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ConocoPhillips

Ethane2Power

Noise Survey & Assessment

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1. Introduction

Ove Arup & Partners (Arup) has been commissioned by ConocoPhillips Teesside to undertake a noise and vibration study to accompany the planning application for the development of a Power Island (herein referred to as the Proposed Development) at the ConocoPhillips Teesside Crude Oil Terminal, Seal Sands.

The Site lies within the Norsea Terminal boundary (herein referred to as the Oil Terminal), on land leased to the applicant from PD Teesport Ltd, operated by ConocoPhillips (UK) Teesside Operator Ltd (herein referred to as ConocoPhillips). It will occupy a similar footprint to the previous RWE plant site.

The key operational area of the Proposed Development would be located within a fenced area north of the South Boundary Road at the western edge of the Oil Terminal.

The Proposed Development comprises up to a maximum 18 No. gas engine units with associate stacks up to 11m, that would generate electrical power for use at the Oil Terminal, with excess power being exported to the National Grid. The total generation capacity of the Power Island would not exceed 49.9 MWe. The Power Island includes up to three electrical rooms, utilisation of an existing substation at the southern end of the Site, existing electrical transformers, storage tank for fresh lubrication oil and recovered waste lubrication oil, and fuel gas metering kiosk.

This report assesses the potential impacts of the operation of the Proposed Development. This report is also prepared in response to pre-application discussions with the Environmental Health Officer at Stockton-on-Tees Borough Council (SBC) regarding the low frequency noise from the Proposed Development.

Regarding construction noise and vibration impact assessments, given the nearest residential receptor is at a distance of approximately 3km from the Proposed Development, and the temporary nature of works, it is anticipated that no temporary construction impact is likely at the sensitive receptor. Therefore, construction noise and vibration assessments are scoped out.

2. Planning Policy and Guidance

2.1 Regulations

2.1.1 The Environmental Noise (England) Regulations 2006

The Environmental Noise (England) Regulations 2006[1] enact the requirements for noise action planning to promote good health and good quality of life (wellbeing) through the effective management of noise. The Environmental Noise (England) (Amendment) Regulations 2018 provide for new common noise assessment methods for five-yearly Action Plans.

2.1.2 Control of Pollution Act

The Control of Pollution Act 1974[2] gives the local authority powers to control construction site noise. This may include specific controls to restrict certain activities identified as causing particular problems. Conditions regarding hours of operation will generally be specified and noise and vibration limits at certain locations may be applied in some cases. All requirements must adhere to established guidance and be consistent with use of best practicable means (BPM) to control noise and vibration only as far as is necessary to prevent undue disturbance.

[1] The Environmental Noise (England) (Amendment) Regulations 2018, SI 2018/1089, HMSO, London, 2018.

[2] Control of Pollution Act 1974. C.40, HMSO, London, 1974.

2.1.3 Environmental Protection Act

Under Part III of the Environmental Protection Act 1990[3], local authorities have a duty to inspect their area for statutory nuisances, or to investigate complaints thereof from local residents. Included within the definition of statutory nuisance are noise from premises and noise emitted from vehicles, machinery or equipment in the street, excluding traffic noise. If the local authority is satisfied that the noise amounts to a statutory nuisance it will serve an abatement notice which may require that the noise be reduced, stopped altogether or limited to certain times.

2.2 National Policy

The UK government's noise policy is set out in the Noise Policy Statement for England (NPSE)[4]. In legislative and policy terms, noise is taken to include vibration.

Government noise policy sets three aims, which are to be met within the context of government policy on sustainable development:

- To avoid significant adverse impacts on health and quality of life;
- To mitigate and minimise adverse impacts on health and quality of life; and
- Where possible, contribute to the improvement of health and quality of life.

The National Planning Policy Framework (NPPF)[5] sets out the requirements for the planning system in England and must be considered in conjunction with local development plans during planning decisions. In reference to noise, the framework states:

"Planning policies and decisions should:

- mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life[4];
- identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."

Planning Practice Guidance (PPG)-Noise[6] provides guidance on the application of government noise policy. PPG-Noise sets out in the associated noise exposure hierarchy table that unacceptable adverse effects on health and quality of life due to noise exposure (set at a level higher than significant adverse impacts on health and quality of life) should be 'prevented'.

Thresholds for identifying adverse effect levels in terms of government noise policy are not defined numerically in NPSE, NPPF or PPG-Noise. The threshold values adopted for this assessment have been based on published standards and guidance, as set out below, and agreed with an Environmental Health Officer (EHO) at SBC.

[3] Environmental Protection Act 1990. C.43, HMSO, London, 1990.

[4] Department for Environment, Food & Rural Affairs [2010] Noise policy statement for England [online]. Available at: https://www.gov.uk/government/publications/noise-policy-statement-for-england [Accessed: 06/01/2025]

[5] Ministry of House, Communities & Local Government [2024] National Planning Policy Framework [online]. Available at: https://assets.publishing.service.gov.uk/media/65829e99fc07f3000d8d4529/NPPF_December_2023.pdf [Accessed: 06/01/2025]

[6] Department for Levelling Up, Housing and Communities [2019] Planning Practice Guidance - Noise - GOV.UK [Online]. Available at: https://www.gov.uk/guidance/noise--2 [Accessed: 09/01/2025]

2.3 Local Planning Policy

2.3.1 Stockton-on-Tees Borough Council Local Plan (Adopted 30 January 2019)[7]

The Local Plan sets out the Council's policies and proposals to guide planning decisions and establishes the framework for the sustainable economic growth and development of the Borough up to 2032. The Local Plan states following policies and guidance with regards to noise.

Policy ENV7 – Ground, Air, Water, Noise and Light Pollution

1. *"All development proposals that may cause groundwater, surface water, air (including odour), noise or light pollution either individually or cumulatively will be required to incorporate measures as appropriate to prevent or reduce their pollution so as not to cause unacceptable impacts on the living conditions of all existing and potential future occupants of land and buildings, the character and appearance of the surrounding area and the environment.*
2. *Development that may be sensitive to existing or potentially polluting sources will not be sited in proximity to such sources. Potentially polluting development will not be sited near to sensitive developments or areas unless satisfactory mitigation measures can be demonstrated.*
3. *Where development has the potential to lead to significant pollution either individually or cumulatively, proposals should be accompanied by a full and detailed assessment of the likely impacts. Development will not be permitted when it is considered that unacceptable effects will be imposed on human health, or the environment, taking into account the cumulative effects of other proposed or existing sources of pollution in the vicinity. Development will only be approved where suitable mitigation can be achieved that would bring pollution within acceptable levels."*

2.3.2 Hartlepool Local Plan, Hartlepool Local Planning Framework (May 2018)[8]

The Hartlepool Local Plan sets out the Council's policies and proposals to guide planning decisions and establish the framework for the sustainable growth and development of the Borough. The document contains the following policies with regard to noise.

Policy RUR1: Development in the Rural Area

The Borough Council will seek to ensure the rural area is protect and enhanced to ensure that its natural habitat, cultural and built heritage and rural landscape character are not lost. Development outside the development limits will be strictly controlled.

The Borough Council will seek to support the rural economy. Proposals must be considered necessary for the efficient or the continued viable operation of agriculture, horticulture, forestry, equine uses, and /or other appropriate land based businesses. This includes the diversification of activities on existing farm units which do not prejudice continued agricultural use and are of a scale and nature that is suitable to a rural location.

Development in the rural area should, where relevant:

- *… 4) Not have a significant detrimental impact on neighbouring users or surrounding area by way of amenity, noise, access, light pollution or visual intrusion;"*

2.4 Standards and Guidance

BS 4142:2014+A1:2019: Methods for rating and assessing industrial and commercial sound[9], describes methods for rating and assessing sound of an industrial and/or commercial nature.

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[7] Stockton-on-Tees Borough Council [2019] Local Plan Adopted 30 January 2019 [online]. Available at: https://www.stockton.gov.uk/media/2518/Local-Plan-2019/pdf/Local_Plan_2019.pdf?m=1645450086087 [Accessed: 09/01/2025]

[8] Hartlepool Council, Hartlepool Local Plan, Hartlepool Local Planning Framework, May 2018. Available at: https://www.hartlepool.gov.uk/downloads/file/4393/hartlepool_local_plan_-_adopted_may_2018pdf [Accessed: 28/01/2025]

[9] British Standards Institution [2019] BS 4142:2014+A1:2019: Methods for rating and assessing industrial and commercial sound.

In February 2005, the University of Salford published a research paper which was prepared for Department for Environment, Food and Rural Affairs (Defra)[10], entitled 'Procedure for the assessment of low frequency noise disturbance'. This paper provides criteria and procedures for assessing low frequency noise. The objective of this paper is to assist Environmental Health Practitioners to handle complaints of low frequency noise as effectively and correctly as possible. It should be noted that this assessment procedure is not intended as a means of predicting when disturbance might occur, for example in a planning situation. This paper provides a criterion curve for assessment of low frequency noise which is referenced in this report for context in the absence of any other specific guidance regarding low frequency sound.

Design Manual for Roads and Bridges (DMRB), LA 111 Noise and vibration[11] gives procedures to assess road traffic noise impact. The details of traffic data are not available at this stage. The principles that are set out in the DMRB have been considered in determining potential impacts from road traffic. A high-level consideration has been given to the additional operational vehicle movements on the road network.

IOS 9613-2 'Acoustics – Attenuation of sound during propagation outdoors'[12] provide a prediction methodology for the propagation of sound which has been implemented in the model used to calculate noise emission levels at noise sensitive receptors.

2.5 Consultation

Consultation has been undertaken with an Environmental Health Officer (EHO) from SBC regarding the noise and vibration assessment for the Proposed Development. Prior to submission of the screening opinion [Ref. E2P-ARU-ZZ-ZZ-RP-YA-0001], discussions took place with the SBC through an online meeting on 21 March 2024 and the following items were agreed and reflected in the screening opinion:

- Monitoring duration of a 24 hours period at locations around the site boundary to understand the existing sound level climate in this area;
- Given the distance separation between the proposed site and the nearest residential receptor approximately 3km from the proposed development site, it is unlikely that the Proposed Development would impact on the residential properties; and
- The applicant to provide the operational noise levels of the Proposed Development.

Following the online meeting, an email from the EHO dated 25 June 2024 expressed some concerns regarding the potential impact of low frequency noise from the industrial plant:

"Whilst we recognise the distance to them is 3-4km we are concerned about the potential for low frequency noise which may travel such a distance within a free-field environment with no structures etc to block the noise between source and receiver."

In response to the screening opinion, the following response was provided, dated 19 June 2024:

"The site lies within an existing industrial estate and there are no residential dwellings that should be affected by either the proposal or its construction. However, I note that the noise was assessed over a period of 24 hours on a weekday, it is recommended that background measurements are to be derived from 7 days or more and the LA90 level is to be the 25th percentile of the data gathered. This is to make a full and proper assessment of the quieter periods of weekends and nighttime".

