



The Creamery, Aber-Arad
Dairy Partners Limited

BAT Noise Audit

16th September 2024
First Issue





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Revision History

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Executive Summary

This document, a BAT Noise Audit, has been written to evaluate the noise contributions from each individual process, plant and machinery (that generates a significant amount of noise) at the nearby residential properties, in order to determine which are the main contributors, and therefore which will require further noise mitigation to reduce the level of impact.

The document also evaluates the existing mitigation measures (including those recently installed) and determines whether more action could feasibly be taken, i.e. are Best Available Techniques already being implemented and if not, how could they (and should they).

PJA attended site on the 20th of July 2023 to conduct noise measurements and audit noise generating equipment/processes. PJA took measurements both close to the source of noise, and at the site boundary/outside residential properties (the latter involving leaving monitoring equipment over several days between the 20th and 24th of July). This information was then used in conjunction with noise mapping/modelling to determine specific noise contributions from each source at the closest/most affected residents and effectively rank the sources in order of disturbance. See **Section 3.2**.

A further set of noise monitoring at source of the LNG Refuelling process was undertaken on the 4th of June 2024 to reflect a recent change in the process as a result of a supplier change, which has made the method significantly noisier. The only update to this Report since the last issue in July 2023 is to reflect the results of these new measurements.

A review of the noise mitigation measures already applied and whether further BAT measures should be installed has been made. It is recognised that a number of measures have been implemented in the years/months prior to this report and that significant reductions in noise emissions have been made.

A review of possible mitigating actions is therefore given in **Section 3.3**, for the operator to consider further and present a plan to put forward to NRW.

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1.0 Introduction

ParkerJones Acoustics Limited (PJA) has been instructed by Dairy Partners Limited (DP) to undertake a Best Available Techniques (BAT) Noise Audit, as requested by Natural Resources Wales (NRW) in regulating the existing Environmental Permit for the facility at The Creamery, Aber-Arad, Newcastle Emlyn, SA38 9DQ ('the site').

This document, a BAT Noise Audit, has been written to evaluate the noise contributions from each individual process, plant and machinery (that generates a significant amount of noise) at the nearby residential properties, in order to determine which are the main contributors, and therefore which will require further noise mitigation to reduce the level of impact.

The document also evaluates the existing mitigation measures (including those recently installed) and determines whether more action could feasibly be taken, i.e. are Best Available Techniques already being implemented and if not, how could they (and should they).

The report follows on from similar documents produced by PJA in September 2020, July 2021, November 2021, and July 2023.

The only update to this Report since the last issue in July 2023 is to reflect the results of measurements taken on the 4th of June 2024 of the LNG refuelling process, to reflect a recent change in the process as a result of a supplier change, which has made the method significantly noisier.

Note that whilst every attempt has been made to ensure that this report communicates effectively to a reader who might not have much knowledge of acoustics, some parts are necessarily technical. A glossary of acoustic terminology and concepts is provided in **Appendix A**.

2.0 Background Information

2.1 Site Description

The site is located at grid reference SN 31672 40106 (SN316401) in Aber-Arad, Newcastle Emlyn, with the main entrance to the site off the B4333 along the south boundary. The facility is on the outskirts of the town with residential receptors along the south and west boundaries, with some slightly further to the north.

The development is a dairy processing facility, operating for 24 hours a day, 365 days a year, with many items of plant running continuously throughout this. This includes heavy goods vehicles coming in and out of site around the clock, and an average batch cycle of approximately 35 hours (28 hours production, 7 hours cleaning).

2.2 Changes since the last BAT Noise Audit

Since the last visit/report in July 2023, it does not appear that any significant noise mitigating works have been carried out, or that noise generating processes have changed significantly.

The exception to this is the LNG refuelling process, which has undergone changes, with a change of supplier and the reverting back to a noisier process that has previously been improved to a near silent level. PJA noted that a Heras fencing based noise barrier (approx. 1.8m tall) had been partially erected locally around the re-fuelling process (i.e. within 3m of it), and long parts of the south site boundary. A very large and wide stack of wooden pallets had also been placed along parts of the south boundary albeit this is believed to be variable in nature.

2.3 Noise Generating Plant/Processes

Whilst on-site in July 2023, PJA spent several hours observing the various noise generating processes, plant and equipment. The main noise emitters (locations shown in **Figure 2.1** overleaf) considered in this report are:

- **ETP Tankers** – tankers entering the site via the south-east entrance and collecting effluent from the tankers to take away from site and dispose of. The pumping process is the noisiest aspect, also requiring the tanker engine to idle, occurring for around 10 - 20 minutes at a time. During this site visit, no tankers visited. Previously with the old ETP, around 8 to 9 tankers visited site per day.
- **Milk Tankers** – delivering milk to the front of the site, there can be roughly 24 to 30 tankers per day with up to 6 at any one time.
- **Chiller compound**, including:
 - **Chillers (x 3)**– running continuously but varying in noise as the load changes (depending on how much the temperature needs to be chilled, and whether all chillers are operational). Acoustic lagging jackets were added to parts of the chillers and a partial angled roof/barrier has been added on the east side of the compound in 2021 (as measured in the last visit).
 - **Glycol Pumps** – also within the chiller compound, running continuously at a steady load.
- **Cooling Tower** – two towers with a large set of acoustic attenuators on either side (added in 2019).
- **Cooling Tower Pumps** – in a small enclosure at the corner of the Boiler House and behind the Cooling Tower – running continuously at a steady load. The enclosure was extended in 2021.

- **Borehouse Pump Room** – several pumps inside a small lightweight building beside the chiller compound – running continuously. The door was previously open, it has now been closed since the first audit in 2020 and the ventilation fan in the east façade is now back in operation.
- **Borehole Water Tank** – next to the pump room, running continuously.
- **Vat Room Exhausts (east elevation)** – two high level vents on the east elevation of the main production building above rooms appearing to contain milk/cream VATs – running continuously.
- **Vat Room Exhaust (south elevation)** – added in early 2021, on the south elevation of the Vat Room, sitting in the external wall (not ducted)
- **Production Hall Exhausts** – two high level vents on the west side of the production hall near to the dock levellers – running continuously.
- **Boiler House Louvres** – high level ventilation louvres on the south elevation.
- **Boiler House Pressure Valve Release** – high level dog leg shaped exhaust flue on the north elevation – operating occasionally for a few minutes at a time.
- **Whey Dispatch Pump** – unloading tankers in through the main entrance 4 to 5 times a day per 30 minutes at a time.
- **Pump House** – set of 5 to 6 pumps on the north side of site which operate intermittently for a few minutes. External door added in 2021.
- **ETP (Effluent Treatment Plant)** – area which became operational in 2021, with an array of noise generating plant pumps, blowers, and flotation units. Replaces the old ETP plant to the north-east which has now ceased operating entirely.

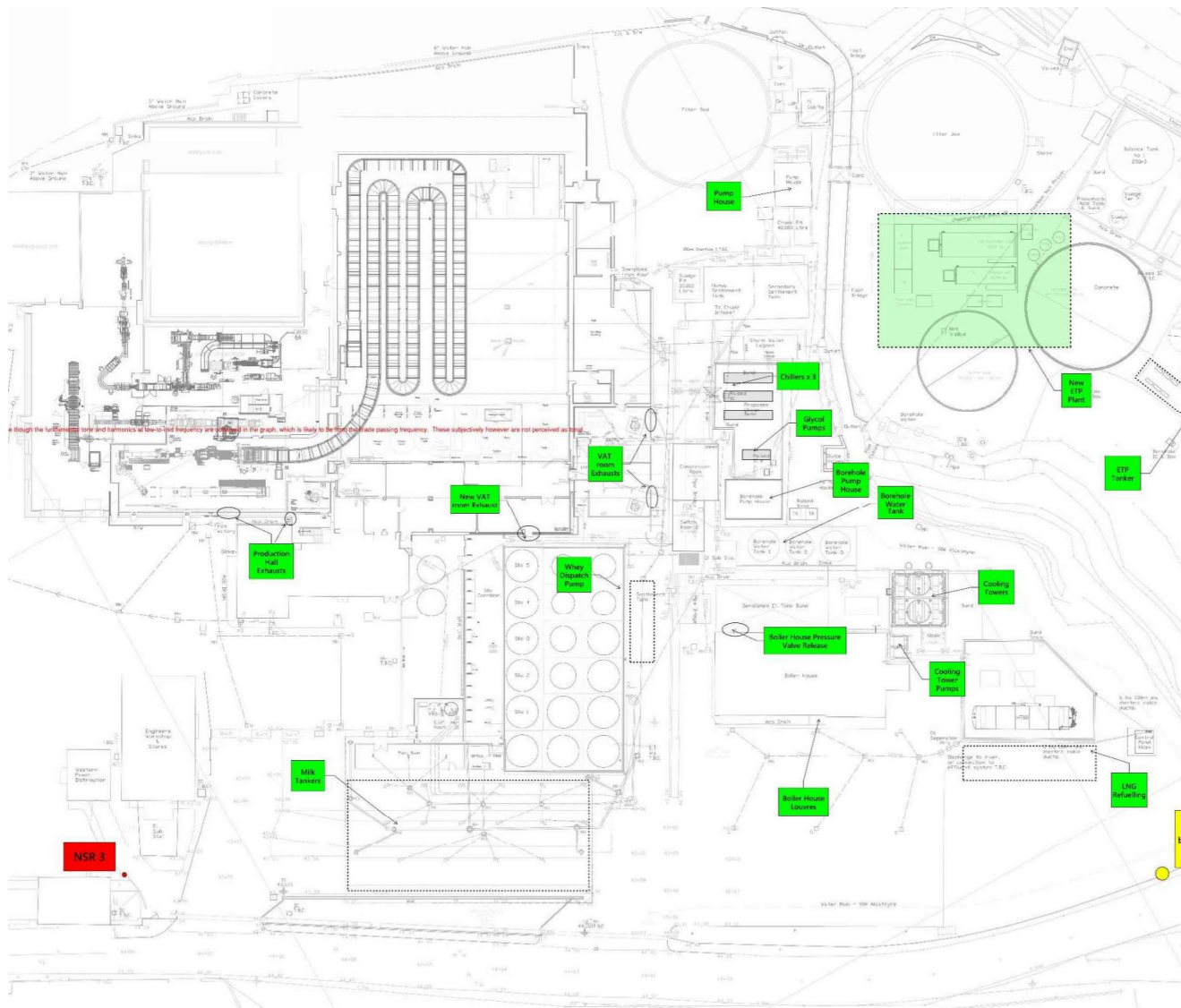
Whilst on-site on the 4th of June 2024, PJA were asked to survey the following:

- **LNG** – refuelling of liquified natural gas tankers for approximately 5 hours per visit, once a week.

2.4 Noise Sensitive Receptors

For the purpose of this assessment, three noise-sensitive receptors (NSRs) have been defined overleaf in **Figure 2.1**. The locations represent positions close to the boundaries of residential properties PJA were able to access and measure at during the survey.

Figure 2.1 – Site plan showing locations of main noise generating processes/equipment (green), long term measurement positions (yellow)



3.0 Assessment

3.1 Methodology

PJA attended site on the 20th of July 2023 to conduct noise measurements and audit noise generating equipment/processes. PJA took measurements both close to the source of noise, and at the site boundary/outside residential properties (the latter involving leaving monitoring equipment over several days between the 20th and 24th of July).

The site appeared to be in full/normal operation throughout.

Whilst on-site on the 4th of June 2024, PJA were asked to survey the LNG refuelling process. PJA were not instructed to conduct further measurements of other plant.

For a handful of the plant, it was possible to determine individual noise contributions at nearby residential properties through measurement in isolation. However, noise emissions from the majority of processes were either well below or close to the residual baseline noise level (from noise sources other than the site) when attempting to measure at the receptors. Therefore, the assessment has also utilised noise map modelling (based upon measurements taken close to source) to predict the individual noise contributions from each process at the receptors where they could not be conclusively determined through measurement alone. In many cases, the noise source was subjectively audible but required this additional modelling to determine the specific noise level.

Where noise sources were not operational during the survey (some noise sources are intermittent every few days), measurements conducted successfully in the previous two noise audits have been presented.

The tonality of the dominant sources has been assessed using narrow-band frequency analysis, in accordance with Annex D of BS 4142:2014+A1:2019.

Baseline levels in fixed positions at the site boundary near to NSR 1 and NSR 2, monitoring over approximately 24 hours. More information regarding the survey and modelling process is given in **Appendix B**.

3.2 Operational Measurements/Observations

Table 3.1 overleaf presents the estimated noise contributions from each noise source at each of the three NSRs based upon the measurements, modelling, and subjective observations. Photographs from site and screenshots of the noise model are shown in **Appendix B.3**.

