sound frequency in cycles per second

Impulsive sound

A sound that is of short duration (typically less than one second), the sound pressure level of which is significantly higher than the background.

$L_{Aeq,T}$

The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T. The duration of T may be as short as 1 second when used to describe a single event, or as long as 24 hours when used to describe the sound climate at a specified location. $L_{Aeq,T}$ can be measured directly with an integrating sound level meter.

Noise

Unwanted sound. Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a subject exposed to it, or any sound, that could to cause actual physiological harm to a subject exposed to it, or physical damage to any structure exposed to it, is known as noise.

NR

Noise Rating curves, similar to Noise Criteria (NC) curves, form a set of noise criteria given in octave bands.

Noise–sensitive receptor

Any dwelling, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity, which for its proper enjoyment requires the absence of noise at nuisance levels.

Acoustic Terminology
R'w
Weighted Apparent Sound Reduction Index - a single number rating of airborne sound insulation, over a range of frequencies, based on field measurement.
Rating level $L_{Ar,T}$
The equivalent continuous 'A' –weighted sound pressure level of an industrial sound during a specified time interval, plus specified adjustments for tonal character and impulsiveness of the sound.
Residual sound
The sound level in the area in the absence of the sound source under investigation.
Sound power level and sound pressure level
Any source of sound has a characteristic sound power, a basic measure of its acoustic output, but the sound pressure levels it gives rise to depend on many external factors. These include the distance and orientation of the receiver, the temperature and velocity gradients in the medium through which the sound is transmitted. Sound power, on the other hand, is a fundamental physical property of the source alone, and is therefore an important absolute parameter, which is widely used for rating and comparing sound sources.
Specific sound level
The equivalent continuous 'A' –weighted sound level produced by the source under investigation (that is, the specific sound source) over a period (T) as measured at the assessment point (usually a noise–sensitive receptor) $L_{Aeq,T}$.

Contact us:

Uniper Technologies Limited
Technology Centre
Ratcliffe-on-Soar
Nottingham
NG11 0EE
England

+44 (0) 115 936 2900

https://engineering.uniper.energy