A subsequent email dated 7 August 2024 stated:

"I can understand your initial thoughts that the monitoring longer than 24hours will not be required as there is some distance between the site and the nearest dwellings, however, I do have experience of low frequency noise travelling distances, and when the general plant noise and activities do reduce, the background level

[10] Defra, [2011], Procedure for the assessment of low frequency noise disturbance, NANR45 revision 1. Available at: https://images.reading.gov.uk/2021/10/CD-6.26-NANR45-procedure_rev1_23_12_2011.pdf [Accessed: 28/01/2025]

[11] Highways England [2020], Design Manual for Roads and Bridges, LA 111 Noise and Vibration Revision 2.

[12] International Organization for Standardization (ISO) [2024], Acoustics – Attenuation of sound during propagation outdoors, Part 2: Engineering method for the prediction of sound pressure levels outdoors.

can drop significantly, therefore I would be requesting a minimum of a weeks of monitoring to catch those quieter times, and a particular interest to the lower frequencies of sound".

Arup requested noise assessment criteria from an industrial noise source, to which the following was received on 27 January 2024:

"the rating level shall not exceed the LA90 background between the hours of 23:00-07:00 hrs and the rating level can exceed the LA90 background level by up to 5dB during the hours of 07:00-23:00 hrs."

The comments are responded to in Section 4 and Section 5.

3. Assessment Methodology

This section outlines the methodology for assessing the likely significant effects of noise from the operation of the Proposed Development.

3.1 Operational plant noise

An assessment of the potential impacts arising from operational noise sources has been undertaken in line with BS4142 at a location representative of the residential receptor closest to the Proposed Development.

An initial estimate of the impact of industrial noise according to BS4142 is based upon the difference between the measured background sound level without the sound of the Proposed Development, and the 'rating level' of the Proposed Development, at the receiver location.

The 'background sound level' ($L_{A90,T}$) is defined in BS4142 as the typical existing level in the absence of the 'specific sound level' at the receiver location. The specific sound level ($L_{Aeq,Tr}$) from the industrial source can be subject to a weighting (penalty) where it displays an identifiable character (such as tonality, impulsivity, intermittency or otherwise distinctive character) to provide a rating level ($L_{Ar,Tr}$). The background sound level is subtracted from the rating level and the difference used to inform the assessment of the effects.

BS4142 advises: *"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 initial estimate of the impact of the specific sound be conducted by subtracting the measured background sound level from the rating level and consider the following:

- Typically, the greater this difference, the greater the magnitude of the impact;
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context, and
- 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 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.

Importantly BS4142 advises that where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following:

- *"The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*
- *Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night".*

The EHO at SBC recommended that the rating level shall not exceed the background sound level between 23:00 and 07:00 hrs.

BS 4142 states that *"this standard is not applicable to the assessment of low frequency noise."*

The Defra paper NANR45 'Procedure for the assessment of low frequency noise complaints'[13] is also noted not to be applicable to planning noise assessment. NANR45 provides a proposed reference curve for the assessment of low frequency noise complaints.

Table 1 Proposed reference curve

Hz	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB,L_{eq}	92	87	83	74	64	56	49	43	42	40	38	36	34

A 5dB relaxation may be applied to the proposed reference curve if the noise occurs during the day time only.

In the absence of specific guidance, both BS 4142 and NANR45 have been considered to provide context for the low frequency noise assessment.

3.2 Operational road traffic noise

During the operational phase, it is expected that the Proposed Development will generate four additional vehicles per day on the road network. Given the additional operational traffic movements is insignificant, it is unlikely this would give rise adverse impacts on noise sensitive receptors. Therefore, no further consideration is given to operational road traffic noise.

3.3 Assumptions and limitations

A 3-dimensional noise prediction model has been created along with topography of the proposed site and surroundings and intervening buildings. The following assumptions have been implemented in the noise prediction model:

- LiDAR Digital Terrain Map (DTM) topography information on the existing site and surroundings;
- OSMM was used to extract the building layout;
- Acoustically 'hard' ground representative of a worst-case is assumed;
- All plant is assumed to be in operation 24 hours / 7 days;
- Each engine would be located inside a container. The detailed specification of the enclosure is unknown at this stage, it is understood that a sound pressure level from the engine enclosure would be limited to a sound pressure level of 72dB(A) at 1m from the engine enclosure;
- Each engine unit contains eight cooler/condensers, located at 4.1m above ground level just above the top of the engine enclosure;
- The stack from each engine would at 10.4m above ground level; and
- Facilities such as control rooms, welfare, oil tank and storage area are not considered as contributing sources of noise.

The number of engines installed will be contingent upon the projected volumes of available fuel gas. The Proposed Development includes 18 engines, however, the number required is anticipated to be approximately 14 engine, this is considered an operational worst case. Up to four of the installed engines will provide redundancy to ensure that the availability of the Proposed Development meets target levels. Consequently, it is likely that a maximum of 10 engines will operate simultaneously. Furthermore, the available fuel gas volumes are expected to decline over time, which will correspondingly reduce the number of engines required to operate to remain aligned with the available fuel gas volume. The maximum number of engines is projected to be operational only during the first 4-5 years of the Proposed Development, with a rapid decrease in the number of operational engines thereafter. For the purposes of this assessment, therefore, two scenarios have been considered:

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- a worst conservative scenario of 18 engines in operation; and
- a reasonable realistic worst-case scenario of 14 engines in operation.

Noise input data used in the prediction model is tabulated in Table 2.

Table 2 Input data for key sources of noise

Plant	Sound Pressure level in octave frequency band, dB (re 20 µPa)									SPL, dB(A) at 1m
	31.5	63	125	250	500	1000	2000	4000	8000	
Each engine plant room	53.0	58.8	63.5	63.7	65.2	64.3	63.8	60.7	69.3	72.0
Cooler/Condenser per fan (4.1m above ground)	-	13.0	40.0	52.0	64.0	69.0	70.0	63.0	53.0	74.0
Stack at 10.4m above ground level	61.7	68.3	83.9	71.3	67.7	67.2	69.3	65.4	-	75.0

Plant noise propagation has been calculated using the prediction software in accordance with ISO 9613-2. The engine plant room is modelled comprising an area source for each façade and roof of the plant room. Cooler/condenser and stack are modelled as point noise sources.

4. Baseline Sound Survey

A baseline environmental sound level survey has been undertaken to determine the existing sound climate in and around the proposed site. The initial survey was carried out on Wednesday 3 and Thursday 4 April 2024. The additional survey was carried out between Thursday 12 and Tuesday 19 November 2024.

Measurements were undertaken in accordance with the principles described in BS 7445-1:2003 'Description and measurement of environmental noise – Part 1: Guide to quantities and procedures' and BS 4142: 2024 +A1:20019 'Methods for rating and assessing industrial and commercial sound'.

During the first site visit, unattended and attended measurements were made at and around the proposed development site boundary. The dominant noise source affecting the measurement location was the activities associated with the existing ConocoPhillips Teesside site including plant noise.

During the second site visit, unattended and attended measurements were made at locations representative of the nearest residential property, Marsh House Lane Farm, which is located approximately 3km from the Proposed Development. Observations made during the site visit that plant noise from the north was dominant, possibly from a steel mill. Plant noise from the northeast was also audible, however it was not possible to identify the exact source of noise. Plant noise was continuous but varying in character and level. Freight trains on the railway line located to the north of the monitoring location were noticed during the site visit and dominated as they passed.

The results from the second baseline sound survey have been used in this assessment and summarised overleaf. The details of the surveys can be found in Appendix B. The monitoring locations and an indicative Proposed Development site location are presented in Figure 1.

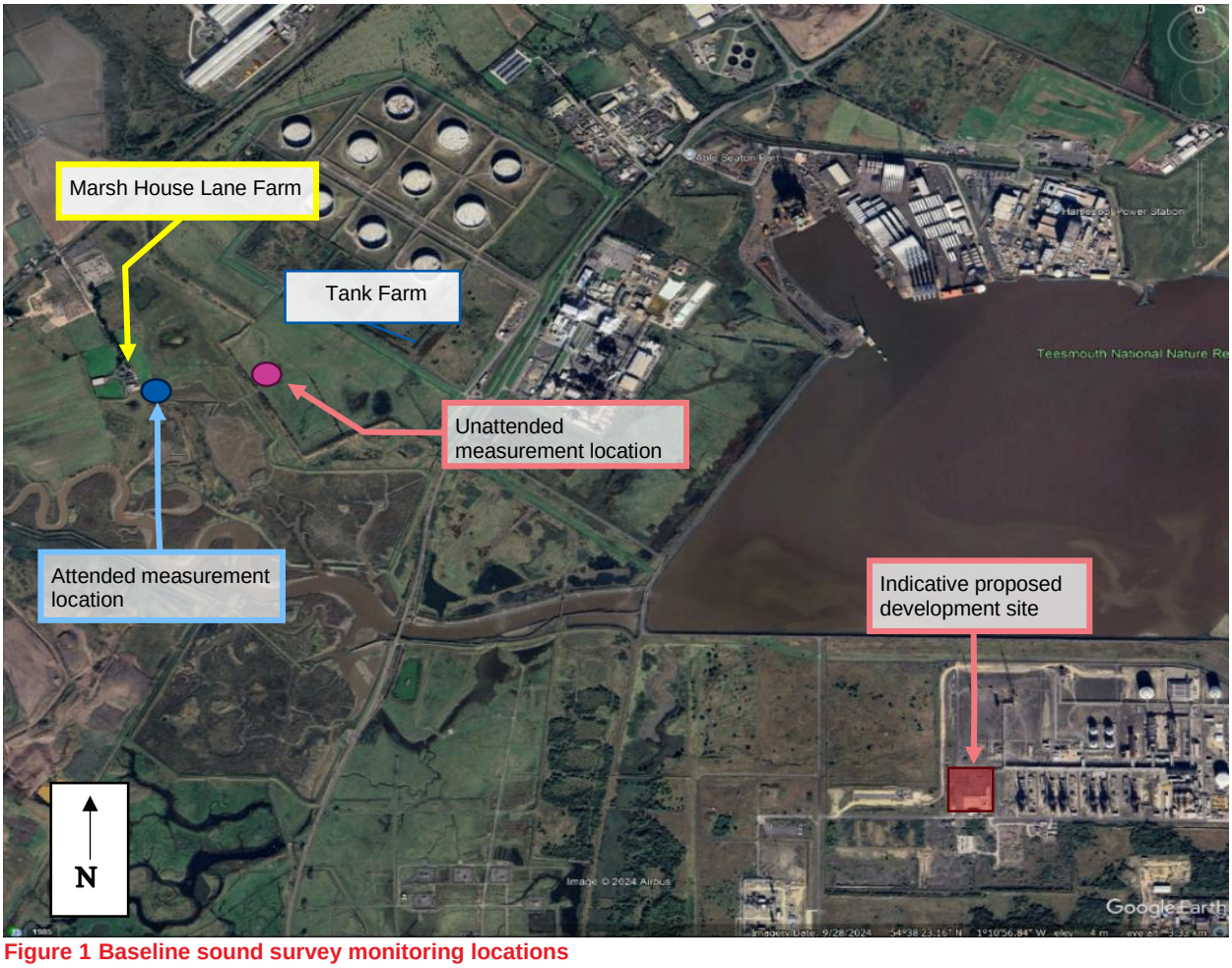

Figure 1 Baseline sound survey monitoring locations

Unattended sound level measurements during daytime are summarised in Table 3 and during night time in Table 4. The background sound levels are presented with modal values and 25th percentile of the given period, as recommended by the EHO. The L_{eq} values are the logarithmically averaged value of the given period. The ranges of maximum values are tabulated.