Table 3.1 – Noise contributions and subjective observations from each source at nearby residential receptors

Source	Noise Contribution dB L _{Aeq,T}			Subjective Notes / Dominant Noise Generating Component	Regularity
	NSR 1	NSR 2	NSR 3		
ETP Tankers (pumping)	62 – 65	52 – 55	29 - 32	Very loud and dominant at receptors close to the ETP site entrance. Fairly tonal noise. However, 7 – 10 dB quieter than the survey in Sept 2020, but pump noise may be different on each lorry. <u>Noisiest component(s):</u> Vacuum Pump	20 minutes typically once every other day.
ETP Tankers (idling)	55	43	22	Low frequency hum, clearly audible though not as noticeable when pumping. <u>Noisiest component(s):</u> Tanker engine	20 minutes typically once every other day.
Chillers	40	40	23	Tonal qualities audible at NSR 1 <u>Noisiest component(s):</u> Screw compressor tonal quality dependent upon speed of the internal fan.	Continuous - 24 hours a day. Tonal quality varies depending upon the load.
Cooling Tower Pumps	38	40	22	Slight tonal element though not particularly noticeable outside of the recently constructed enclosure. <u>Noisiest component(s):</u> Rotary component in pump.	Continuous - 24 hours a day
Milk Tankers (pumping and idling)	40	48	65	Pumps relatively quiet, the main noise is the tanker engines idling whilst pumping. <u>Noisiest component(s):</u> Engine	30 minutes for up to 30 times a day – can accommodate 4 – 6 tankers at the same time
Vat Room Exhausts (east elevation)	41	40	20	Low-frequency/broadband hum with no tonal qualities – clearly heard but not as distinguishable as other noise sources at a similar level because of the lack of tonal characteristic.	Continuous - 24 hours a day

Source	Noise Contribution dB L _{Aeq,T}			Subjective Notes / Dominant Noise Generating Component	Regularity
	NSR 1	NSR 2	NSR 3		
				<u>Noisiest component(s)</u> : Extract fan within the ventilation system. Possible flow-generated noise.	
Vat Room Exhaust (south elevation)	33	24	26	Low-frequency/broadband hum, blade passing frequency noticeable at source objectively but subjectively not particularly tonal, and not perceived as tonal at the receptors. <u>Noisiest component(s)</u> : Extract fan	Continuous - 24 hours a day
ETP (Effluent Treatment Plant)	36	35	15	High pitched tonal element can be heard at around 8 kHz at the site boundary with NSR 2 on occasion. Intermittent noise every minute or so from a 'knife gate valve' also faintly audible. <u>Noisiest component(s)</u> : Pumps, knife gate valve, fluid rushing through pipes	Continuous - 24 hours a day
Borehole Pump Room	29	20	7	Constant low-mid frequency broadband noise – improved since the door has been shut. <u>Noisiest component(s)</u> : Several pumps.	Continuous - 24 hours a day
Boiler House Pressure Valve Release	54	50	47	Clearly noticeable but relatively broadband noise without particularly annoying characteristics. <u>Noisiest component(s)</u> : Flow regenerated noise from pressured steam through small pipework.	Rarely occurs.
LNG (pressure fill)	50	48	≤35	Very noticeable low-mid frequency noise. <u>Noisiest component(s)</u> : Pumps at the rear of the tanker.	1.5 hours – twice a week
LNG (alarm)*	60	58	≤45	Tonal alarm, very audible at the receptor across the road with the door open but muffled with the door closed.	1.5 hours – twice a week – intermittent every 3 minutes for 2 seconds

Source	Noise Contribution dB L _{Aeq,T}			Subjective Notes / Dominant Noise Generating Component	Regularity
	NSR 1	NSR 2	NSR 3		
				<u>Noisiest component(s)</u> : Tonal alarm	
Cooling Towers	33	35	12	Slight mid-high frequency broadband noise but relatively quiet compared to other sources due to the addition of silencers. <u>Noisiest component(s)</u> : Airflow noise	Continuous - 24 hours a day
Glycol Pumps (Chiller Base)	37	31	23	Clear harmonic tones when measuring close to source but not particularly noticeable outside of the chiller compound. <u>Noisiest component(s)</u> : Rotary component inside pump, tonal quality seen close to internal fans assumed RPM + 1 st harmonic.	Continuous - 24 hours a day
Whey Dispatch Pump	38	33	30	High frequency tonal quality – but not that perceptible at the receptors. <u>Noisiest component(s)</u> : Rotary component inside pump, tonal quality seen close to internal fans assumed RPM.	30 minutes for up to 4 or 5 times a day
Boiler House Louvres	20	37	30	Low-frequency hum, not particularly noticeable. <u>Noisiest component(s)</u> : Ventilation system inside – airflow type noise.	Continuous - 24 hours a day
Pump House	19	18	3	Constantly running but very intermittent, pumps run for a minute or so then turn off completely for another minute. Not noticeable at receptors. <u>Noisiest component(s)</u> : Pumps on the left hand side of the door.	Continuous/intermittent - 24 hours a day

Source	Noise Contribution dB L _{Aeq,T}			Subjective Notes / Dominant Noise Generating Component	Regularity
	NSR 1	NSR 2	NSR 3		
Production Hall Exhausts	13	13	34	Low-frequency hum, not particularly noticeable or disturbing. <u>Noisiest component(s)</u> : Extract fan	Continuous - 24 hours a day
Borehole Water Tank	21	17	18	Broadband noise but not distinguishable from other sources when more than 5 – 10m away. <u>Noisiest component(s)</u> : Water flow.	Continuous - 24 hours a day
*Values shown are L _{Aeq,2sec} values, given that alarm operates very briefly for 1 -2 seconds roughly every 3 minutes.					

3.3 BAT Audit and Recommended Mitigation

Table 3.2 overleaf presents a review of the noise mitigation measures already installed to existing noise sources, determines where best available techniques (BAT) are already being applied, and if not, what BAT techniques could be applied, and lastly, where it is necessary to implement further mitigation on the basis of whether the noise is particularly disturbing/requires reduction.

These techniques also take into account the guidance of the Food, Drink and Milk BREF note which is applicable to the site, which was recently reviewed in December 2019.

Processes listed as 'maybe' needing improvement are those where an improvement can be made but may not be necessary as either noise contributions are low at receptors relative to other sources, or they do not have tonal, intermittent, or impulsive characteristics which would make them more noticeable/annoying to receptors.

In the first instance, those listed as 'yes' under needing improvement should be considered. The list of potential measures is not intended to be a list of measures which should be implemented right away, they are a list of options. **This includes the recently changed LNG refuelling process.**

The likely reductions at the receptor are based upon applying the reduction at source in the noise modelling and recalculating the noise levels at receptors (the overall levels from all continuous noise sources operating simultaneously, as normal). Hence whilst a large reduction can be achieved at source in some cases, this does not necessarily translate to a large reduction at the receptor, given the summation of all noise sources and that there is no one, single dominant noise source.

For example, if an acoustic enclosure were installed around the chiller compound (which houses the chillers and the glycol pumps), a reduction of up to 25 dB could feasibly be achieved when measured outside of the enclosure. However, if this is the only mitigation measure implemented, then this may only result in an improvement in overall noise levels of 2 dB at the boundary, because of the balance of noise contributions between several noise sources.

Of course, if several mitigation options are taken forward, then the reduction in overall levels at the boundary would increase.

Ultimately, DP will need to consider a cost benefit analysis and input on which measures are feasible and could be taken forward, as well as providing a timetable for doing so to NRW (and agreeing the measures to be taken with NRW). It is not up to PJA to decide timescales/deadlines by which mitigating actions should be taken. PJA understand that DP has actively made enquiries to contractors in the past but in many cases have been turned down when previously installing mitigation due to the small size of the proposed contracts and the location relative to the manufacturers.

Table 3.2 – Assessment of current noise control measurements and potential future BAT mitigation

Source	Noise generating parts (in order of dominance)	Current Noise Control Measures	Already employing BAT?	Potential BAT Measures	Possible Next Step for Improvement?
ETP Tankers (pumping)	<ul style="list-style-type: none"> Vacuum pump Tanker engine idling 	<ul style="list-style-type: none"> The number of ETP tankers visiting the site has decreases substantially as a result of the new ETP being commissioned. ETP tankering does not occur at night. 	Yes	<ul style="list-style-type: none"> Erect a portable screen/barrier at the side of the tanker. The barrier can be lifted into place around the vacuum pump and hydraulic cooler. Alternatively a more permanent structure could be constructed to form a bay for the tanker to reverse in to. The barrier should break the line of sight from the side of HGV to the residential properties. Likely a 5 - 10 dB reduction. Position tanker vehicles so that the side where the vacuum pump and hydraulic cooler are facing north-westwards, with the tanker itself acting as a noise barrier, out of sight from residents to the south-east. Install silencers on to vacuum pumps if possible, or replace with quieter alternatives. 	<p>No</p> <p>Substantial improvements have already been recently made</p>
ETP Tankers (idling)					

Source	Noise generating parts (in order of dominance)	Current Noise Control Measures	Already employing BAT?	Potential BAT Measures	Possible Next Step for Improvement?
Chillers	<ul style="list-style-type: none"> Chiller screw compressors <p>Tonal noise is created by the rotary components running at high speed (cooled water rotary screwed chiller), and ringing of metal-on-metal contact from lack of anti-vibration fixings.</p>	<ul style="list-style-type: none"> A third chiller was installed to reduce the load on the existing two, which appears to have improved the situation. Installed in an open top enclosure with acoustic absorption installed to the walls. A small section of angled roof has been added. Acoustic insulation/lagging has now been installed on all of the screw compressors and oil separators. 	No	<ul style="list-style-type: none"> Construct a full enclosure including roof to replace the chiller compound. Likely a 10 – 15 dB reduction at source/1m outside the compound. However, only up to a 2 dB reduction in overall levels at the receptors (if this is the only mitigation taken forward). Enclosure would also require fan ventilation system which in itself will generate noise and require silencers. Ventilation system may also cause plant to need to run at a higher capacity if airflow is limited. Extending the roof such that it covers the noisier components, i.e., the screw compressors and the oil separators. Up to a 1 dB reduction in overall levels at the receptors. Look for an alternative type of chiller (not a cooled water rotary screw chillers). High speed rotary components produce clear pure tone noises which can vary in frequency (giving the siren type quality in this case). Depends on what's installed, assumed up to a 5 - 10 dB reduction at source if the right models chosen. However, only up to a 1 dB reduction in overall levels at the boundary/receptors. Installing anti-vibration fixings, replacing bolts/screws with new ones which include rubber fittings/washers to reduce the high frequency metallic ringing sound. Likely a minor reduction of up to 2 dB at source. Negligible reduction in overall levels at the boundary. Improved maintenance of equipment including cleaning and lubrication with oil around fixings. Likely a minor reduction of up to 2 dB at source. Negligible reduction in overall levels at the boundary. 	<p>Yes – subject to cost/benefit analysis</p> <p>A roof or a full enclosure is the next step to gain any further substantial reduction in noise emissions.</p> <p>However, the expense of this measure may be prohibitive and limited in benefit, given the likely level of reductions stated to the left.</p>

Source	Noise generating parts (in order of dominance)	Current Noise Control Measures	Already employing BAT?	Potential BAT Measures	Possible Next Step for Improvement?
Cooling Tower Pumps	<ul style="list-style-type: none"> Rotary component (speed/vane passing frequency) <p>Tonal noise is created by the rotary components, and ringing of metal-on-metal contact from lack of anti-vibration fixings.</p>	<ul style="list-style-type: none"> Partial enclosure installed around the pumps – the size of the enclosure has increased recently which has benefited residents to the south. Contained at the corner of the Boiler House which provides some screening to residents to the west. 	No	<ul style="list-style-type: none"> Improving the enclosure to close all significant air gaps around it on all sides and adding sections to reduce noise breaking out underneath the cooling tower escaping to the east. Anticipated 5 – 10 dB improvement directly outside of the enclosure. However, only a 1 - 2 dB improvement in overall levels at the boundary/receptor. Adding acoustic lagging/jackets to the pumps. Potentially a 3 - 5 dB reduction at source (as many of the pumps have some lagging already). However, only a 1 dB improvement in overall levels at the boundary/receptor. Installing anti-vibration fixings, replacing bolts/screws with new ones which include rubber fittings/washers to reduce the high frequency metallic ringing sound. Likely a minor reduction of up to 2 dB at source. Negligible reduction in overall levels at the boundary. Improved maintenance of equipment including cleaning and lubrication with oil around fixings. Likely a minor reduction of up to 2 dB at source. Negligible reduction in overall levels at the boundary. Adding silencers if possible, to the pump outlets. Anticipated 5 – 10 dB improvement directly outside of the enclosure. However, only a 1 - 2 dB improvement in overall levels at the boundary/receptor. 	<p>Maybe</p> <p>Acoustic lagging is installed, as well as an enclosure, but could be improved.</p>
Milk Tankers (pumping and idling)	<ul style="list-style-type: none"> Engine idling Pumps 	<ul style="list-style-type: none"> Low noise emission pumps are installed (engine noise is dominant). Operations limited to daytime only. 	No	<ul style="list-style-type: none"> An electric pumping system – noise emissions could be reduced by using an electric motor/pump system rather than powering pumps from the tankers diesel engine. Electric motors can be retrofitted to existing trucks and is charged while the vehicle is in motion. This could achieve a 5 – 10 dB reduction at source. Up to a 2 - 3 dB 	<p>Maybe</p> <p>Will require a significant overhaul which may not provide enough benefit against cost.</p>

Source	Noise generating parts (in order of dominance)	Current Noise Control Measures	Already employing BAT?	Potential BAT Measures	Possible Next Step for Improvement?
				<p>reduction in overall levels at the boundary/receptors to the east/south- east.</p> <ul style="list-style-type: none"> Installing a noise attenuating fence along the site boundary. Likely only a 2 – 3 dB improvement in overall levels at receptors given that the fence won't be able to be placed directly next to source and cover enough area to have a significant affect (fences can usually achieve up to a 10 – 15 dB reduction if placed right by the source or right by the receptor, at a height of 3 – 4m). 	
Vat Room Exhausts (east elevation)	<ul style="list-style-type: none"> Fan 	<ul style="list-style-type: none"> None to PJA's knowledge. 	No	<ul style="list-style-type: none"> Installing in-duct noise silencers between the fan and exhaust. This would usually achieve a 15 – 25 dB reduction at source. A 2 dB reduction in overall levels at the boundary. Replacing the existing louvres with acoustic louvres. This could achieve a 5 dB reduction and a 1 dB reduction in overall levels at the receptors. Installing an angled cowl/hood over the exhaust to direct noise emissions either downwards, upwards, or to the north, may improve noise at the boundary by 5 – 10 dB. 	<p>Yes – subject to cost/benefit analysis</p> <p>Broadband noise with no tonal qualities, but may be a significant noise contributor which has a clear line of sight to receptors.</p>
Vat Room Exhaust (south elevation)	<ul style="list-style-type: none"> Fan 	<ul style="list-style-type: none"> None to PJA's knowledge. 	No	<ul style="list-style-type: none"> Ducting the fan and Installing in-duct noise silencers between the fan and exhaust. This would usually achieve a 15 – 25 dB reduction at source/outside of the louvres. However, a negligible dB reduction in overall levels at the boundary/receptor. Replacing the existing louvres with acoustic louvres. This could achieve a 5 dB reduction at source/outside of the louvres. However, a negligible dB reduction in overall levels at the boundary/receptor. 	<p>Maybe</p> <p>Recently installed and less noise contributions than other sources, no tonal quality.</p>

Source	Noise generating parts (in order of dominance)	Current Noise Control Measures	Already employing BAT?	Potential BAT Measures	Possible Next Step for Improvement?
ETP	<ul style="list-style-type: none"> Pump Knife valve Water rushing through the pipes 	<ul style="list-style-type: none"> Acoustic lagging installed around the blower pipe. Acoustic louvres installed to the blower house. Pump recently fixed to remove high frequency tonal element. 	No	<ul style="list-style-type: none"> A partial enclosure/screen could be constructed between the buffer and aeration tanks. However, likely to only achieve a small reduction in levels at the boundary of up to 1 dB. A screen could be installed around the knife valve to reduce the intermittent noise characteristic which is faintly audible at the boundary. However, likely to only achieve a small reduction in overall average levels at the boundary of up to 1 dB. Installing anti-vibration fixings, replacing bolts/screws with new ones which include rubber fittings/washers to reduce the high frequency metallic ringing sound. Negligible reduction in overall levels at the receptors/boundary. Improved maintenance of equipment including cleaning and lubrication with oil around fixings. Negligible reduction in overall levels at the receptors/boundary. 	<p>No</p> <p>Negligible reduction at boundary vs significant cost outlay.</p> <p>Significant improvements already made to the blower pipe.</p>
Borehole Pump Room	<ul style="list-style-type: none"> Several pumps 	<ul style="list-style-type: none"> Installed within a ventilated room rather than located outside 	Yes	<ul style="list-style-type: none"> No further at this stage, the room previously had the door left open, this has now been closed and the ventilation fan switched back on. 	<p>No</p> <p>Already improved recently</p>
Boiler House Pressure Valve Release	<ul style="list-style-type: none"> Valve 	<ul style="list-style-type: none"> Exhausts at the rear of the building without line of sight to most residents. 	No	<ul style="list-style-type: none"> An exhaust silencer could be installed on the flue. This would usually achieve a 15 – 25 dB reduction in noise levels at source from the pressure release. No significant effect on average overall noise levels at the boundary as this noise source is intermittent. 	<p>Maybe</p> <p>As this only occasionally happens, it would not appear critical to treat this before other noise sources.</p>

Source	Noise generating parts (in order of dominance)	Current Noise Control Measures	Already employing BAT?	Potential BAT Measures	Possible Next Step for Improvement?
LNG (pressure fill)	<ul style="list-style-type: none"> Valves on the rear of the tanker 	<ul style="list-style-type: none"> Temporary noise fencing around the tanker. 	Yes	<ul style="list-style-type: none"> Find an alternative supplier as used recently where the mechanism of refuelling is virtually silent. Likely around a 30 dB reduction. or Install a permanent noise barrier around the area, replacing the temporary barrier, which is imperforate, with no air gaps underneath of between panels, to a height of at least 2.5m. Likely around a 10 dB reduction. 	Yes
LNG (alarm)*	<ul style="list-style-type: none"> Tonal alarm 	<ul style="list-style-type: none"> None 	Yes	<ul style="list-style-type: none"> Installing and keeping the door on the alarm closed, with the operator nearby (alarm is loud enough to be heard without needing the door open). Around 25 dB reduction at source. No significant effect on average overall noise levels at the boundary as this noise source is intermittent. 	Yes Whilst the alarm is necessary a simple casing could be installed around the alarm as observed on previous suppliers tankers.
Cooling Towers	<ul style="list-style-type: none"> Fans/airflow 	<ul style="list-style-type: none"> New cooling towers recently installed with acoustic silencers on all exhausts. 	Yes	None.	No Already improved recently
Glycol Pumps (Chiller Base)	<ul style="list-style-type: none"> Rotary component (speed/vane passing frequency) <p>Tonal noise is created by the rotary components, and ringing of metal-on-metal contact from lack of anti-vibration fixings.</p>	<ul style="list-style-type: none"> Installed in an open top enclosure with acoustic absorption installed to the walls. Roof recently installed over the top. Acoustic insulation/lagging has been installed on to sections of the 3 pumps. 	No	<ul style="list-style-type: none"> Construct a smaller enclosure around the pumps. Likely a 10 – 15 dB reduction at source. However, a negligible reduction (close to 0 dB) in overall noise levels at the receptors/site boundary. Improvements to the chiller compound, i.e., extending roof, or making into a full, ventilated enclosure. Negligible reduction (close to 0 dB) in overall noise levels at the receptors/site boundary. Reduction more noticeable to the chillers, not the glycol pumps. 	Yes – subject to cost/benefit analysis A roof or a full enclosure is the next step to gain any further substantial reduction in noise emissions.

Source	Noise generating parts (in order of dominance)	Current Noise Control Measures	Already employing BAT?	Potential BAT Measures	Possible Next Step for Improvement?
				<ul style="list-style-type: none"> Installing anti-vibration fixings, replacing bolts/screws with new ones which include rubber fittings/washers to reduce the high frequency metallic ringing sound. Likely a minor reduction of up to 2 dB at source. Negligible reduction in overall levels at the boundary. Improved maintenance of equipment including cleaning and lubrication with oil around fixings. Negligible reduction in overall levels at the boundary. Adding silencers if possible, to the pump outlets. 5 – 10 dB improvement at source. However, negligible reduction in overall levels at the boundary. 	However, the expense of this measure may be prohibitive and limited in benefit, given the likely level of reductions stated to the left.
Whey Dispatch Pump	<ul style="list-style-type: none"> Rotary component (speed/vane passing frequency creates a whine) 	<ul style="list-style-type: none"> Acoustic insulation/lagging is installed on some of the components. 	No	<ul style="list-style-type: none"> Add acoustic lagging/jackets to all noise generating parts. Parts appeared to have this already, but parts that did not were clearly noisier. Around 4 – 8 dB reduction at source. However, negligible reduction in overall levels at the boundary. Construct a one-side enclosure or barrier around the pump on its east side (between it and the tanker). Could achieve a 10 – 15 dB reduction at source, though a <1 dB reduction in overall levels at the boundary/receptors. Installing anti-vibration fixings, replacing bolts/screws with new ones which include rubber fittings/washers to reduce the high frequency metallic ringing sound. Negligible reduction in overall levels at the boundary. Improved maintenance of equipment including cleaning and lubrication with oil around fixings. Negligible reduction in overall levels at the boundary. 	<p>No</p> <p>Not critical in comparison to other noise sources.</p> <p>Negligible reduction at boundary vs significant cost outlay.</p>

Source	Noise generating parts (in order of dominance)	Current Noise Control Measures	Already employing BAT?	Potential BAT Measures	Possible Next Step for Improvement?
Boiler House Louvres	<ul style="list-style-type: none"> General broadband noise from inside 	<ul style="list-style-type: none"> None to PJA's knowledge 	No	<ul style="list-style-type: none"> Replacing the existing louvres with acoustic louvres. Around a 5–10 dB reduction at source. Negligible reduction in overall levels at the receptors/boundary. Using a ducted ventilation system with an induct silencer rather than louvres. Around a 15 dB reduction at source. Negligible reduction in overall levels at the receptors/boundary. 	<p>No</p> <p>Not critical in comparison to other noise sources.</p> <p>Negligible reduction at boundary vs significant cost outlay.</p>
Pump House	<ul style="list-style-type: none"> Several pumps 	<ul style="list-style-type: none"> None to PJA's knowledge 	No	<ul style="list-style-type: none"> Installing a better ventilation system would enable a smaller façade open area through which noise escapes. Around a 15 dB reduction at source. Negligible reduction in overall levels at the receptors/boundary. Installing a better ventilation system would enable a smaller façade open area through which noise escapes. Around a 15 dB reduction. 	<p>No</p> <p>Not critical in comparison to other noise sources.</p> <p>Negligible reduction at boundary vs significant cost outlay.</p>
Production Hall Exhausts	<ul style="list-style-type: none"> Fans/airflow 	<ul style="list-style-type: none"> None to PJA's knowledge. 	No	<ul style="list-style-type: none"> Installing in-duct noise silencers between the fan and exhaust – around a 15 – 25 dB reduction at source. Around a 2 dB reduction in overall levels at the receptor on the west boundary. Negligible impact at eastern receptors. Replacing the existing louvres with acoustic louvres. Around a 5–10 dB reduction at source. Around a 1 - 2 dB reduction in overall levels at the receptor on the west boundary. Negligible impact at eastern receptors. Installing an angled cowl/hood over the exhaust to direct noise emissions either downwards, upwards, or to the north, Around a 5–10 dB reduction at source. Around a 1 - 2 dB 	<p>No</p> <p>Not critical in comparison to other noise sources.</p> <p>Negligible reduction at boundary vs significant cost outlay.</p>

Source	Noise generating parts (in order of dominance)	Current Noise Control Measures	Already employing BAT?	Potential BAT Measures	Possible Next Step for Improvement?
				reduction in overall levels at the receptor on the west boundary. Negligible impact at eastern receptors.	
Borehole Water Tank	<ul style="list-style-type: none"> Pump and water flow noise 	<ul style="list-style-type: none"> None to PJA's knowledge (though the tank is relatively well screened from residents) 	No	<ul style="list-style-type: none"> Enclosure could be constructed around the pump – around a 10 – 15 dB reduction. Negligible reduction in overall levels at the receptors/boundary. 	<p>No</p> <p>Not particularly loud or disturbing.</p>

Appendix A – Acoustic Terminology and Concepts

A.1 – Glossary

Table A.1 – Glossary of acoustic terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio of the root-mean-square pressure of the sound and a reference pressure (2×10^{-5} Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Frequency	<p>Sound can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. Sound is generally described over the frequency range from 63Hz to 4000Hz (4kHz). This is roughly equal to the range of frequencies on a piano. Frequency is often divided into ('first') octave bands for analysis, with the range above considered within 7 octave bands with centre frequencies at 63 Hz, 125 Hz, 250 Hz, 1 kHz, 2 kHz and 4 kHz.</p> <p>'Third' octave bands split this further into smaller frequency bands. This is typically only referenced in assessment of tonality of a noise source by identifying peaks (tones) in the frequency spectrum, i.e. when applying a rating penalty for tonality within a BS 4142:2014 assessment.</p>
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period. This parameter is typically considered as a good representation of the 'average' overall noise level. It is referred to technically as the A-weighted equivalent continuous sound level and is a dB(A) as defined above.
$L_{A90,T}$	The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level'.
$L_{A10,T}$	The A-weighted noise level that is exceeded for 10% of the measurement period T. This parameter is often considered as the 'average maximum level';
$L_{AFmax,T}$	The maximum A-weighted noise level during the measurement period T.

A.2 – Subjective Changes in Noise Level

Table A.2 – Subjective loudness from an increase or decrease in sound pressure level

Change in sound pressure level	Relative change in sound power energy (multiplier)		Change in apparent subjective loudness (for mid-frequency range)
	Decrease	Increase	
3 dB	1/2	2	'Just perceptible'
5 dB	1/3	3	'Clearly noticeable'
10 dB	1/10	10	'Half or twice as loud'
20 dB	1/100	100	'Much quieter, or louder'

Appendix B – Measurement/Modelling Details

B.1 – Survey Equipment

The monitoring equipment used for the baseline noise survey is detailed in the table below. The sound level meters were calibrated before and after the survey, with no significant drifts of greater than 0.5 dB observed. The sound level meters has been calibrated to a traceable standard within the 24 months preceding the survey, and the calibrators have been calibrated to a traceable standard within the 12 months preceding the survey. The equipment complies with the standards of as BS EN 60942:2003 Class 1 device.

Table B.1 – Equipment used for the noise survey

Name	Serial Number	Last Calibrated	Calibration Due
SVAN 949 Class 1 Sound Level Meter	9720	Jan-24	Jan-26
SVAN 949 Class 1 Sound Level Meter	9719	Jan-24	Jan-26
SVAN 957 Class 1 Sound Level Meter	28043	Jan-24	Jan-26
SVAN 971A Class 1 Sound Level Meter	113251	Jun-23	Jun-25
Casella CEL 120-1 Class 1 Acoustic Calibrator	3864607	Feb-24	Feb-25

B.2 – Noise Modelling


The noise predictions within this report have been undertaken using the proprietary software CadnaA® by DataKustik, a 3-D noise mapping package which implements a wide range of national and international standards, guidelines and calculation algorithms, including those set out in ISO 9613-2:1996.


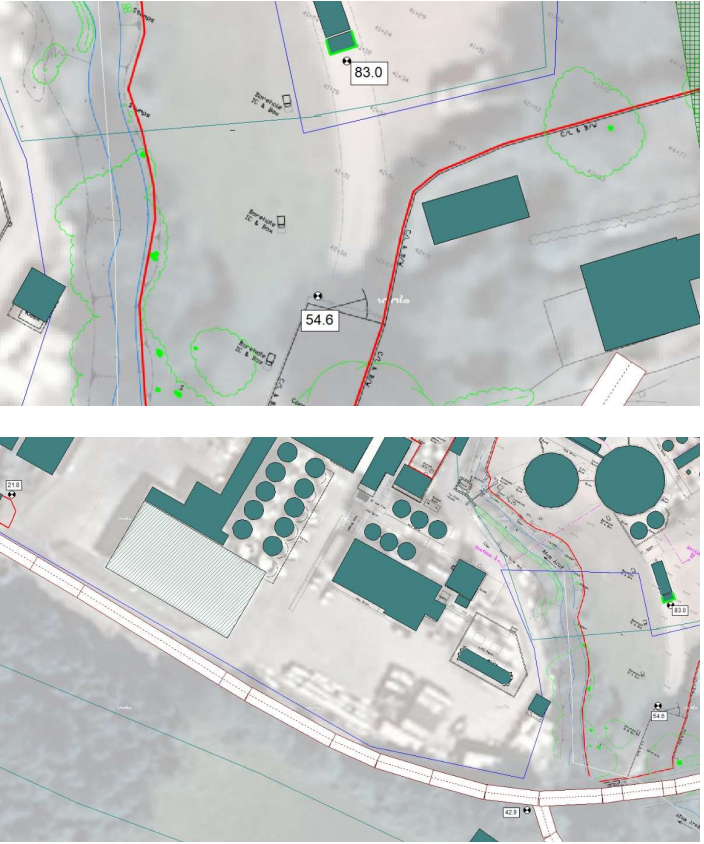
The noise model has been used to help predict noise contributions from each process/plant based upon measurements taken close to source. This is necessary as most noise sources are not loud enough to be dominant over the background noise at the nearby residents. The noise model has assumed:


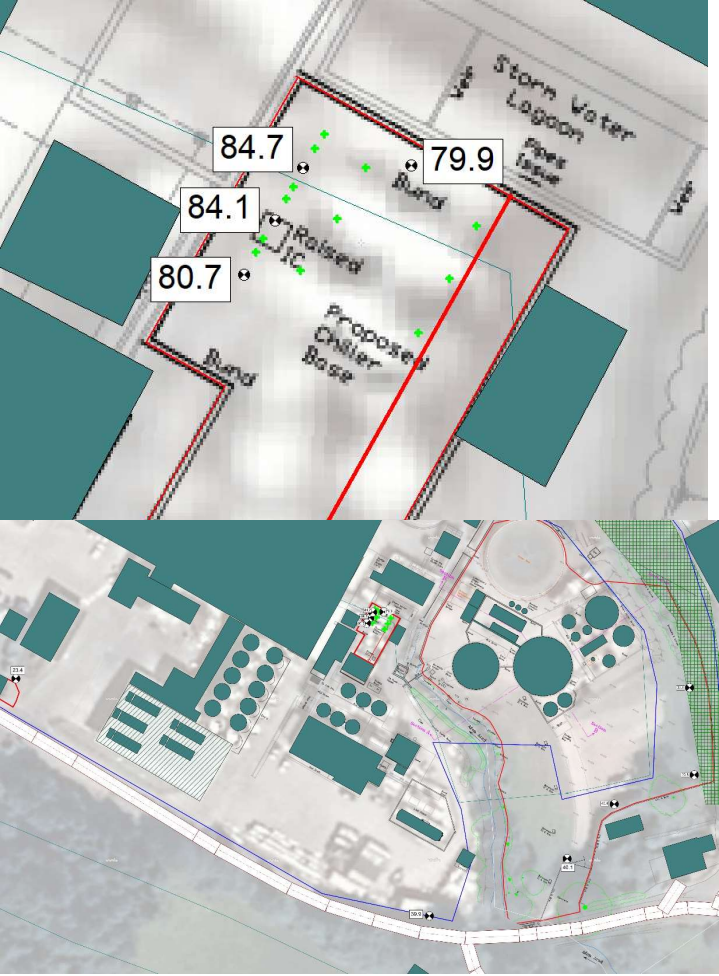
- downwind propagation, i.e. a wind direction that assists the propagation of sound from source to receptor;
- a ground absorption factor of 0 on any roads, car parks, buildings, and any tarmacked/concreted areas;
- a ground absorption factor of 1 on grassy areas;
- a maximum reflection factor of three where buildings and barriers are assumed to have a 'smooth' reflective façade, as a worst-case;
- atmospheric sound absorption based upon a temperate of 10°C and a humidity level of 70%, as per Table 2 of ISO 9613-2:1996.
- Source heights representing the heights of the noise generating components observed on site.