Table 3 Summary of unattended measurements – day time

Period	Date and start time		Duration (hh:mm)	Sound Pressure Level, dB(A) (ref 20 µPa)			
				L_{90}		L_{eq}	L_{max}
				Modal value	25th percentile		
Day 1	Tue	12/11/2024 13:30	08:30	44	41	47	45-79
Day 2	Wed	13/11/2024 07:00	16:00	41	40	49	42-81
Day 3	Thu	14/11/2024 07:00	16:00	40	40	46	49-73
Day 4	Fri	15/11/2024 07:00	16:00	42	40	47	48-69
Day 5	Sat	16/11/2024 07:00	16:00	39	36	42	41-73
Day 6	Sun	17/11/2024 07:00	16:00	40	37	42	45-68
Day 7	Mon	18/11/2024 07:00	16:00	43	38	46	48-69
Averaged day weekdays				40	38	47	42-81
Averaged day weekends				39	36	42	41-73

For the daytime period, the modal background sound levels varied between 39 and 43dB $L_{A90, 15min}$. The lowest 25th percentile of background noise level during day time was 36dB $L_{A90, 15min}$. The averaged sound levels during the weekends are slightly lower but not significant different to the weekday averaged sound levels.

Table 4 Summary of unattended measurements – night time

Period	Date and start time		Duration (hh:mm)	Sound Pressure Level, dB(A) (ref 20 µPa)			
				L_{90}		L_{eq}	L_{max}
				Modal value	25th percentile		
Night 1	Tues-Wed	12/11/2024 23:00	08:00	40	39	45	44-63
Night 2	Wed-Thurs	13/11/2024 23:00	08:00	39	37	42	40-59
Night 3	Thurs-Fri	14/11/2024 23:00	08:00	35	35	44	44-63
Night 4	Fri-Sat	15/11/2024 23:00	08:00	34	33	38	42-61
Night 5	Sat-Sun	16/11/2024 23:00	08:00	31	31	36	38-68
Night 6	Sun-Mon	17/11/2024 23:00	08:00	43	42	44	46-59
Night 7	Mon-Tues	18/11/2024 23:00	08:00	42	41	44	40-66
Averaged night weekdays (12/11/2024 – 14/11/2024)				39	37	44	40-63
Averaged night, weekends (15/11/2024 – 16/11/2024)				31	31	37	38-68
Averaged night, weekdays (17/11/2024 – 18/11/2024				43	42	44	40-66

A time history showing night-time measurements and histograms showing the distribution of measured $L_{A90, 15min}$ values during each night can be found in Appendix B. For the night-time period, three distinct periods are apparent.

Tuesday, Wednesday and Thursday (12-15 November) showed similar sound levels, which were lowest towards the beginning or middle of the night and steadily increased from about 03:00 to 04:00. The most frequently occurring $L_{A90,15min}$ during this weekday period was 39 dB and the 25th percentile was 37 dB.

On Friday and Saturday nights (15-17 November) the sound levels were much lower throughout the whole night, with the lowest sound levels around 02:00 to 03:00. The most frequently occurring $L_{A90, 15min}$ value during this weekend period was 31 dB and the 25th percentile was 31 dB.

On Sunday and Monday nights (17-19 November) the sound levels were higher and showed little variation throughout the night. The most frequently occurring $L_{A90, 15min}$ during this period was 43 dB and the 25th percentile was 42 dB. During the Sunday to Monday night, the background sound level was higher than measured during the day. It is unknown what caused the increased night time background level.

The 25th percentile of octave band background sound levels have been analysed in respect of low frequency noise impact. The lowest night-time 25th percentile values are presented in Table 5.

Table 5 The lowest 25th percentile background sound levels in octave bands – $L_{A90, 15min}$

	Octave Band Centre Frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
25th percentile L_{90} measurements, dB (ref 20 µPa), A-weighted	7	17	18	24	27	25	14	13	13

5. Assessment of potential impacts

5.1 Operational plant noise

5.1.1 BS4142 operational noise assessment

The assessment is presented for the night-time as it is worst-case since the Proposed Development is expected to be in continuous operation, including weekends. If noise emissions are effectively controlled for the night-time, then they are expected to remain acceptable for the daytime as well.

The predicted sound pressure level at the closest receptor from a worst conservative scenario and a reasonable realistic worst-case scenario are provided in Table 6 and Table 7 alongside the BS 4142 analysis.

Table 6 Predicted sound pressure level at the closest receptor for a worst conservative scenario of 18 engines

Results		BS4142 Relevant Clause	Commentary
Background sound level	25th percentile $L_{A90,\ 15min}$ =31 dB	8.1.3 8.3	Existing background sound levels measured at the unattended monitoring location. Measured under free-field conditions. Sound level considered to be representative of the Marsh House Lane Farm at night. The 25th percentile of background noise levels during the quietest night time period.
Specific sound level	$L_{Aeq,T}$ = 14dB	7.3.6	Sound level predicted at the nearest sensitive receptor in 3D noise model.
Acoustic corrections	6dB	9.2	This is an estimated correction of +6dB to account for the potential character of sound from the engine, cooler and stack as a worst-case.
Rating level	14dB + 6dB = 20dB	9.2	
Excess of rating over background sound level	20dB -31 dB = -11dB	11	Low impact

Table 7 Predicted sound pressure level at the closest receptor for a reasonable realistic worst-case scenario of 14 engines

Results		BS4142 Relevant Clause	Commentary
Background sound level	25th percentile $L_{A90,\ 15min}$ =31 dB	8.1.3 8.3	As above
Specific sound level	$L_{Aeq,T}$ = 12dB	7.3.6	As above
Acoustic corrections	6dB	9.2	As above
Rating level	12dB + 6dB = 18dB	9.2	As above
Excess of rating over background sound level	18dB -31 dB = -13dB	11	Low impact

The predicted rating level at the far south of the farm buildings does not exceed the background sound level at the nearest residential receptor.

Based on the predicted rating levels from the worst conservative scenario of 18 engines operating and the measured background level during the quietest time period, a low impact is predicted at the nearest residential dwelling. As the predicted rating noise level is well below the background sound level, this is assessed as no significant effect due to the operation of the proposed development.

For the reasonable realistic worst-case scenario, the predicted rating level at the nearest residential dwelling is well below the measured background sound level during the quietest time period; this is assessed as no significant effect.

5.1.2 Low frequency noise disturbance

In response to the EHO's concerns regarding low frequency noise issues, considerations have been given to the existing background sound levels, predicted noise emission levels at the residential receptor, and the recommended NANR45 reference curve.

The sound levels in the frequency band between 31.5Hz and 125Hz have been considered. The predicted noise emission levels at the nearest residential receptor in these octave band frequency regions are significantly below both the recommended NANR45 reference curve and the lowest 25th percentile background sound levels. This indicates that the low frequency noise during the operation of the Proposed Development is likely to be a low impact which is assessed as no potential significant effect. Operational noise assessment uncertainty.

The level of uncertainty for the operational noise assessment is dependent upon the complexity and quality of information included in the noise prediction model. The assessment is considered as conservative and robust.

6. Conclusions

A noise impact assessment has been undertaken to assess the potential impacts associated with the operation of the Proposed Development on the closest noise sensitive receptor.

A 3-dimensional noise prediction model has been constructed to predict noise emission from plant items and an assessment of their likelihood of impact has been undertaken in line with British Standard BS 4142.

The predicted noise emissions arising from the Proposed Development do not exceed the 25th percentile of background noise level during the quietest night-time period. As per BS 4142, where the rating level does not exceed background sound levels, this is an indication of a low impact.

The conclusions set out in this report should be satisfied if the final selected plant achieves the assumed sound pressure levels set out in Section 3.3 Assumptions and limitations.

Appendix A

A.1 Glossary of acoustic terminology

A.1.1 Decibel (dB)

The ratio of sound pressures which we can hear is a ratio of 10^6:1 (one million: one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (L) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

A.1.2 dB(A)

The unit used to define a weighted sound pressure level, which correlates well with the subjective response to sound. The 'A' weighting follows the frequency response of the human ear, which is less sensitive to low and very high frequencies than it is to those in the range 500Hz to 4kHz.

In some statistical descriptors the 'A' weighting forms part of a subscript, such as L_{A10}, L_{A90}, and L_{Aeq} for the 'A' weighted equivalent continuous noise level.

A.1.3 Frequency

Frequency is the rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the hertz (Hz), which is identical to cycles per second. A 1000Hz is often denoted as 1kHz, e.g. 2kHz = 2000Hz. Human hearing ranges approximately from 20Hz to 20kHz. For design purposes, the octave bands between 63Hz to 8kHz are generally used. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For more detailed analysis, each octave band may be split into three one-third octave bands or narrow frequency bands.

A.1.4 Maximum noise level

The maximum noise level identified during a measurement period. Experimental data has shown that the human ear does not generally register the full loudness of transient sound events of less than 125ms duration and fast time weighting (F) has an exponential time constant of 125ms which reflects the ear's response. Slow time weighting (S) has an exponential time constant of 1s and is used to allow more accurate estimation of the average sound level on a visual display.

The maximum level measured with fast time weighting is denoted as $L_{Amax,\,F}$. The maximum level measured with slow time weighting is denoted $L_{Amax,\,S}$.

A.1.5 Sound pressure level

The sound power emitted by a source results in pressure fluctuations in the air, which are heard as sound.

The sound pressure level (L) is ten times the logarithm of the ratio of the measured sound pressure (detected by a microphone) to the reference level of 2 x 10^{-5}Pa (the threshold of hearing).

Thus L (dB) = 10 log $(P1/P_{ref})^2$ where P_{ref}, the lowest pressure detectable by the ear, is 0.00002 pascals (i.e. $2x10^{-5}$ Pa).

The threshold of hearing is 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dBL_A and a change of 3dB is only just detectable. A change of 10dB is subjectively twice, or half, as loud.

A.1.6 Statistical noise levels

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{p10}, the level exceeded for 10% of the time period under consideration and can be used for the assessment of road traffic noise (note that L_{pAeq} is used in BS 8233 for assessing traffic noise). The L_{90}, the level exceeded for 90% of the time, has been adopted to represent the background noise level. The L_1, the level exceeded for 1% of the time, is representative of the maximum levels recorded during the sample period.

A weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T) is normally included, e.g. dB$L_{A10, 5min}$ or dB$L_{A90, 8hr}$.

A.1.7 Typical levels

Table A.1 Typical noise level examples

Noise Level, dB(A)	Example
130	Threshold of pain
120	Jet aircraft take-off at 100m
110	Chain saw at 1m
100	Inside disco
90	Heavy lorries at 5m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night

A.2 Baseline sound surveys

ARUP

Conoco Phillips

Teesside E2P

Baseline Sound Level Report

Reference: E2P-ARU-ZZ-ZZ-RP-YA-0001

02 | 12 December 2024

Job number 297973-10

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ARUP

Document Verification

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Job number	297973-10
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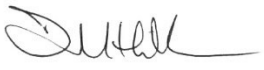
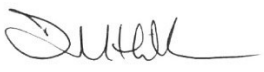
File reference	4-50

Revision	Date				
P01	24/05/2024	**Filename**	Baseline Sound Level Report		
		Description	Baseline Sound Level Report		
			Prepared by	**Checked by**	**Approved by**
		Name	Katie Salter MPhys AMIOA	Young Youn BEng MSc MIOA	David Hiller BSc MSc PhD CEng MIOA MIMMM FGS
		Signature			
P02	12/12/2024	**Filename**	Baseline Sound Level Report		
		Description	Baseline Sound Level Report		
			Prepared by	**Checked by**	**Approved by**
		Name	Katie Salter MPhys AMIOA	Young Youn BEng MSc MIOA	David Hiller BSc MSc PhD CEng MIOA MIMMM FGS
		Signature			
		Filename			
		Description			
			Prepared by	**Checked by**	**Approved by**
		Name			
		Signature			

Issue Document Verification with Document ✓

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Appendices

1. Introduction

An environmental baseline sound survey has been undertaken to determine the existing sound climate and character at the nearest noise sensitive receptor from the proposed ConocoPhillips Teesside Crude Oil Terminal ('Oil Terminal') boundary. This is to accompany the planning application for the development of a gas fired power generation project (the Proposed Development). This report details the results from the baseline sound survey.

The aim of this survey was to respond to the following comments, received from the Environmental Health Officer (EHO):

- Comments from the EHO provided in the screening response dated 19 June 2024:

"The site lies within an existing industrial estate and there are no residential dwellings that should be affected by either the proposal or its construction. However, I note that the noise was assessed over a period of 24 hours on a weekday, it is recommended that background measurements are to be derived from 7 days or more and the LA90 level is to be the 25th percentile of the data gathered. This is to make a full and proper assessment of the quieter periods of weekends and nighttime".

- Comment provided in subsequent email correspondence; email from EHO dated 7 August 2024:

"I can understand your initial thoughts that the monitoring longer than 24hours will not be required as there is some distance between the site and the nearest dwellings, however, I do have experience of low frequency noise travelling distances, and when the general plant noise and activities do reduce, the background level can drop significantly, therefore I would be requesting a minimum of a weeks of monitoring to catch those quieter times, and a particular interest to the lower frequencies of sound".

The attended and unattended sound level survey work was carried out by Arup between 13:30 on Tuesday 12 November and 13:30 on Tuesday 19 November 2024.

This baseline survey report supplements a previous baseline survey report (E2P-ARU-ZZ-ZZ-RP-YA-0001) issued 20 May 2024. This can be found in Appendix B.

2. Site description

The site is located at Seal Sands, Teesside at the Conoco Phillips Oil Terminal. It is of many industrial sites located at Seal Sands. Teesmouth National Nature Reserve is to the north, Central Area Transmission Systems (CATS) terminal to the west, Exolum site to the east and a waste management site to the south. It is an active industrial site with large amounts of active plant.

3. Monitoring locations

Sound level measurements were taken over the course of a week at a location close to the boundary of the Conoco Phillips tank farm site and representative of the nearest noise sensitive receptor, a farmhouse, located

approximately 2.5km from the proposed development boundary. Spot measurements were also taken next to the farmhouse. These locations are shown in Figure 1.

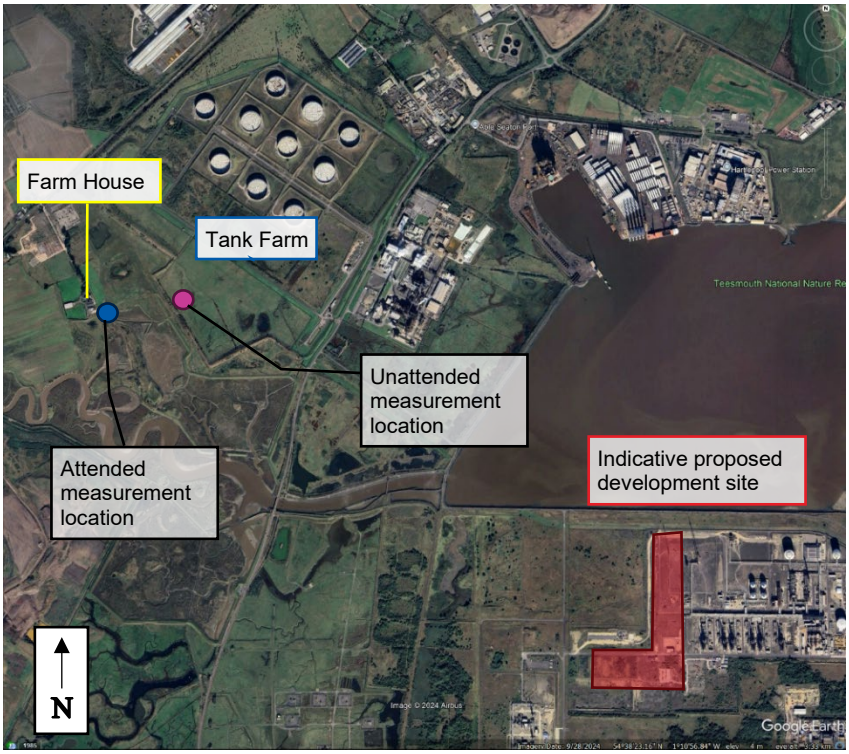


Figure 1 Survey locations

4. Instrumentation

The sound level meters (SLMs), microphones and sound pressure level calibrators used by Arup are Class 1 instruments, conforming to BS EN 61672-1:2013. All Arup instrumentation is calibrated annually and has full traceable calibration to national and international standards, which are undertaken by an accredited calibration laboratory. Calibration certificates can be provided upon request.

The SLM was checked for correct calibration before and after each series of measurements. No significant fluctuation in level was noted throughout each survey period.

Instrumentation used to undertake the survey is described in Table 1.

Table 1 Instrumentation

Description	Manufacturer	Model number	Serial number
Sound level meter	RION	NL-52	00721058
Pre-amp	RION	NH-25	22164
Calibrator	RION	NC-75	34824365
Microphone	RION	UC-59	22046
Sound level meter	B&K	2250	3011327
Pre-amp	B&K	ZC-0032	25776
Calibrator	B&K	4231	3018054
Microphone	B&K	4189	3087165
Weather station	Kestrel	5500	-
Weather sensor	Lufft	WS600	-

5. Measurement methodology

At each location, the L_{Aeq}, L_{A90}, L_{A10} and L_{Amax} metric parameters were measured and recorded. All broadband measurements were A-weighted, and octave band data was also collected. All measurements used a fast time constant (0.125s).

At each measurement location, the SLM was mounted on a tripod with the microphone set between 1.2m to 1.5m above local ground level. All measurements were taken under acoustically free-field conditions. The appropriate windshield for the SLM was fitted to the microphone throughout to minimise wind-induced noise.

Unattended contiguous measurements of 15 minutes duration were made at each location. The time period was appropriate to provide a good representation of the typical noise climate at each measurement location.

A weather station was set up at the unattended measurement location alongside the sounds level meter to record weather conditions during the measurement period. Metrics recorded include wind speed, wind direction and temperature. Measurements were taken every 5 minutes and timing synchronised with the unattended logging sound level meters.

6. Measurement results

6.1 Attended measurements

The summary tables for the measurement location provide an arithmetic average of the individual measurements during each time period for $L_{A10;}$ typical lowest background sound level during each time period for L_{A90}; a logarithmic average for L_{Aeq}; and a range of the values for L_{Amax}.

Location Description:

Measurement location is presentative of the farm house and close to the boundary of tank farm site, approximately 300m from the edge of the tank area and approximately 200m from the farmhouse on Marsh Lane. The monitoring location is approximately 2.5km from the proposed development.**Measurement duration:**

Tuesday 12/11/2024 14:50 to

Tuesday 12/11/2024 15:21

Environment and observations:

Plant noise from the north was dominant, possibly from a steel mill. Plant noise from north east was also audible. Plant noise was continuous but varying in character and level. Road traffic noise is present from Tees Road to the south. Passing freight train dominated as it passed.

Weather conditions:

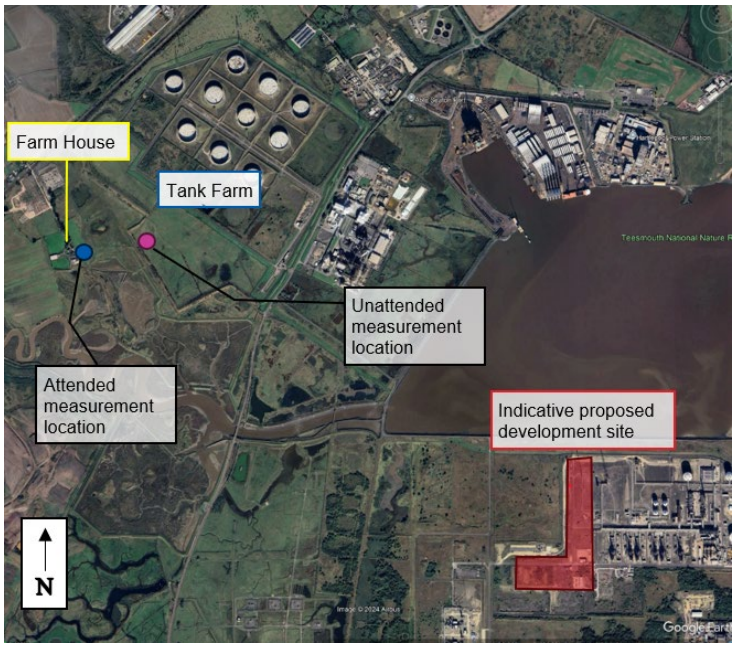
Average wind speed: 0.5 m/s

Wind direction: North west

Summary: Dry and overcast, no rain observed with minimal wind. Wind levels fairly consistent throughout.