B.3 – Operational Noise Results

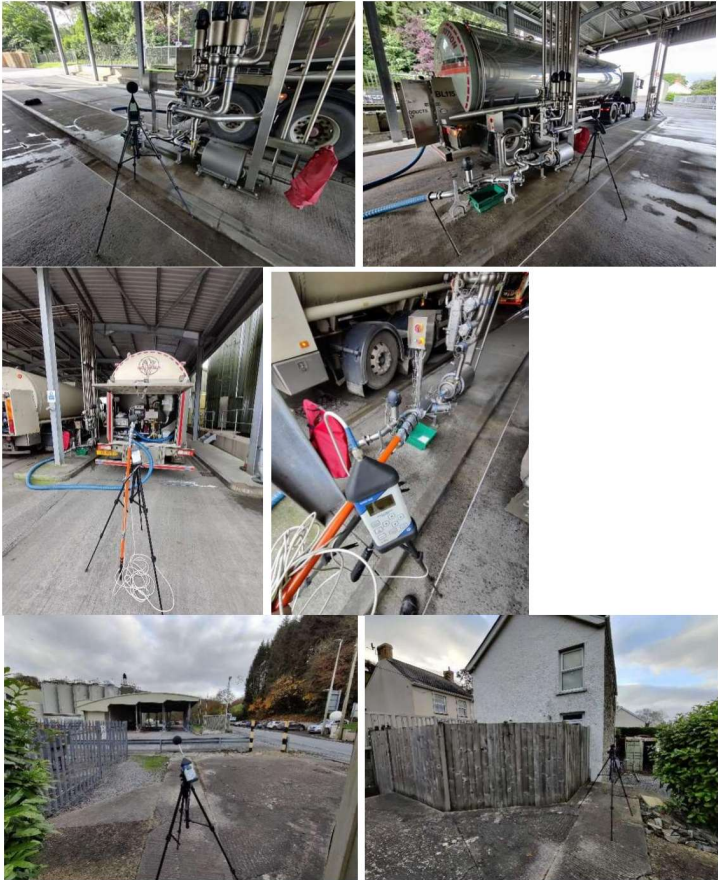

Shown on the subsequent pages. The results are those taken from the most recent measurements conducted on the 20th of July 2023, unless otherwise stated. Measurements presented from November 2021, July 2021, or September 2020 are done so because either a) the noise source did not operate during the latest survey, b) the noise source is sufficiently quiet and/or reliable measurements could not be taken due to the presence of other noise sources, or c) the noise source was not accessible due to works.


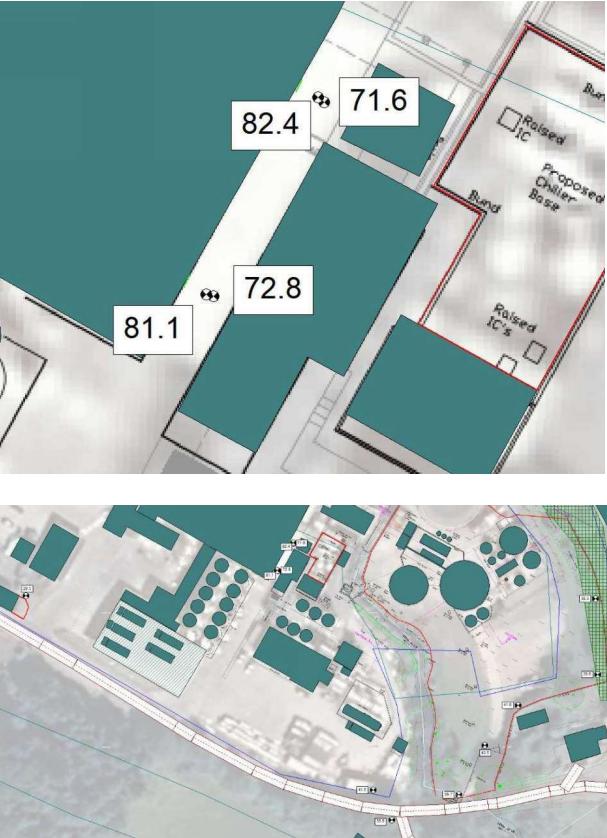
Noise Source	Measured/ Predicted Noise Levels (L _{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>ETP Tankers (pumping)</p>	<p>Measurements below from Nov 2021. Noise source did not operate during the most recent survey.</p> <p><u>Source</u> 84 dB @ 1m from Vacuum Pump and Hydraulic Cooler</p> <p><u>NSR 1</u> 65 dB (dominant)</p> <p><u>NSR 2</u> 55 dB</p> <p><u>NSR 3</u> 32 dB</p> <p>Levels likely to fluctuate from tanker to tanker</p>		<p>Not required as noise source was clearly dominant during the measurements.</p>


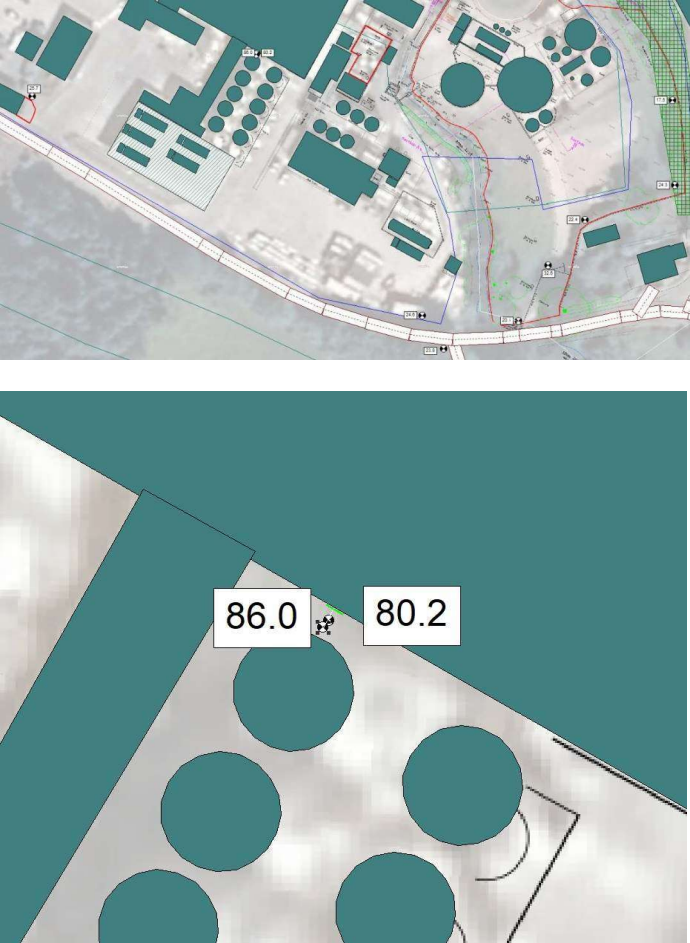
Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>ETP Tankers (idling)</p>	<p>Measurements below from Nov 2021. Noise source did not operate during the most recent survey.</p> <p>Source 83 dB @ 1m from front cab</p> <p>NSR 1 55 dB (dominant)</p> <p>NSR 2 43 dB (distinguishable)</p> <p>NSR 3 22 dB (not perceptible)</p>		

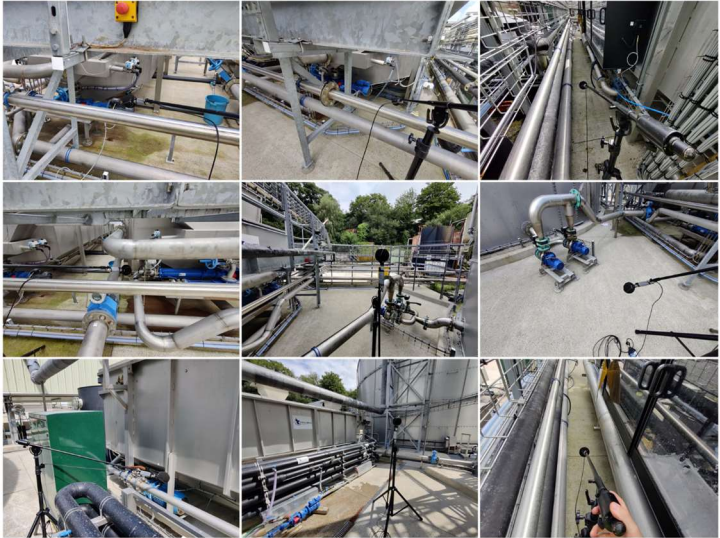

Noise Source	Measured/ Predicted Noise Levels (L _{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Chillers</p>	<p>Slightly higher than Nov 21. Lower than July 21. Chiller load and thus noise levels are variable.</p> <p>Source 75 - 85 dB average inside compound depending on load.</p> <p>85 dB between chiller 1 and 2 oil separators</p> <p>84 dB between chiller 2 and 3 oil separators</p> <p>80 dB south of chiller 3 oil separators</p> <p>80 dB by side of screw compressor of chiller 1</p> <p>NSR 1 40 dB (perceptible)</p> <p>NSR 2 40 dB (perceptible)</p> <p>NSR 3 23 dB (just perceptible)</p>		



Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Cooling Tower Pumps</p>	<p>No change from levels measured in Nov 21.</p> <p>Source 66 dB @ 0.5m in front of enclosure door 81 dB inside the enclosure. 87 dB with the microphone placed directly in centre of pump area.</p> <p>NSR 1 38 dB (barely perceptible)</p> <p>NSR 2 ≈ 40 dB (just perceptible during periods of low traffic)</p> <p>NSR 3 22 dB (not perceptible)</p>		


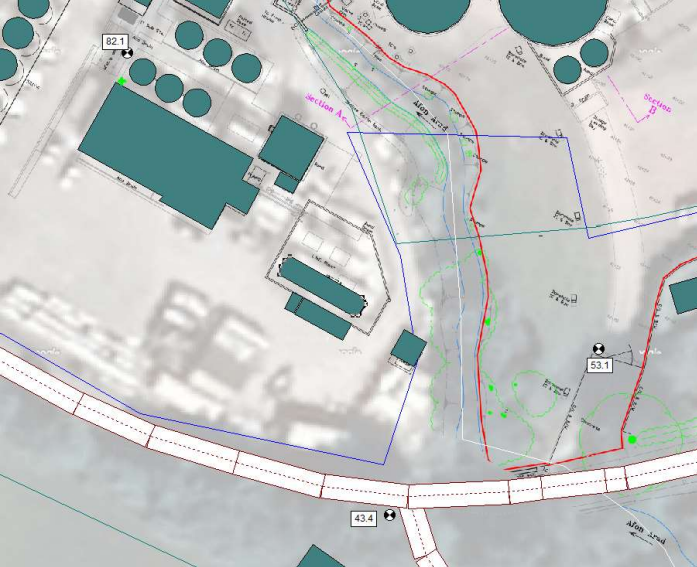
Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Milk Tankers (pumping and idling)</p>	<p>No change from previous measured levels.</p> <p>Source 85 dB @ 1m from front cab</p> <p>74 dB @ 1m from pump (though mostly idling noise from the lorry)</p> <p>NSR 1 40 dB (barely perceptible)</p> <p>NSR 2 48 dB (perceptible at most times, particularly during quiet periods of road traffic)</p> <p>NSR 3 65 dB (dominant) (with 5 lorries)</p> <p>55 dB (with 1 lorry)</p>		


Noise Source	Measured/ Predicted Noise Levels (L _{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Vat Room Exhausts (east elevation)</p>	<p>Source 78 dB at 1m below exhaust, 1m away from elevation (same as previously measured).</p> <p>82 dB at 1m (and on axis) in front of the exhaust (measured in Nov 21)</p> <p>72 dB at 1.5m above ground.</p> <p>NSR 1 41 dB (audible broadband noise – not clear where it is these exhausts or the chiller compound)</p> <p>NSR 2 40 dB (audible broadband noise – as per above)</p> <p>NSR 3 20 dB (inaudible)</p>		


Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Vat Room Exhaust (south elevation)</p>	<p>Measurements below from Nov 2.1 Noise source could not be reached due to cordoning off of the area for works. Subjectively appeared to be the same.</p> <p><u>Source</u> 80 dB at 1.5m height below. 86 dB at 1m in front and on axis</p> <p><u>NSR 1</u> 33 dB (not distinguishable from other noise sources)</p> <p><u>NSR 2</u> 24 dB (not perceptible)</p> <p><u>NSR 3</u> 26 dB (not perceptible)</p>		


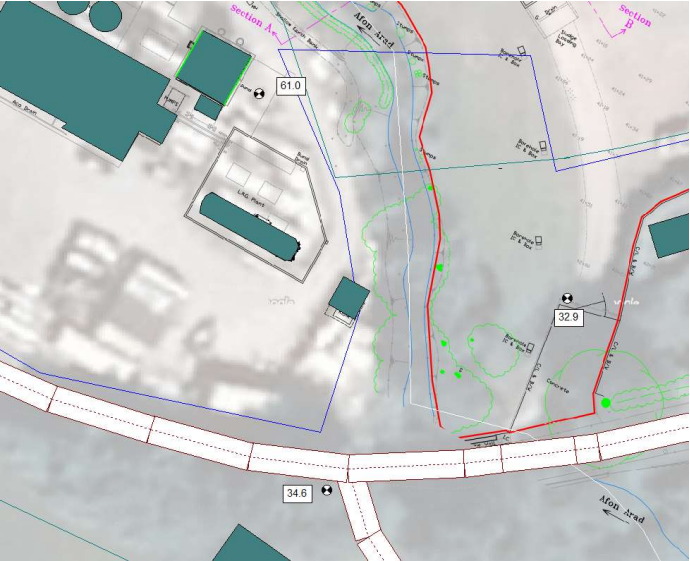
Noise Source	Measured/ Predicted Noise Levels (L _{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>ETP (Effluent Treatment Plant)</p>	<p>No change from levels measured in Nov 21</p> <p>Source 60 to 85 dB at 1m depending on location.</p> <p>NSR 1 36 dB (perceptible but not clearly distinguishable from other more dominant noise sources)</p> <p>NSR 2 35 dB (perceptible but not clearly distinguishable)</p> <p>NSR 3 15 dB (not perceptible)</p>		


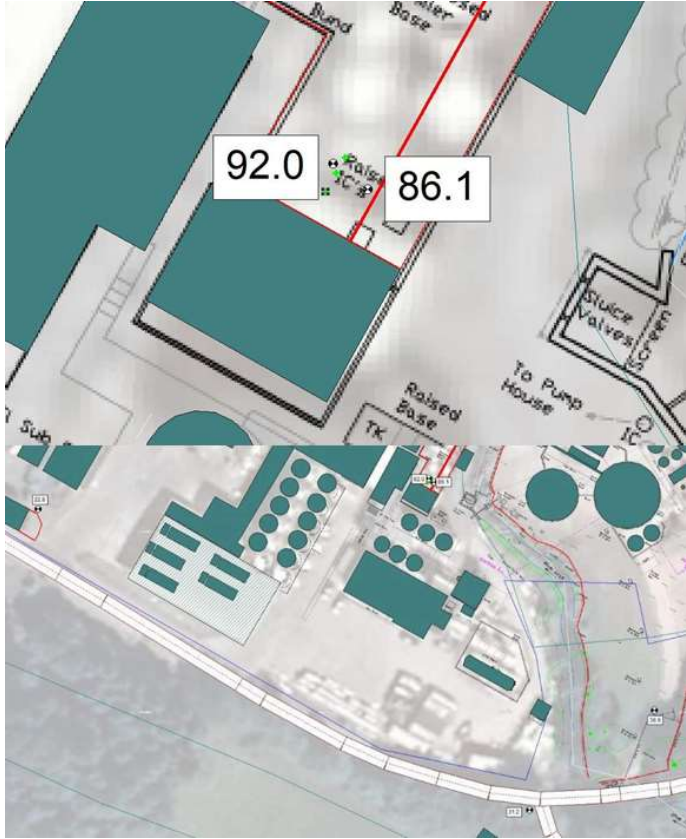
Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Borehole Pump Room</p>	<p>No change from levels measured in Nov 21</p> <p>Source 66 dB 1m outside of the door.</p> <p>70 dB 0.5m outside of fan on front elevation.</p> <p>NSR 1 29 dB (barely perceptible)</p> <p>NSR 2 20 dB (not perceptible)</p> <p>NSR 3 7 dB (inaudible)</p>		


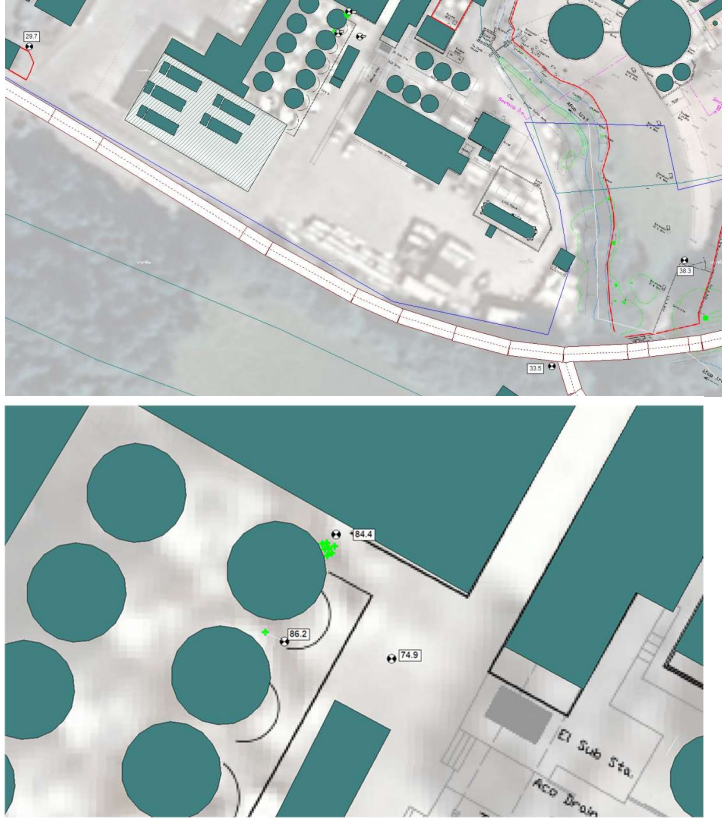
Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Boiler House Pressure Valve Release</p>	<p>Measurements below from Sept 2020. Noise source did not operate during the most recent survey.</p> <p>Source <82 dB at ground level beneath the exhaust</p> <p>NSR 1 54 dB when on (audible broadband noise – 49 dB when off)</p> <p>NSR 2 50 dB when on (audible broadband noise – 48 dB when off)</p> <p>NSR 3 47 dB (audible broadband noise)</p>		



Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>LNG (pressure fill)</p>	<p>Source ≈83 dB @ 1m</p> <p>NSR 1 50 dB (clearly audible)</p> <p>NSR 2 48 dB (clearly audible)</p> <p>NSR 3 ≤35 dB (not audible over milk tanker noise)</p>		<p>Measurements taken at all three NSRs in June 2024 as detailed in the Noise Impact Assessment report dated the 18th of June</p>


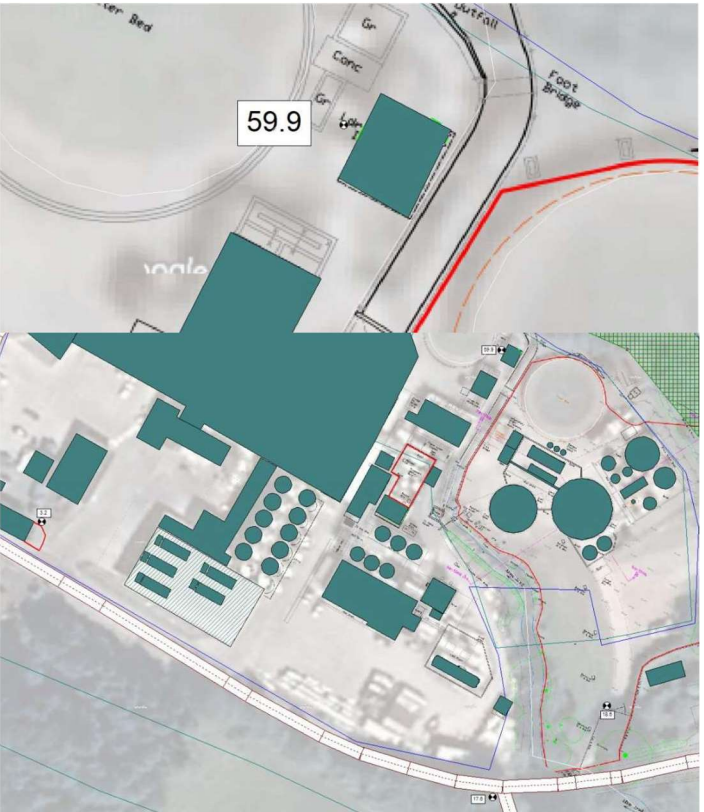
Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>LNG (alarm)</p>	<p>Source 93 dB @ 1m from alarm</p> <p>Alarm sounds for a couple of seconds every 3 minutes</p> <p>NSR 1 ≈ 60 dB $L_{Aeq,2sec}$ (clearly audible)</p> <p>NSR 2 ≈ 58 dB $L_{Aeq,2sec}$ (clearly audible)</p> <p>NSR 3 ≤ 45 dB $L_{Aeq,2sec}$ (not audible over milk tanker noise)</p>		<p>Measurements taken at all three NSRs in June 2024 as detailed in the Noise Impact Assessment report dated the 18th of June</p>



Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Cooling Towers</p>	<p>No change from levels measured in Nov 21</p> <p>Source ≈ 61 dB @ 3m away / 3m above ground (previously measured 58 dB at 1.5m above ground. Not clear whether the increase is attributable to the Cooling Tower, assumed it is as a worst case)</p> <p>NSR 1 33 dB (barely perceptible – broadband noise)</p> <p>NSR 2 35 dB (barely perceptible – broadband noise)</p> <p>NSR 3 12 dB (not audible)</p>		



Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Glycol Pumps (Chiller Base)</p>	<p>No change from levels measured in Nov 21</p> <p>Source 86 dB @ 1m in front of 3 pumps</p> <p>92 dB with mic within 20cm of top of the pumps</p> <p>NSR 1 37 dB (just perceptible – slight tonal quality)</p> <p>NSR 2 31 dB (barely perceptible)</p> <p>NSR 3 23 dB (inaudible)</p>		





Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Whey Dispatch Pump</p>	<p><u>Measurements below from Sept 2020.</u> (Measurements were made with a tanker pumping in the Nov 21 survey but the results suggest the pumps were operating at a much lower capacity). Not operational during the most recent survey.</p> <p><u>Source</u> 86 dB at 1m from noisiest dispatch pump</p> <p><u>NSR 1</u> 38 dB (just perceptible)</p> <p><u>NSR 2</u> 33 dB (just perceptible)</p> <p><u>NSR 3</u> 30 dB (just perceptible)</p>		

Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Boiler House Louvres</p>	<p>Source ≈ 66 dB at ≈ 0.3m beneath the bottom of the louvres (higher than previously measured but measured much closer to the louvres)</p> <p>NSR 1 20 dB (not perceptible)</p> <p>NSR 2 37 dB (just perceptible broadband noise thought not typically distinguishable from residual noise)</p> <p>NSR 3 30 dB (just perceptible)</p>		

Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
Pump House	<p>No change from levels measured in Nov 21.</p> <p>Source 60 dB 1m outside door. 86 dB inside.</p> <p>NSR 1 19 dB (not perceptible)</p> <p>NSR 2 18 dB (not perceptible)</p> <p>NSR 3 3 dB (inaudible)</p>		


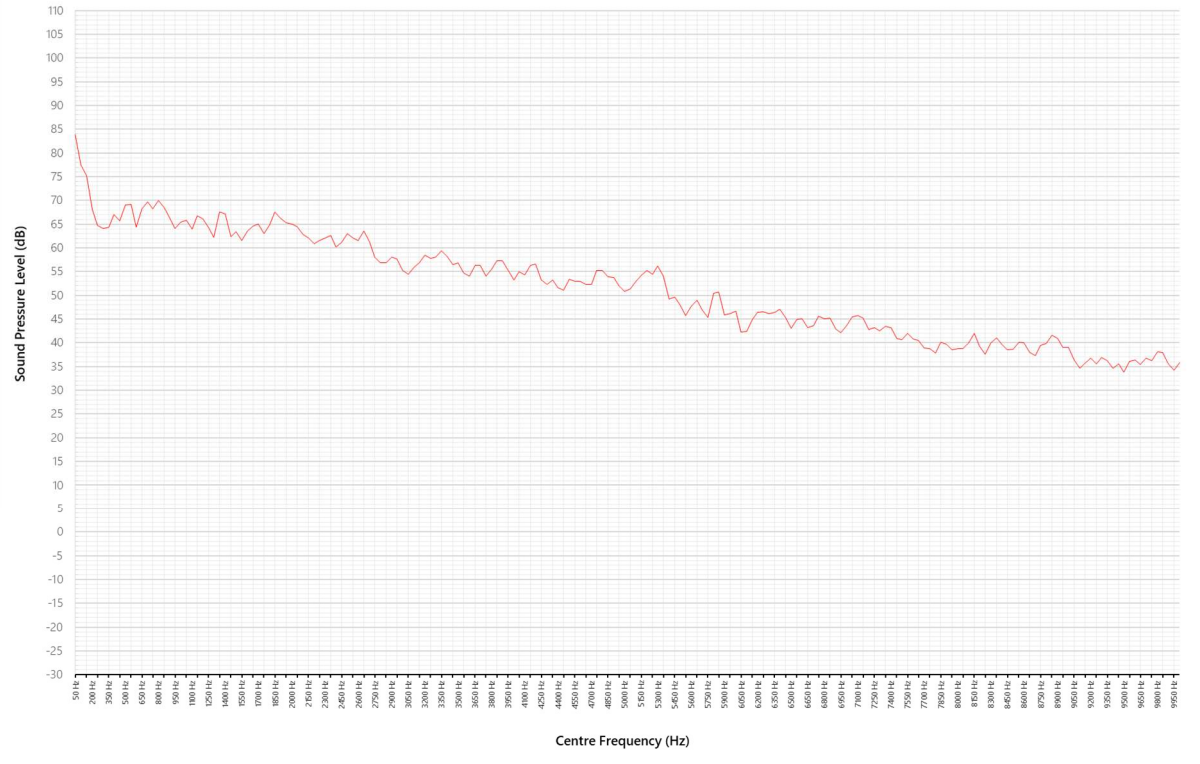
Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Production Hall Exhausts</p>	<p>No change from previous measured levels.</p> <p>Source <67 dB at ground level in sight of two exhausts</p> <p>NSR 1 13 dB (inaudible)</p> <p>NSR 2 13 dB (inaudible)</p> <p>NSR 3 34 dB (just perceptible)</p>		


Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>Borehole Water Tank</p>	<p>No change from previous measured levels.</p> <p>Source 76 dB @ 1m</p> <p>NSR 1 21 dB (not perceptible)</p> <p>NSR 2 17 dB (not perceptible)</p> <p>NSR 3 18 dB (not perceptible)</p>	 <p>(Photo from Sept 2020 measurements shown)</p>	