Personnel:

Josh Heenan, Katie Salter



Date	Time		Sound Pressure Level, dB(A) (re 20 µPa)				Comments
	Start [hh:mm]	Duration [hh:mm:ss]	L_{90}	L_{eq}	L_{10}	L_{max}	
12/11/2024	14:50	00:15:00	42	50	49	70	Dominant noise source steel mill plant to the north, it was noted not tonal with a continuous change in character and occasional percussive noise. Road traffic noise as well as train noise and aircraft overhead.
12/11/2024	15:06	00:15:00	40	43	44	64	Steel mill dominant source with a continuous low frequency tone time at times and varying.

Table 2: Measured sound pressure levels at location A1

6.2 Unattended measurements

The summary tables for each measurement location provide an arithmetic average of the individual measurements during each time period for L_{A10}; a logarithmic average for L_{Aeq}; and a range of the values for L_{Amax}. For L_{A90}, the modal value and 25th percentile are presented. A time history of the measurements is shown in Appendix A.

Location description:

Located close to boundary of tank farm site, approximately 300m from edge of tank area and approximately 200m from farmhouse on Marsh Lane.

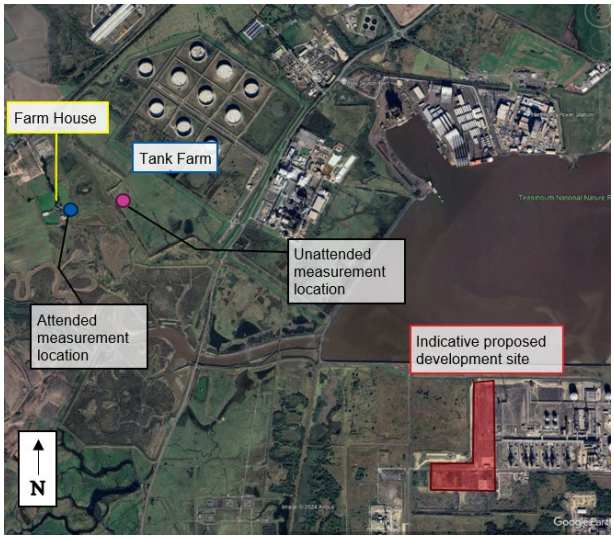
Measurement duration:

Tues 12/11/2024 14:05 to

Tues 12/11/2024 14:05

Environment and observations:

Plant noise from the north was dominant, possibly from a steel mill. Plant noise from northeast was also audible. Plant noise was continuous but varying in character and level. Passing freight train dominated as it passed.



Weather conditions:

Wind speed: Generally below 5m/s, with some periods above 5m/; these periods have been omitted in the analysis and marked in grey in Figure 3.

Wind direction: prevailing wind direction is south-westly

Precipitation: minimal precipitation, except for 19/11/2014; this period has been omitted in the analysis due to the wind speed exceeding recommended conditions (5m/s).

Full weather details presented in Figure 15 and Figure 16.

Personnel:

Table 3 Summary unattended sound level measurements - daytime

Period	Date and start time		Duration (hh:mm)	Sound Pressure Level, dB(A) (ref 20 µPa)				
				L_{90}		L_{eq}	L_{10}	L_{max}
				Modal value	25th percentile			
Day 1	Tues	12/11/2024 13:30	08:30	44	41	47	47	45-79
Day 2	Wed	13/11/2024 07:00	16:00	41	40	49	48	42-81
Day 3	Thurs	14/11/2024 07:00	16:00	40	40	46	46	49-73
Day 4	Fri	15/11/2024 07:00	16:00	42	40	47	47	48-69
Day 5	Sat	16/11/2024 07:00	16:00	39	36	42	42	41-73
Day 6	Sun	17/11/2024 07:00	16:00	40	37	42	42	45-68
Day 7	Mon	18/11/2024 07:00	16:00	43	38	46	46	48-69
Averaged[1] day				39	38	46	45	41-81

[1]*Averaged* means:
- modal value/25th percentile of the given period for L_{90}
- arithmetic average for L_{10}
- logarithmic average for L_{eq}
- range of L_{max}

Table 4 Summary unattended sound level measurements - night-time

Period	Date and start time		Duration (hh:mm)	Sound Pressure Level, dB(A) (ref 20 µPa)				
				L_{90}		L_{eq}	L_{10}	L_{max}
				Modal value	25th percentile			
Night 1	Tues-Wed	12/11/2024 23:00	08:00	40	39	45	44	44-63
Night 2	Wed-Thurs	13/11/2024 23:00	08:00	39	37	42	42	40-59
Night 3	Thurs-Fri	14/11/2024 23:00	08:00	35	35	44	43	44-63
Night 4	Fri-Sat	15/11/2024 23:00	08:00	34	33	38	39	42-61
Night 5	Sat-Sun	16/11/2024 23:00	08:00	31	31	36	36	38-68
Night 6	Sun-Mon	17/11/2024 23:00	08:00	43	42	44	46	46-59
Night 7	Mon-Tues	18/11/2024 23:00	08:00	42	41	44	45	40-66
Averaged[1] night Weekdays (12/11/2024 – 14/11/2024)				40	37	44	43	40-63
Averaged[1] night, Weekends (15/11/2024 – 16/11/2024)				31	32	37	38	38-68
Averaged[1] night, Weekdays (17/11/2024 – 18/11/2024				43	42	44	45	40-66

[1]*Averaged* means:
- modal value/25th percentile of the given period for L_{90}
- arithmetic average for L_{10}
- logarithmic average for L_{eq}
- range of L_{max}

The sound levels showed a large variation throughout the survey. To give a full representation of sound levels throughout the measurement periods, Table 3 and Table 4 present the sound levels averaged for each day and night.

6.2.1 Daytime

For the daytime period, Table 3 presents the sound levels averaged for each day also gives the averaged sound levels across all days. A time history showing only the daytime measurements can be found in Figure 4 in Appendix A, as well as a histogram of the measured daytime L_{A90} values (Figure 5).

6.2.2 Night-time

For the night-time period, three distinct periods are apparent. This is observable in the time history and by comparing the averaged sound levels for each night. A time history showing night-time measurements only (Figure 6), and histograms showing the distribution of measured L_{A90} values during each night (Figure 7 to Figure 13) can be found in Appendix A.

Tuesday, Wednesday and Thursday of the first week (12-15/11/2024) showed similar sound levels, which were lowest towards the beginning or middle of the night and steadily increased from about 03:00 to 04:00. The most occurring L_{A90} during this weekday period in the first week of measurements was 40 dB, and the 25th percentile was 37 dB.

On Friday and Saturday nights (15-17/11/2024) the sound levels were much lower throughout the whole night, with the lowest sound levels around 02:00 to 03:00. The most occurring L_{A90} during this weekend period was 31 dB, and the 25th percentile was 32 dB.

On Sunday and Monday nights (17-19/11/2024) the sound levels were higher and showed little variation throughout the night. The most occurring L_{A90} during this period was 43 dB, and the 25th percentile was 42 dB. Whilst the weather station did not show any adverse weather during Sunday and Monday nights, the lack of temporal variation through the night, and comparison to the previous nights indicates the measured sound levels require careful considerations.

6.2.3 Octave band measurements

The measured sound levels have been analysed in response to the EHO's concerns raised in low frequency noise.

The quietest representative L_{A90} measurements are presented in Table 5 These are the 25th percentile values for each octave band during the quietest period. The quietest period, as discussed above, was during the night-time on Friday and Saturday nights (15-17/11/2024).

The night-time 25th percentile values for each octave band during the three distinct periods described above (week one weekday night, weekend nights and week two weekday nights) are presented in Figure 14 in Appendix A.

Table 5 Octave band measurements – L_{A90} night-time

	Octave Band Centre Frequency, Hz								
	31.5	63	125	250	500	1k	2k	4k	8k
25th percentile L_{90} measurements, dB (ref 20 µPa), A-weighted	7	17	18	24	27	25	14	13	13

Appendix A

Sound measurements

A.1 Sound measurements

A.1.1 Time history for full measurement period

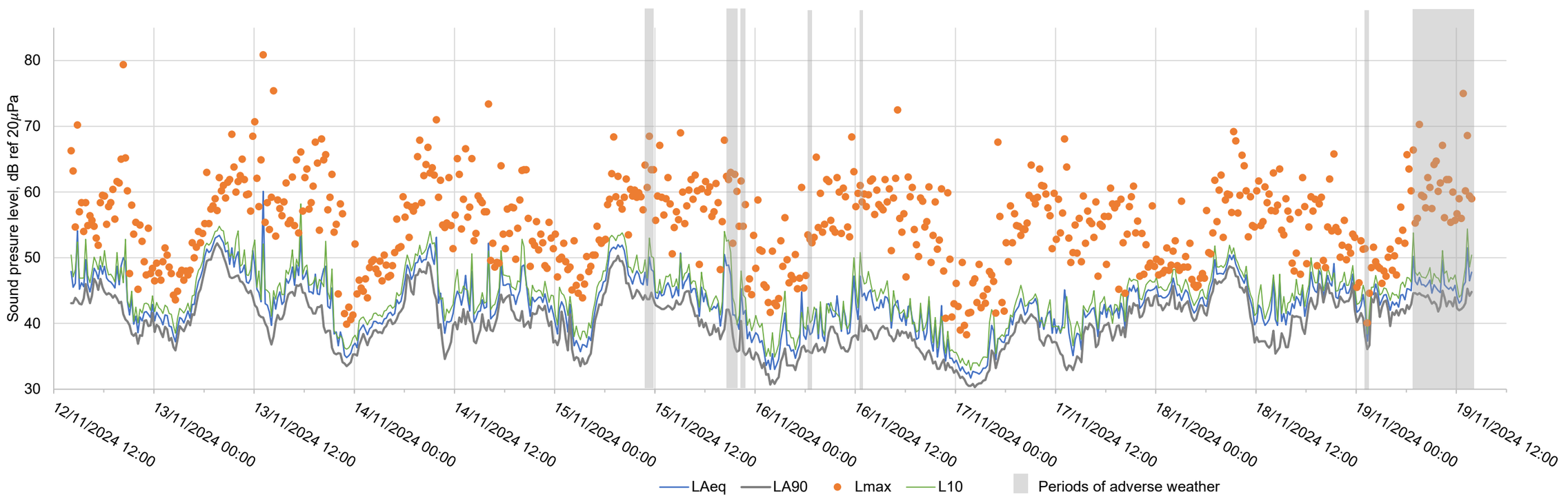


Figure 2 Time history of measurements for full measurement period. Periods of adverse weather are highlighted in grey

A.1.2 Daytime measurements

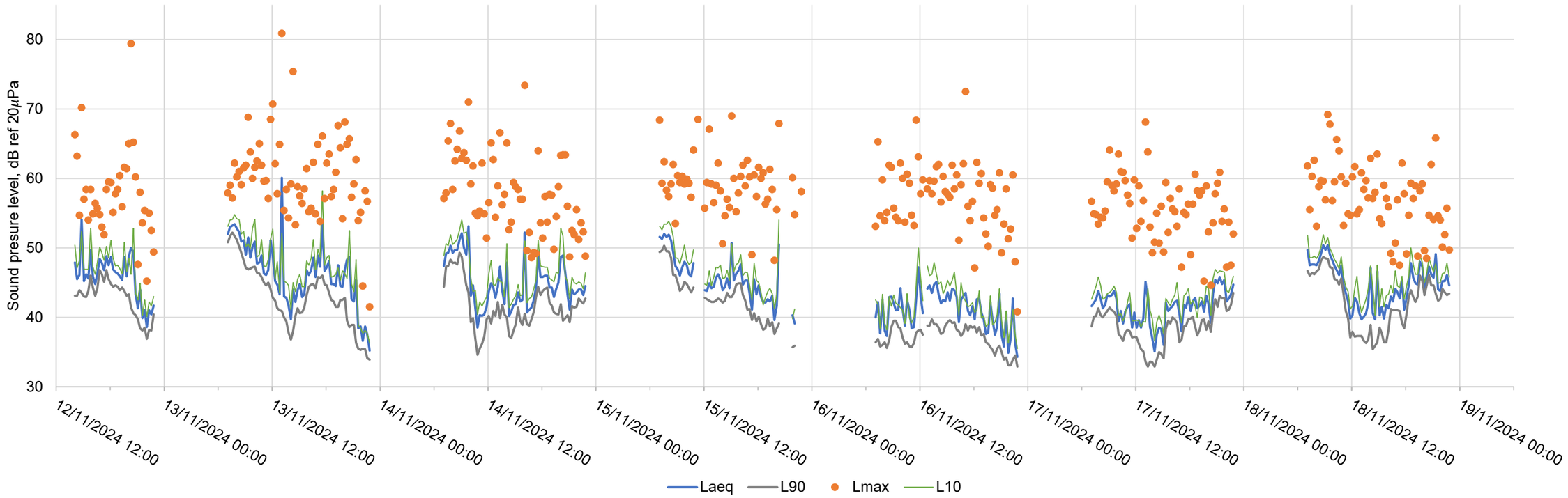


Figure 4 Time history of measurements, showing daytime only, with period of adverse weather omitted

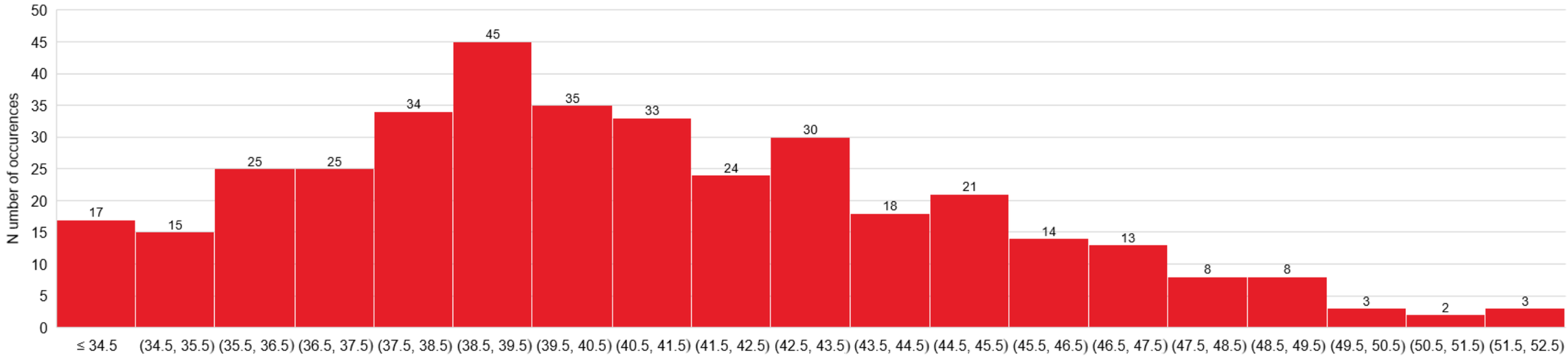


Figure 5 Histogram of daytime L_{A90} sound levels - daytime

A.1.3 Night-time measurements

Octave band graph showing the three distinct periods/nights

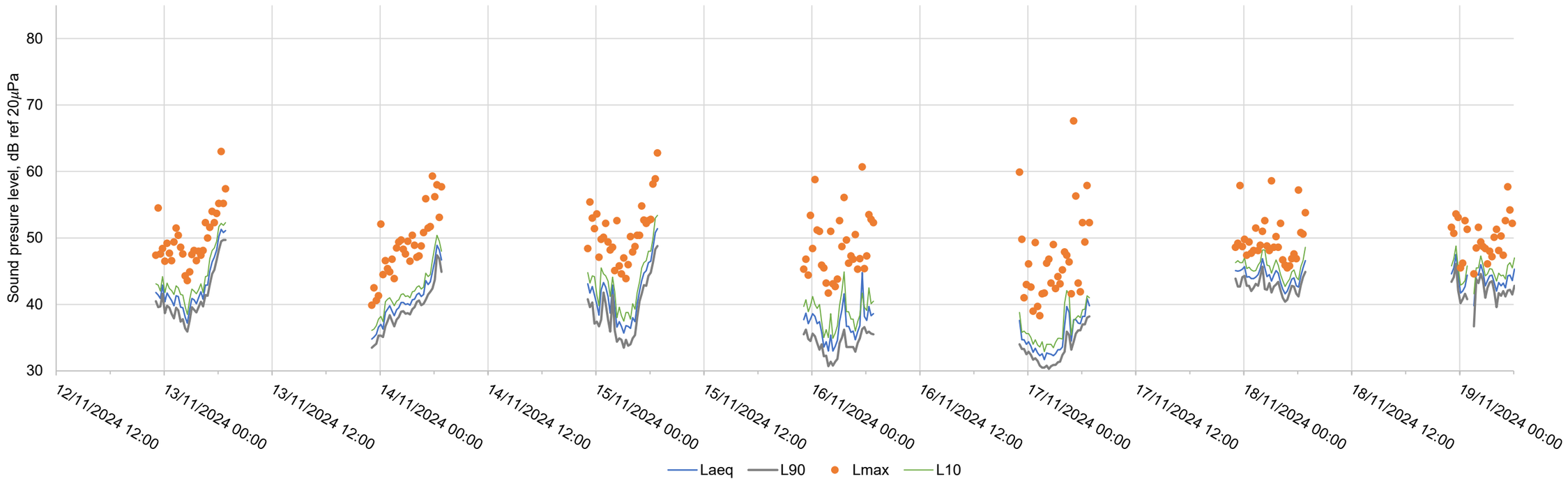


Figure 6 Time history showing night-time measurements only, with periods of adverse weather omitted

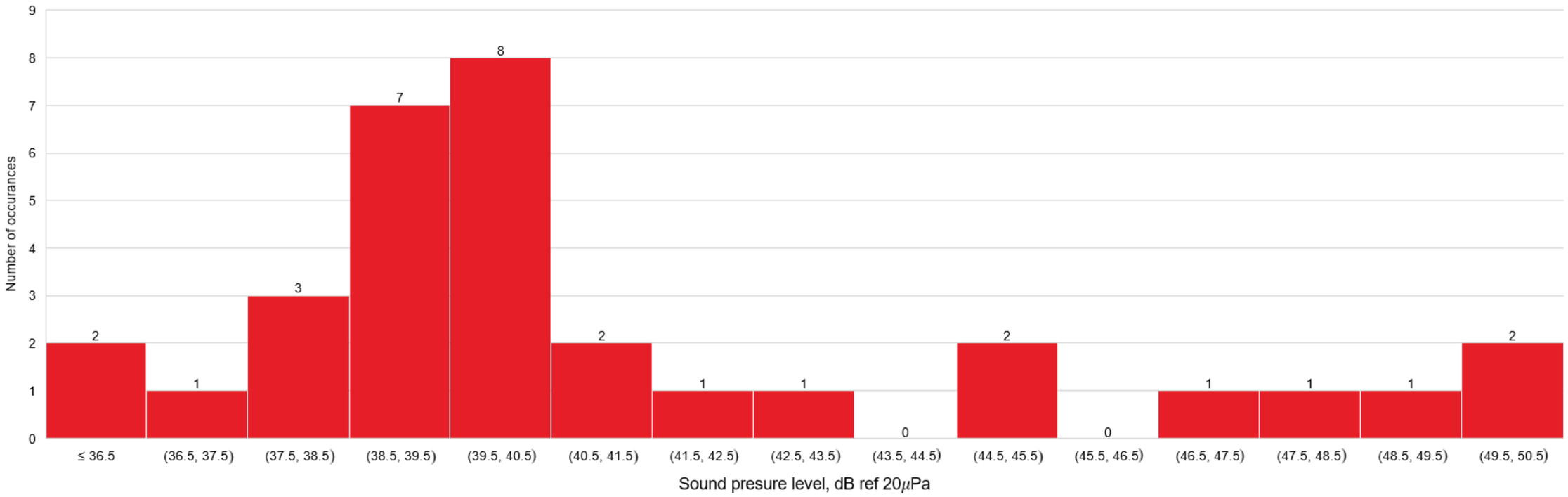


Figure 7 Histogram of night-time L_{A90} levels for night one (12-13/11/2024)

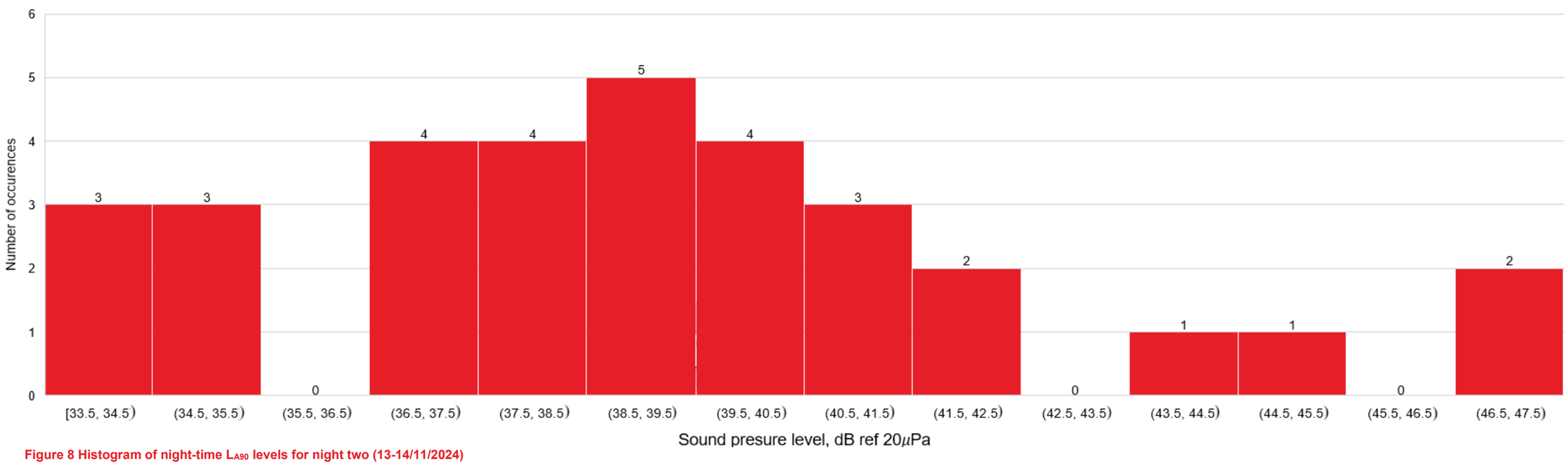


Figure 8 Histogram of night-time L_{A90} levels for night two (13-14/11/2024)