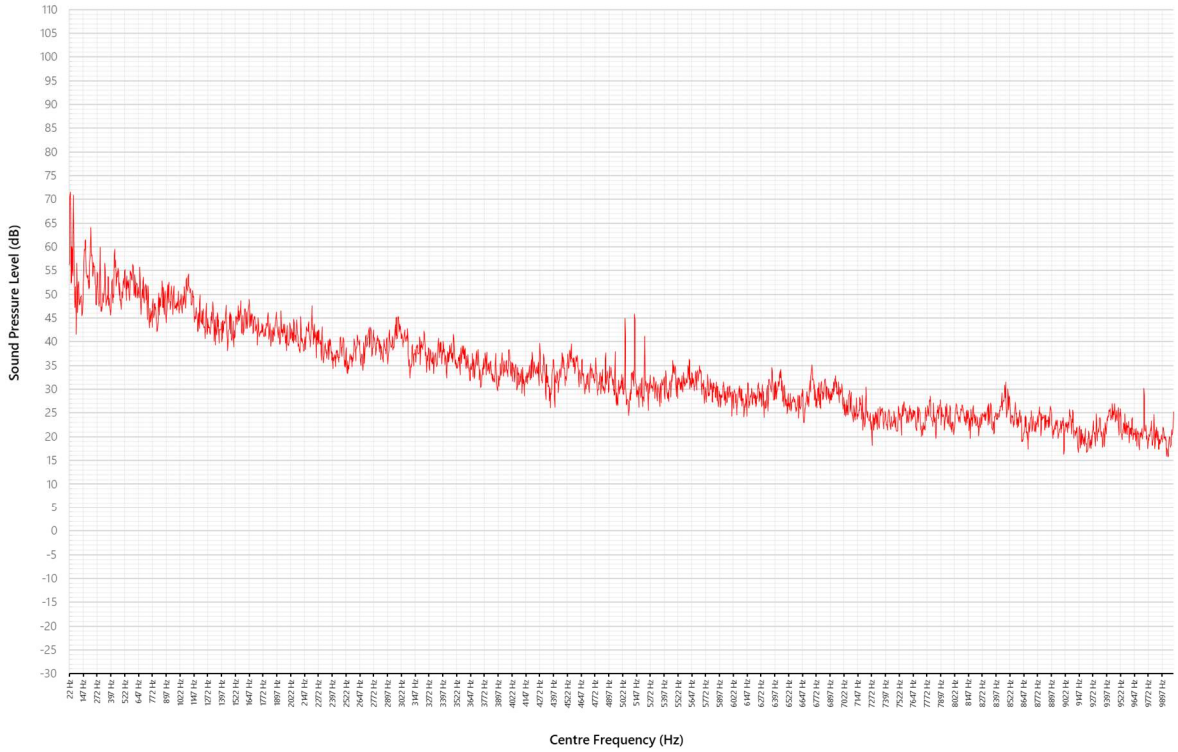
Noise Source	Measured/ Predicted Noise Levels (L_{Aeq}) / Subjective Observations	Site Photographs	Noise Model Screenshots
<p>New ETP Pumps</p>	<p>July 23 measurements were 64 dB, 3 dB below previously measured. Some cladding applied to the top of the pumps. Influenced by other ETP plant, as a worst-case, the previous (higher) measurements have been assumed.</p> <p>Source 67 dB @ 1m</p> <p>NSR 1 31 dB (slight 8 kHz tone occasionally audible)</p> <p>NSR 2 24 dB (imperceptible)</p> <p>NSR 3 3 dB (not perceptible)</p>	 <p>g (July 2023 showing applied on top of the pumps)</p>  <p>(Previous measurements)</p>	 

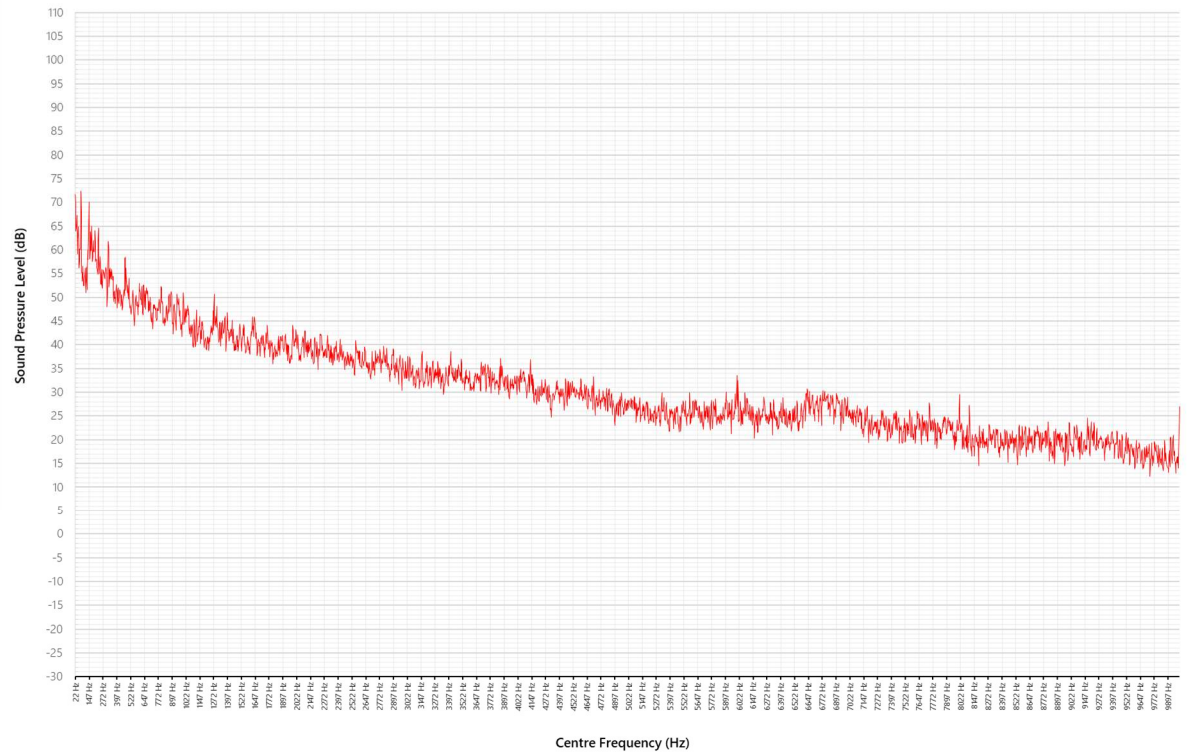
B.4 – Tonal Data


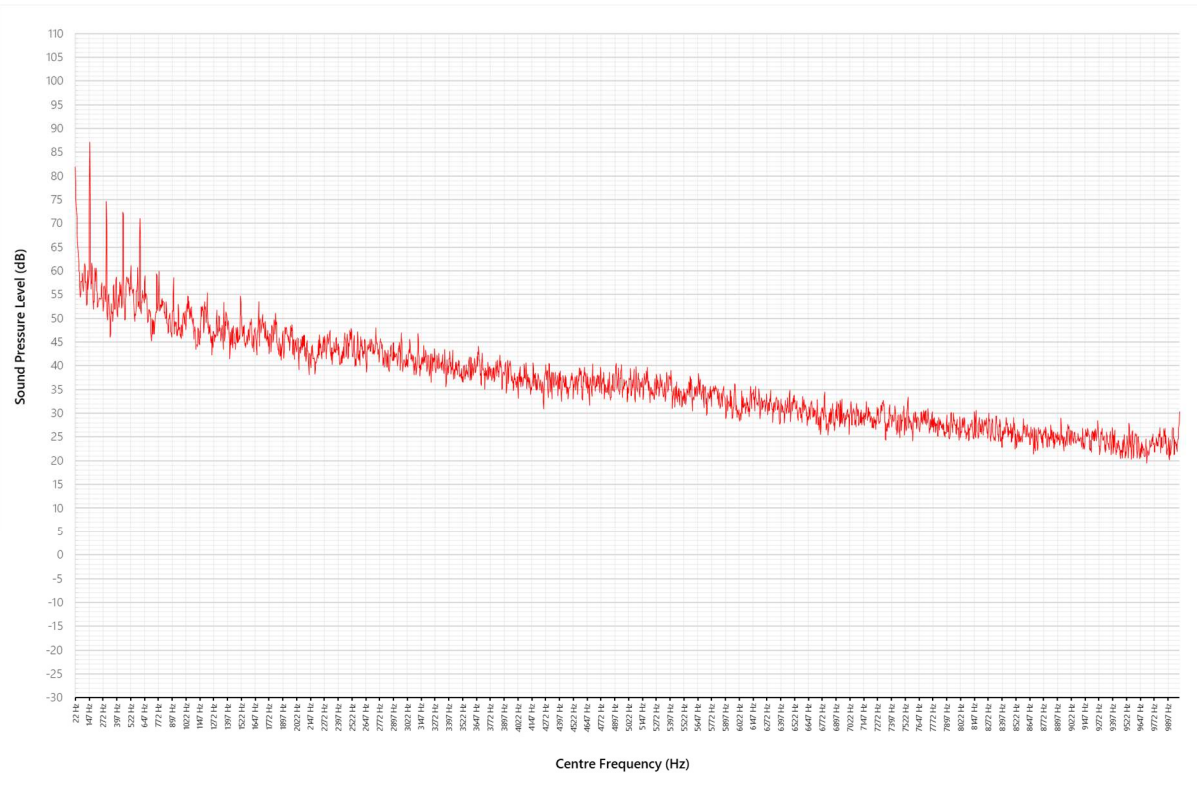
B.4.1 – FFT Graphs/Tone Identification


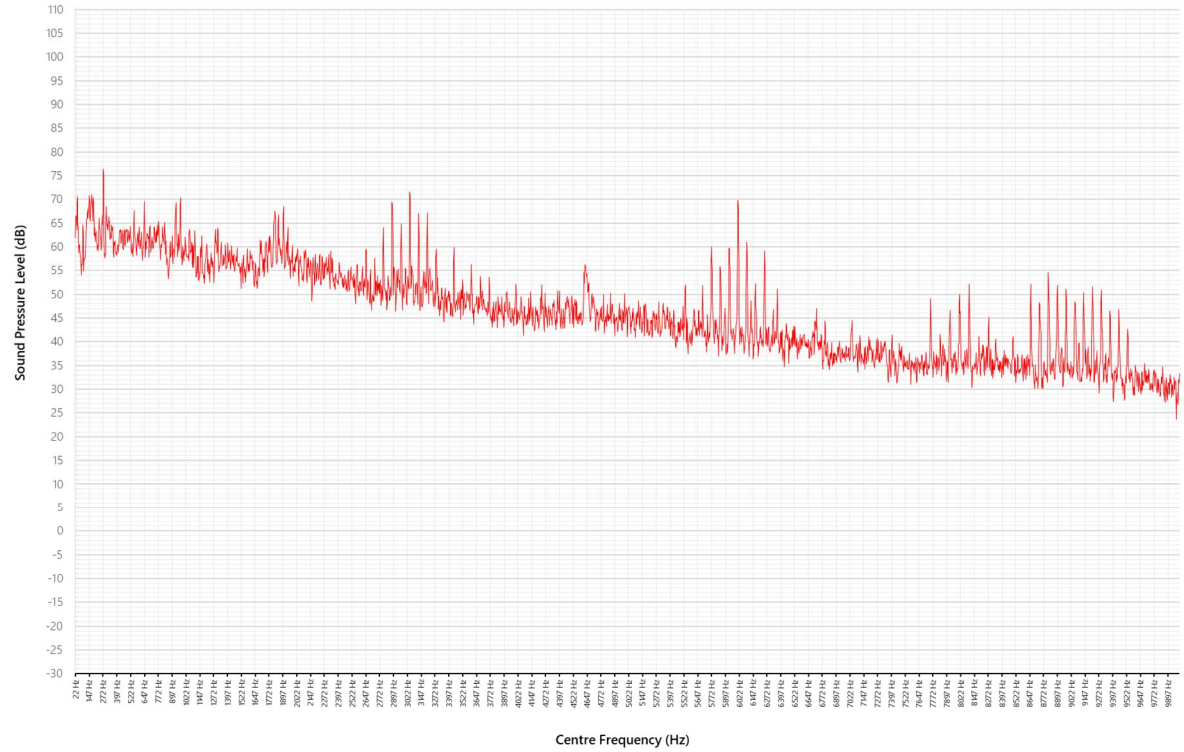
Noise Source	Measured L_{Aeq} / Measurement Position	FFT Graph
<p>ETP Tankers (pumping)</p> 	<p>84 dB L_{Aeq} 1m from Vacuum Pump and Hydraulic Cooler</p>	
<p>Comments</p>	<p>Low frequency bias associated with engine noise, but no particular tonal qualities.</p>	


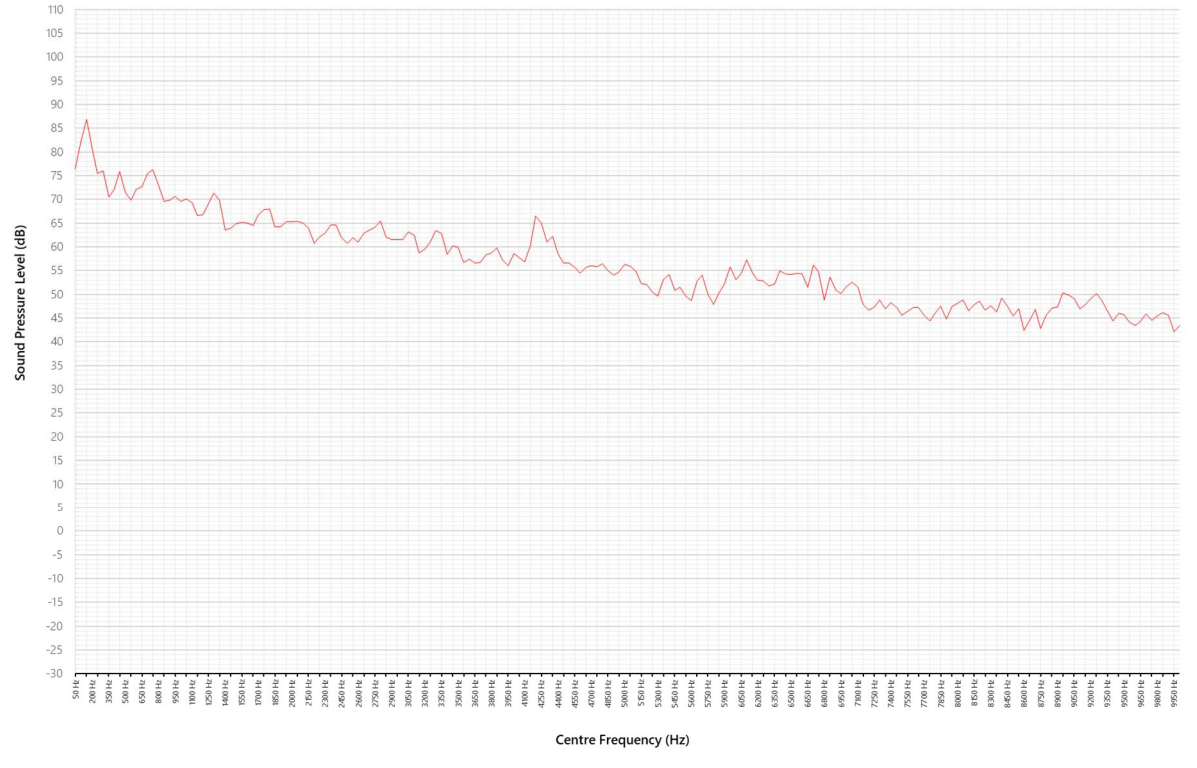
Noise Source	Measured L_{Aeq} / Measurement Position	FFT Graph
<p>Cooling Tower Pumps</p>	<p>81 dB L_{Aeq} Inside the enclosure as shown below.</p> 	
<p>Comments</p>	<p>Tonal qualities observed in the graph at 2866 Hz and 3144 Hz. Also a small spike at 428 Hz. However, not particularly noticeable when standing at the site boundary.</p>	

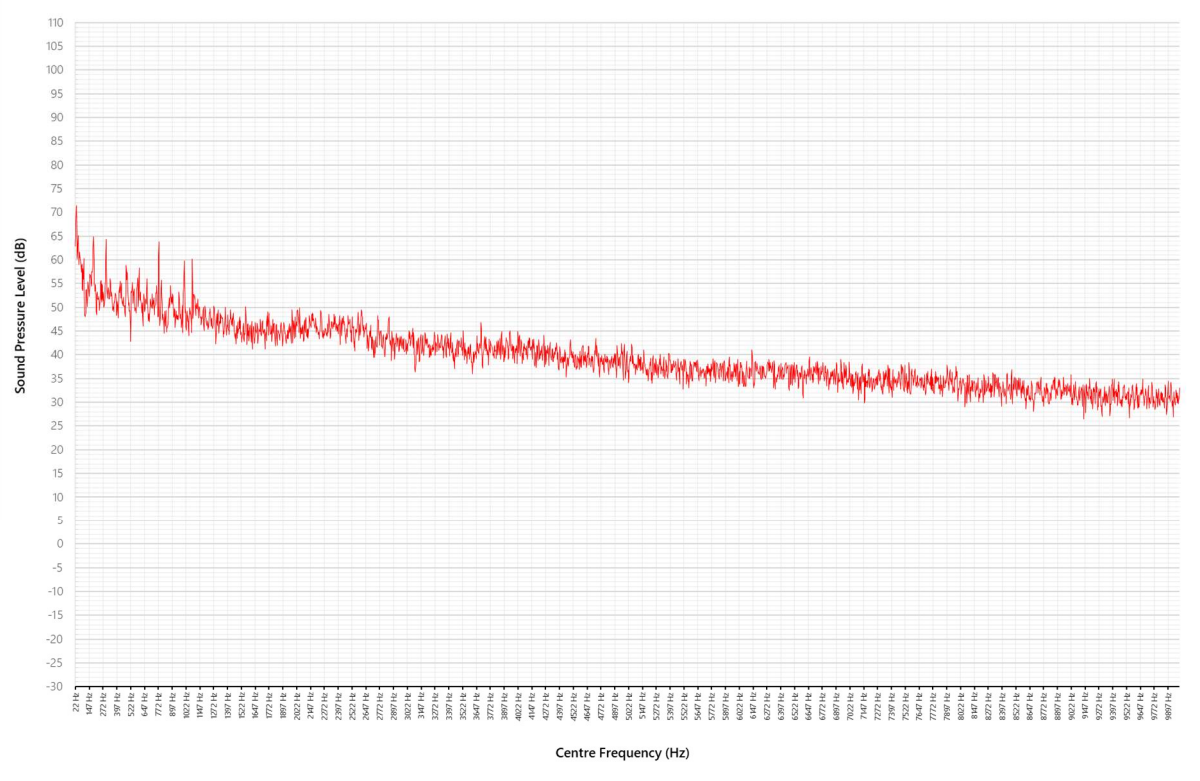
Noise Source	Measured L_{Aeq} / Measurement Position	FFT Graph
<p>Milk Tankers (Pumping and Idling)</p>	<p>74 dB L_{Aeq} 1m from the tanker pump.</p> 	
<p>Comments</p>	<p>No particular tonal qualities observed. Noise mostly from the tankers idling (which is understood to be necessary for the pump to work).</p>	

Noise Source	Measured L_{Aeq} / Measurement Position	FFT Graph
<p>Vat Room Exhausts (east elevation)</p>	<p>78 dB L_{Aeq} 1m under/1m away from southernmost exhaust)</p>	
<p>Comments</p>	<p>No particular tonal qualities observed in the graph or subjectively. Some low frequency emphasis which is likely to be from turbulent flow generated noise, or from the blade passing frequency (assuming a large fan with a low RPM). No mid-to-high frequency tones, very much broadband in nature.</p>	

Noise Source	Measured L_{Aeq} / Measurement Position	FFT Graph
<p>Vat Room Exhaust (new) (south elevation)</p>	<p>80 dB L_{Aeq} 2m underneath the fan.</p> 	
<p>Comments</p>	<p>Perceived as a broadband noise though the fundamental tone and harmonics at low-to-mid frequency are observed in the graph, which is likely to be from the blade passing frequency. These subjectively however are not perceived as tonal.</p>	

Noise Source	Measured L _{Aeq} / Measurement Position	FFT Graph
<p>Glycol Pumps (chiller compound)</p>	<p>86 dB L_{Aeq} 1m in front of 3 pumps.</p> 	
<p>Comments</p>	<p>Graph suggests three areas with evenly spaced tones, at around 3 kHz, 6 kHz, and 9 kHz. Suggesting there may be a fundamental tone at 3 kHz. Subjectively, the noise is mostly broadband with a harmonic type ringing, not perceptible at any one particular frequency.</p> <p>High frequency tonal noise may be attributable to a lack of resilient anti-vibration fixings and the 'ringing' of loose screws/metal on metal contact.</p> <p>Some tonal quality may also be heard from the chillers within the compound.</p>	

Noise Source	Measured L_{Aeq} / Measurement Position	FFT Graph
<p>Pump House</p>	<p>86 dB L_{Aeq} Inside the pump room</p> 	
<p>Comments</p>	<p>Graph suggested a relatively broadband noise with some possible tonal element at around 4 kHz. Not noticeable at the receptors.</p>	

Noise Source	Measured L_{Aeq} / Measurement Position	FFT Graph
<p>Borehole Water Tank</p>	<p>76 dB L_{Aeq} 1m from the water tank (Photo not taken during the survey)</p>	 <p>The FFT graph displays the frequency spectrum of the noise. The vertical axis represents Sound Pressure Level in dB, ranging from -30 to 110. The horizontal axis represents Centre Frequency in Hz, ranging from 221 Hz to 9007 Hz. The noise is characterized by a high level of energy at low frequencies (around 76 dB) that gradually decreases as frequency increases, showing a typical broadband noise profile for flowing water.</p>
<p>Comments</p>	<p>Broadband noise – noise characteristic is of flowing water rather than a mechanical noise.</p>	

B.4.2 – 1/3 Octave Bands

Item	Description	L _{Aeq} (dB)	dB in 1/3 Octave Frequency Bands (Hz)																						
			50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000
ETP Tankers (pumping)	1m from Vacuum Pump	84	66	71	68	67	70	80	71	73	69	70	67	73	75	76	72	73	75	73	72	72	69	66	63
Chillers	1m from the side of Chiller 1	80	71	64	61	64	57	64	60	61	66	66	79	66	73	69	69	71	66	60	56	53	51	61	48
	Between oil separators of Chillers 1 and 2	85	65	66	62	62	59	68	63	60	68	84	75	73	81	73	73	72	71	65	61	62	59	62	53
	Between oil separators of Chillers 2 and 3	84	62	65	62	65	61	69	63	63	69	73	76	73	79	80	74	67	67	64	64	66	62	60	51
	1m from side of Chiller 3 oil separator	80	66	64	63	63	62	70	65	66	74	68	74	69	74	74	66	69	67	61	62	57	56	60	51
Cooling Tower Pumps	1m outside of enclosure door	65	65	63	63	59	61	60	59	62	61	61	58	56	52	52	51	51	51	54	56	49	47	46	40
	1m inside of enclosure door	79	69	63	67	65	71	69	72	73	72	71	71	71	69	66	66	67	67	68	70	65	65	63	60
Vat Room Exhausts (east elevation)	1m in front of left exhaust	82	83	80	79	75	73	76	71	70	75	71	72	71	72	72	71	72	73	72	69	68	65	63	61
	1m in front of right exhaust	82	71	74	71	71	72	82	78	75	79	72	72	72	72	73	72	70	69	69	67	65	62	60	58
Borehole Pump Room	0.5m outside fan	66	69	65	58	61	56	60	62	57	58	55	55	57	57	57	59	57	54	52	49	50	45	42	40
	1m outside door	70	73	70	64	68	64	65	61	60	62	59	58	60	60	60	61	60	58	57	54	54	50	47	45
Boiler House Pressure Valve Release	Below flue	82	64	65	65	62	63	64	66	69	68	71	71	72	76	74	71	72	71	71	71	69	67	64	60

Item	Description	L _{Aeq} (dB)	dB in 1/3 Octave Frequency Bands (Hz)																						
			50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000
LNG (alarm)*	1m - Alarm door open	95	79	68	73	70	64	74	68	75	69	78	68	64	79	67	79	85	92	86	86	82	69	57	54
Cooling Towers	3m - Not dominant noise source, broadband noise from cooling towers	61	67	63	67	69	65	60	62	57	55	53	50	50	50	51	48	46	46	44	46	41	38	37	35
Glycol Pumps (Chiller Base)	1m in front	86	68	65	64	67	68	72	72	76	84	76	75	76	78	78	76	74	71	71	72	66	63	65	65
	20cm above pumps	92	74	67	67	70	76	77	76	78	86	79	76	85	85	82	81	82	77	78	82	72	72	74	72
Whey Dispatch Pump	1m from dispatch pump	86	68	66	62	63	62	67	70	69	68	77	70	68	83	73	74	73	75	76	74	73	73	72	69
Boiler House Louvres	0.3m beneath the bottom of the louvres	66	62	75	83	73	62	60	58	54	55	54	53	55	55	58	54	53	52	53	52	49	46	41	38
Pump House	Inside room	90	64	62	61	69	70	85	75	74	80	83	84	80	80	80	81	78	76	79	76	72	69	68	65
	1m outside closed door	60	53	51	54	51	53	62	57	53	64	51	48	48	47	46	47	45	44	43	41	41	39	37	35
Production Hall Exhausts	Below exhaust	67	71	68	68	66	62	65	61	64	62	61	60	59	57	57	57	57	56	53	52	52	50	48	46
LNG (pressure fill)	1m from pump	83	66	61	65	58	60	75	63	61	60	73	64	60	81	70	73	73	65	59	66	62	58	52	49
Borehole Water Tank	1m in front	76	75	74	65	64	60	66	68	68	70	69	67	66	65	67	65	64	63	63	63	62	61	59	58

B.5 – Fixed/Boundary Noise Monitors

B.5.1 – NSR 1

The microphone was positioned within the edge of the site boundary next to the ETP tanker entrance, in the direction of the residential property to the east (NSR 1), as has been done previously. The position is highlighted in **Figure 2.1 (Section 2.1)**. The position should represent a worst-case given that it is closer to the facility than the residents garden and windows. It is the same position used for surveys conducted several times at the facility including in November 2021, July 2021 and September 2020.

The measured noise levels include for day-to-day operational noise and therefore background noise levels should not be interpreted from these results as ‘true’ baseline noise levels which would occur if the facility were not there/were to cease operating entirely. The most useful parameter is the L_{A90} , which represents the background noise level that is mostly unaffected by intermittent traffic along the road (which affects the L_{Aeq} and L_{AFMax}).

Unfortunately, during the latest survey, the sound level meter experienced a file corruption error which meant that data could not be retrieved. The surveyor had checked the kit several times whilst on site, and when collecting it, with the measurements running, but unfortunately the data could not be downloaded.

Whilst on site between 10:00 and 14:00 on the 20th, the surveyor noted levels of between 50 and 51 dB $L_{A90,15min}$ when checking on the meter. This appears consistent with the values measured at similar times of day during November 2021. Subjectively, the surveyor (having been in attendance at all of the previous surveys) did not perceive a different in plant noise levels at this position, albeit it a 20 month gap between visits. However, the results at NSR 2 (which fortunately, did retain data successfully) suggest very similar minimum values to the surveys conducted in July and November 2021. The levels presented on the following pages are from November 2021, which are still considered to be within 1 – 2 dB of the levels that would have been measured at site in July 2023.

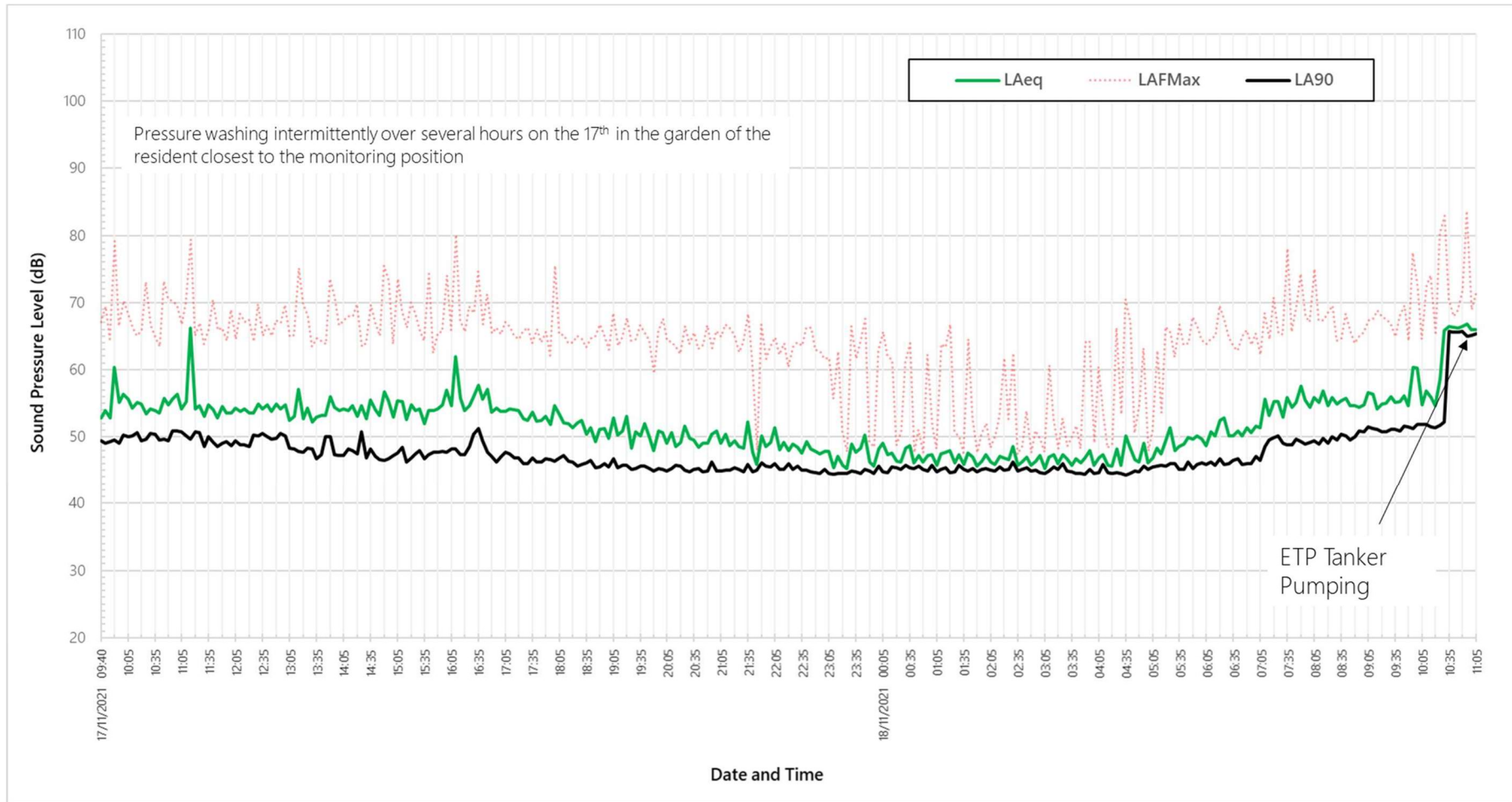
Table B.1 – Summary of measured noise levels – close to **NSR 1** – November 2021