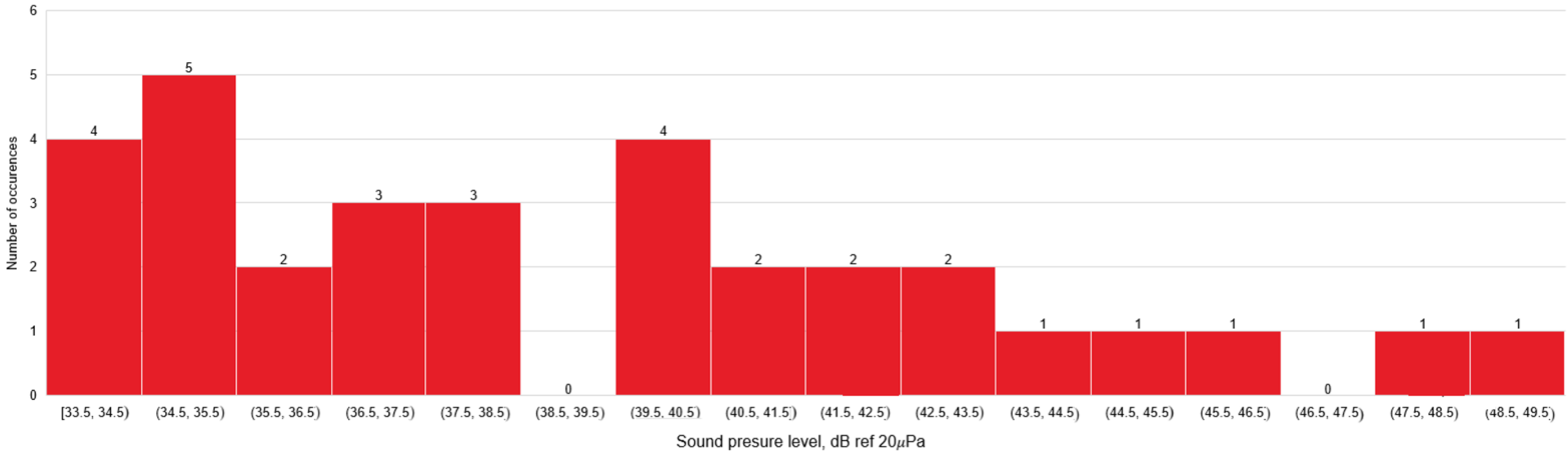


Figure 9 Histogram of night-time LA90 levels for night three (14-15/11/2024)

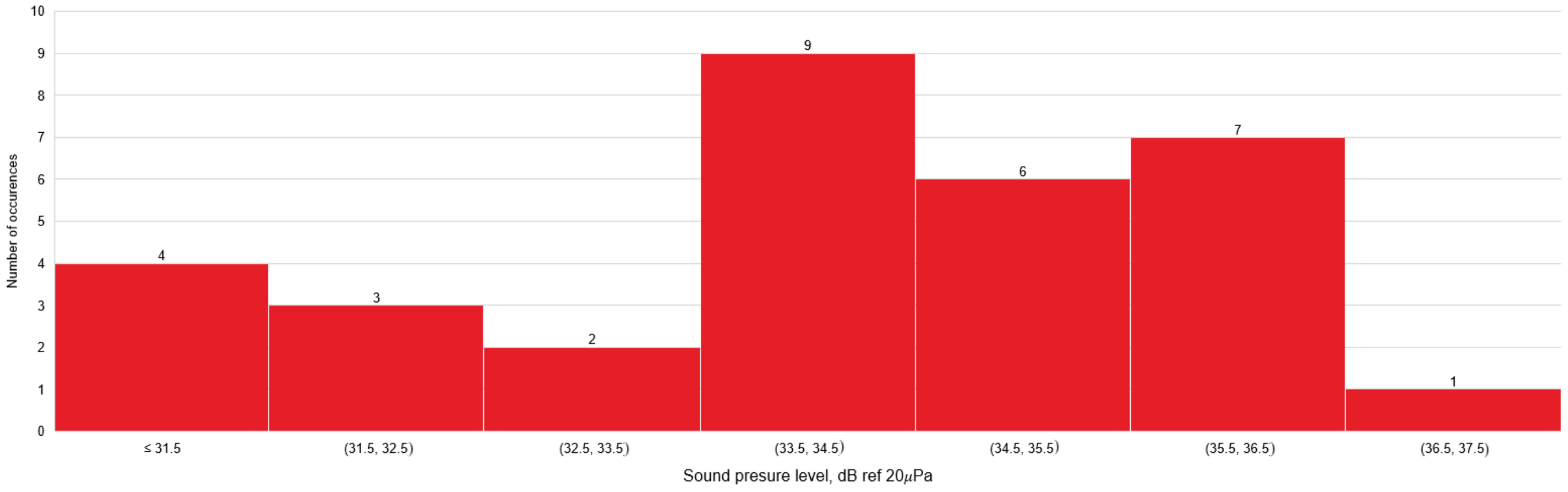


Figure 10 Histogram of night-time LA90 levels for night four (15-16/11/2024)

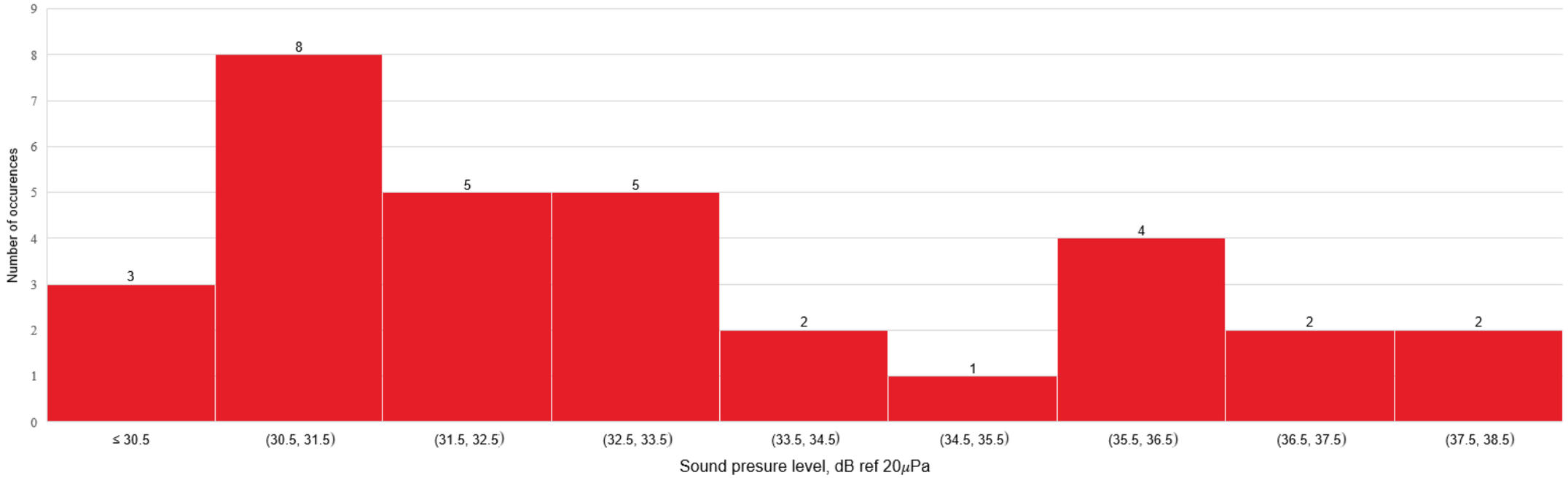


Figure 11 Histogram of night-time L_{A90} levels for night five (16-17/11/2024)

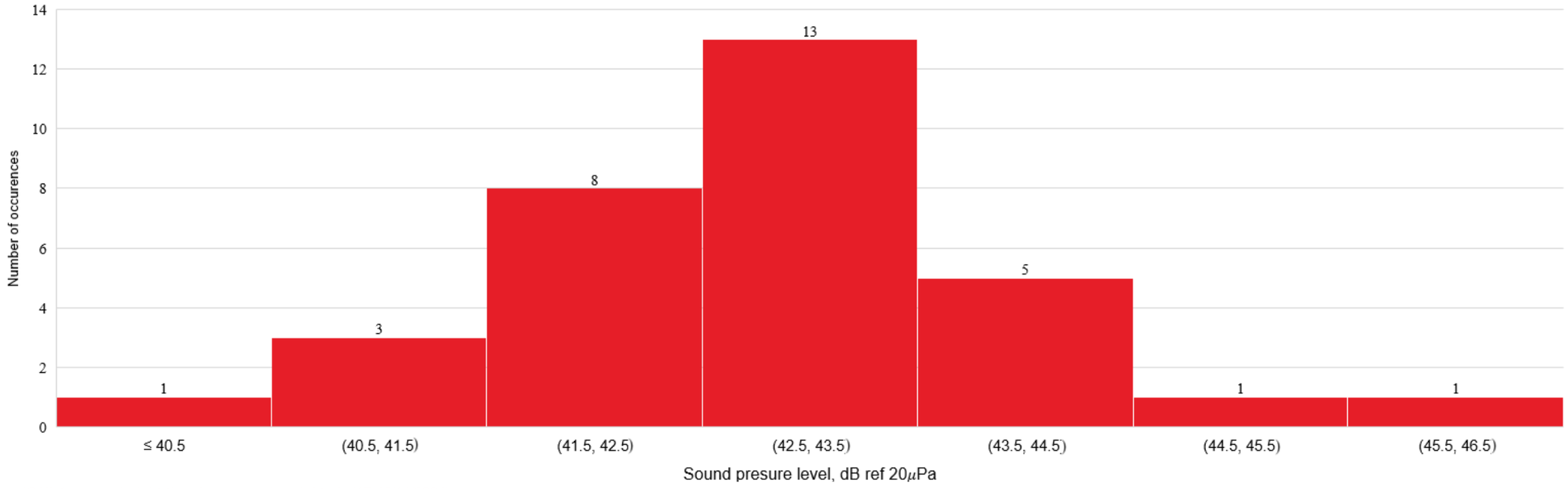


Figure 12 Histogram of night-time L_{A90} levels for night six (17-18/11/2024)