Time Period	Parameter	Maximum	Minimum	Logarithmic Average	Mean Average	Modal Average	Median Average
Daytime (07:00 – 23:00)	L _{Aeq,5min} (dB)	67	46	56	54	54	54
	L _{AFMax,5min} (dB)	84	48	N/A	67	65	66
	L _{A90,5min} (dB)	66	45	N/A	49	45	48
Night-time (23:00 – 07:00)	L _{Aeq,5min} (dB)	53	45	48	48	46	47
	L _{AFMax,5min} (dB)	71	47	N/A	57	48	61
	L _{A90,5min} (dB)	47	44	N/A	45	45	45

Figure B.1 – Photographs of the fixed noise monitor close to **NSR 1** (including day-to-day operational noise)



Figure B.2 – Noise levels close to **NSR1** (including day-to-day operational noise) – November 2021



B.5.2 – NSR 2

The microphone was positioned within the edge of the site boundary along the road, opposite the entrance to the residential property defined as NSR 2. The position is highlighted in **Figure 2.1 (Section 2.1)**. The position should represent a worst-case given that it is closer to the facility than the residents garden and windows. It is the same position used for surveys conducted several times at the facility including in November and July 2021.

The measured noise levels include for day-to-day operational noise and therefore background noise levels should not be interpreted from these results as ‘true’ baseline noise levels which would occur if the facility were not there/were to cease operating entirely. The most useful parameter is the L_{A90} , which represents the background noise level that is mostly unaffected by intermittent traffic along the road (which affects the L_{Aeq} and L_{AFMax}).

The results show that the minimum values of $L_{A90,15min}$ were 44 dB during the day and 43 dB at night. This is 1 dB higher than the minimums measured during November 2021 (albeit a shorter 24 hour survey and measurements conducted in 5 minute rather than 15 minute intervals, which may be influential). The survey conducted in July 2021 measured minimums of 45 dB and 44 dB $L_{A90,5min}$ respectively, over just shy of 48 hours. Hence the baseline levels appear to have stayed relatively consistent.

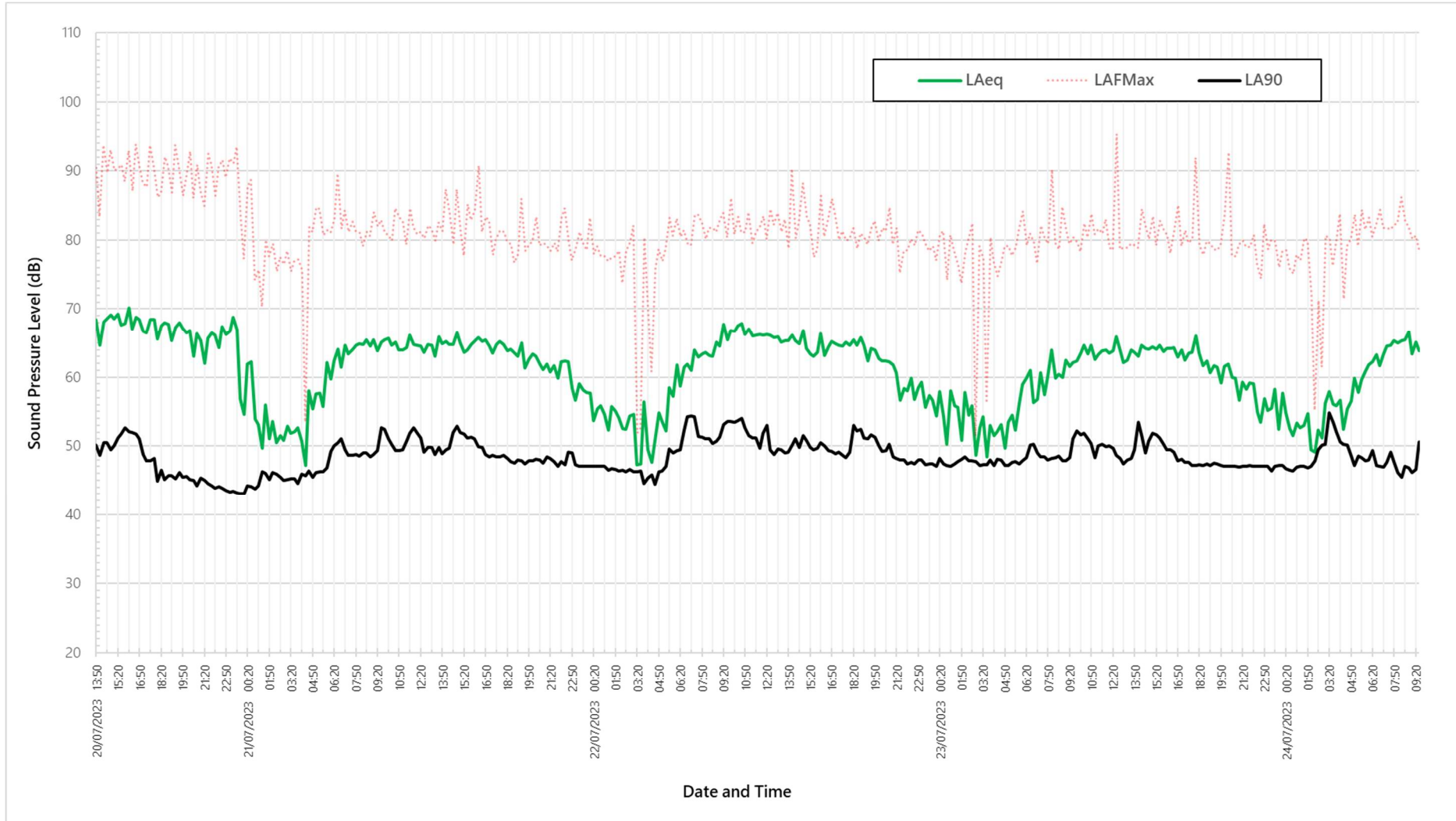
Table B.2 – Summary of measured noise levels – close to **NSR 2**

Time Period	Parameter	Maximum	Minimum	Logarithmic Average	Mean Average	Modal Average	Median Average
Daytime (07:00 – 23:00)	$L_{Aeq,5min}$ (dB)	70	53	65	64	65	64
	$L_{AFMax,5min}$ (dB)	95	74	N/A	83	80	81
	$L_{A90,5min}$ (dB)	54	44	N/A	49	48	49
Night-time (23:00 – 07:00)	$L_{Aeq,5min}$ (dB)	69	47	58	56	56	55
	$L_{AFMax,5min}$ (dB)	94	52	N/A	78	80	79
	$L_{A90,5min}$ (dB)	55	43	N/A	47	47	47

Figure B.3 – Photographs of the fixed noise monitor close to NSR 2 (including day-to-day operational noise)



Figure B.4 – Noise levels close to **NSR 2** (including day-to-day operational noise)



B.6 – Weather Conditions (20th to 24th July 2023)

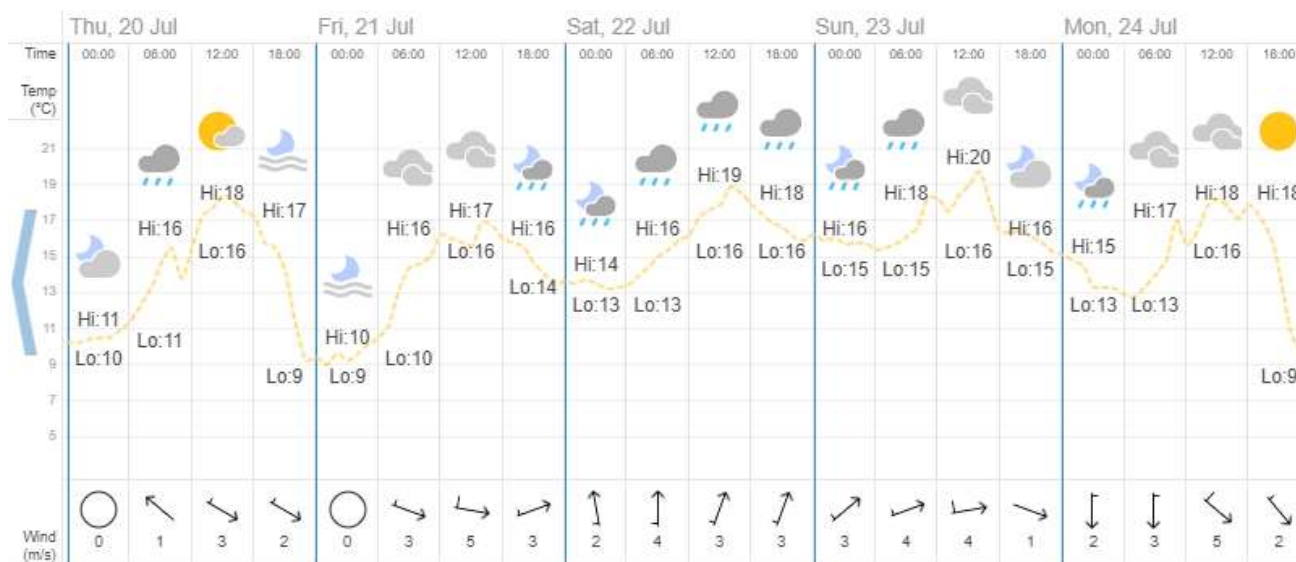
During the survey, weather conditions included intermittent periods of rain. Wind speeds were generally mild up to a maximum of 5 ms⁻¹. The microphone was fitted with a weather protection kit/windshield. These weather conditions are suitable for the measurement of environmental noise in accordance with BS 7445 'Description and Measurement of Environmental Noise'.

However, the rainy conditions may have increased average noise levels from road traffic (as rain/road surface water typically increases noise produced by wheel-to-road interaction).

The weather conditions are sourced from

<https://www.timeanddate.com/weather/@2641676/historic?month=7&year=2023>.

Figure B.6 – Meteorological conditions during the survey



Appendix C – Relevant Guidelines

C.1 - Horizontal Guidance Note for Noise Assessment and Control

The purpose of the *Horizontal Guidance Note for Noise Assessment and Control* is to provide supplementary information, relevant to all sectors, to assist in preventing and minimising emissions of noise as described in the Sector Guidance Notes (or the General Sector Guidance Note).

The guidance is in two parts:

Part 1 – Regulation and Permitting – outlines the main considerations relating to the setting of Permit conditions and subsequent regulation of noise. Part 1 is aimed primarily at the information needs of regulators.

Part 2 – Noise Assessment and Control – describes the principles of noise measurement and prediction and the control of noise by design, by operational and management techniques and abatement technologies. Outline methods of noise control are provided such as:

- use of inherently quieter processes;
- selection of inherently quiet plant or “low-noise options”;
- site layout to maximise natural screening, screening by buildings and separation distances;
- the orientation of directional noise sources away from sensitive receptors; and
- noise barriers or bunding.

C.2 - BS 4142:2014

BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'* is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor (NSR) locations within the context of the existing sound environment. The method is based upon assessing the predicted noise emissions from plant against the existing background sound levels at NSRs. The predicted emissions are termed as a 'rating level', which is the specific sound level from plant, plus 'penalties' which account for whether the noise has distinguishing characteristics such as tonality, intermittency, impulsivity, or is generally distinguishable from the ambient noise environment. Such features may attract attention and be considered annoying, hence sounds with these qualities should be penalised over sounds at the same specific noise level which is less intrusive.

The significance of the impact of an industrial or commercial sound source depends on both the margin by which the rating level $L_{Ar,Tr}$ exceeds the background sound level $L_{A90,T}$ and the context in which the sound occurs. It is therefore essential to place the sound in context. But in general, *“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.”* However, if the rating level does exceed the background sound level, *“a difference of around + 5 dB is likely to be an indication of an adverse impact, depending on the context”, and “a difference of around +10 dB or more is likely to be an indication of a significant adverse impact depending on the context.”*

C.3 - BS 8233:2014

BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' suggests appropriate criteria and limits for different situations. This includes internal noise criteria for residential developments. The limits with BS 8233:2014 are similar to those in the WHO's 'Guidelines for Community Noise and Night Noise Guidelines for Europe' document.

Table 4 of BS 8233:2014 provides internal ambient noise level (IANL) limits for dwellings from "steady external noise sources". These are summarised in Table 3.1 below.

Table C.1 – BS 8233:2014 internal ambient noise level (IANL) upper limits

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

In Annex G.1 of BS 8233:2014 it suggests that "if partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB". Therefore, a noise limit directly outside of the nearest residential windows could be set based upon the values above plus 15 dB.

Therefore, to meet internal noise targets in nearby residential dwellings, noise from the proposed plant should not exceed 50 dB L_{Aeq} during the daytime and 45 dB L_{Aeq} during the night-time when measured/calculated directly outside of a residential bedroom or living room window.

C.4 - World Health Organisation (WHO) Environmental Noise Guidelines

The WHO document *Guidelines for Community Noise 1999* has recently been superseded by the *Environmental Noise Guidelines for the European Region*. However, the updated guidance states that 'all WHO guidelines for community noise (CNG) indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid'.

The document sets out guidance as to noise levels at which there will be an unacceptable impact on the local community. WHO guidelines state:

- To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise.
- To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq} .

Therefore, noise from the proposed plant should ideally be designed to not exceed 50 dB L_{Aeq} during the daytime when measured or calculated within a residential garden, patio, or balcony.

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