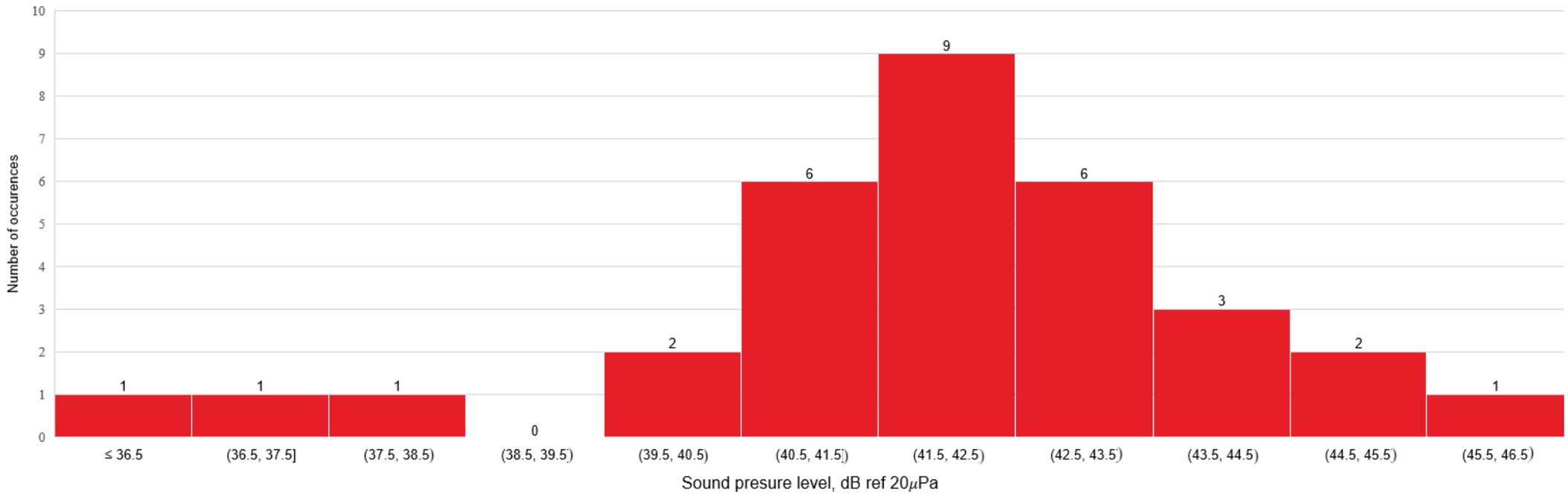


Figure 13 Histogram of night-time LA90 levels for night seven (18-19/11/2024)

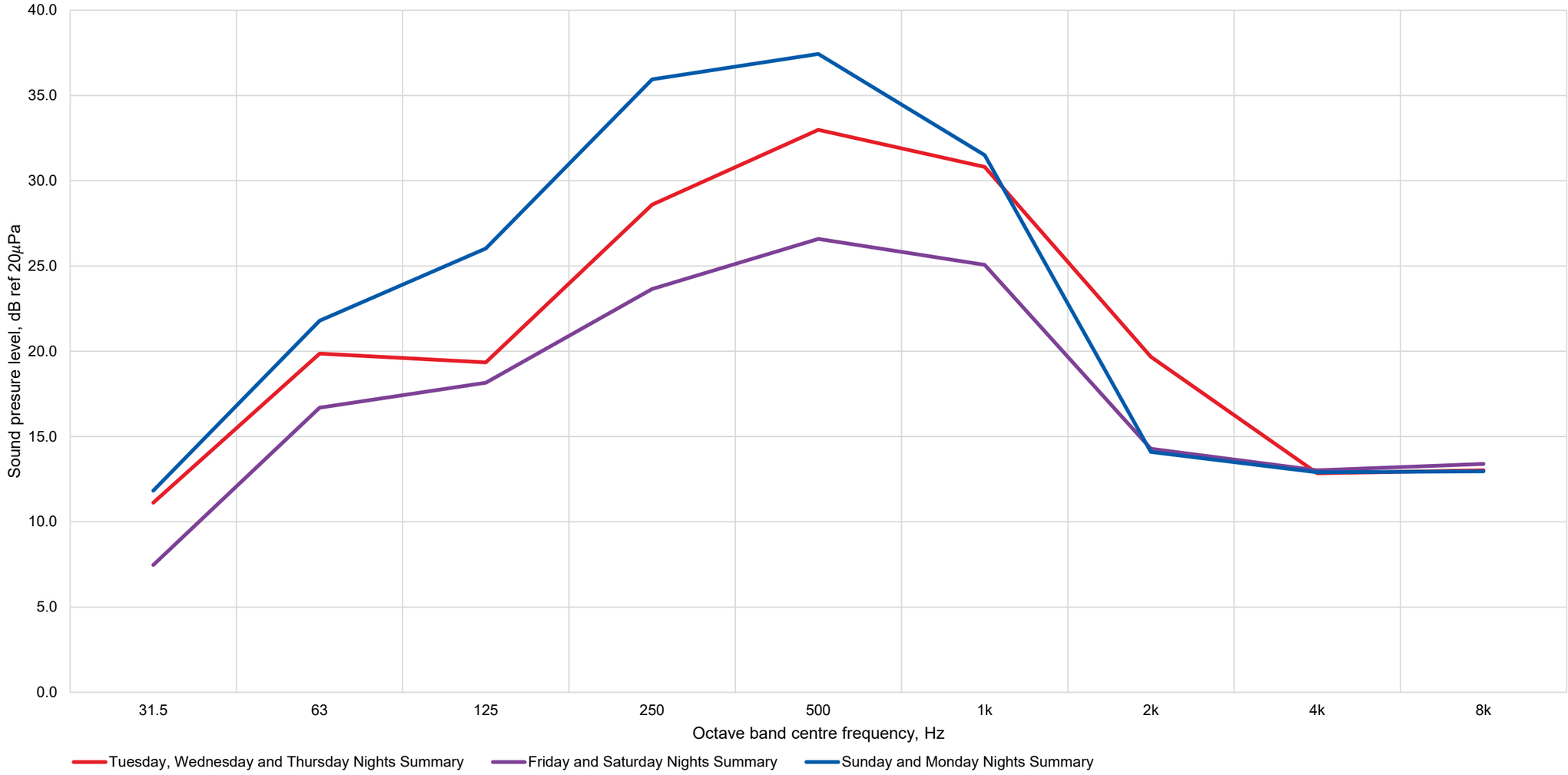


Figure 14 L_{90} sound levels in octave band based on 25th percentile in broadband - night-time

A.2 Weather data

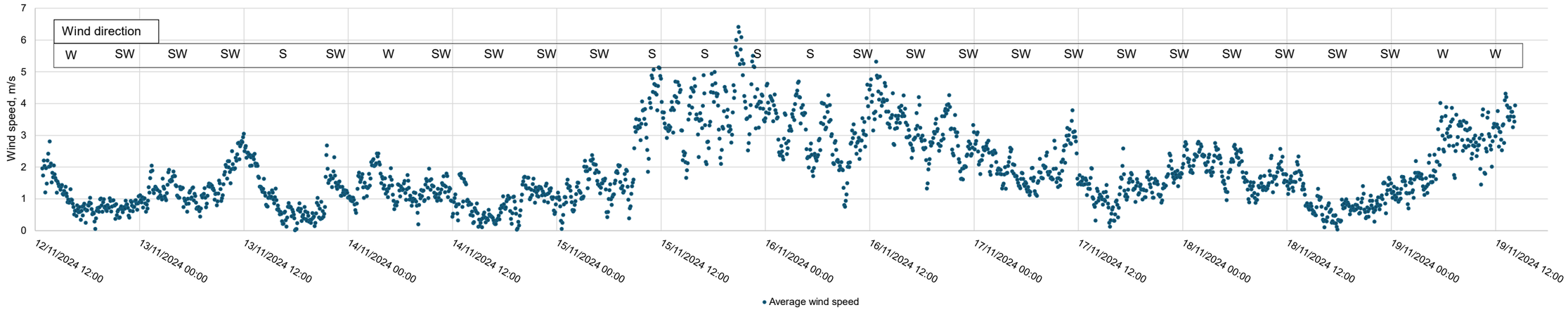


Figure 15 Wind speed and prevailing wind direction

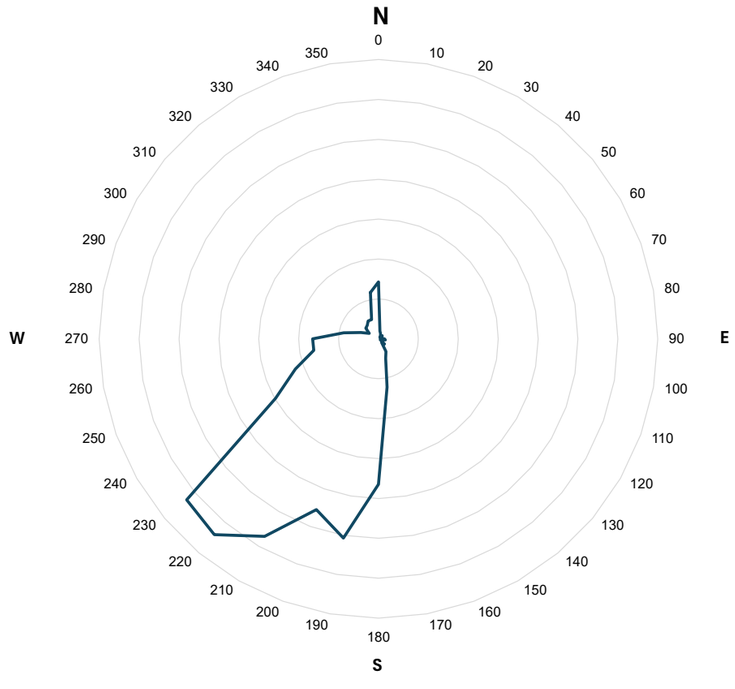


Figure 16 Prevailing wind direction across the duration of the survey

Periods of rainfall	
16/11/2024	06:25 to 06:35
19/11/2024	01:15 to 01:25 07:00 to 07:10 10:10 to 10:40

Figure 17 Periods of rainfall

Appendix B

Previous baseline survey report

B.1 Introduction

An environmental baseline sound level survey has been undertaken to determine the existing sound level climate and character in and around the Conoco Phillips Oil Terminal. This is to support a development for the Ethane2Power project at the Conoco Phillips site. This report details the survey methodology and results.

The attended and unattended survey was carried out by Arup on Wednesday 3 and Thursday 4 April 2024.

B.1.1 Site description

The site is located at Seal Sands, Teesside at the Conoco Phillips Oil Terminal. It is one of three sites owned by Conoco Phillips in the surrounding area and is also one of many industrial sites located at Seal Sands. Teesmouth National Nature Reserve is to the north, Central Area Transmission Systems (CATS) terminal to the west, Exolum site to the east and a waste management site to the south. It is an active industrial site with large amounts of active plant.

B.1.2 Monitoring location

Sound level measurements were undertaken at four locations considered to be representative of noise sensitive receptors, Teesmouth National Nature Reserve to the north and site boundary. The measurement locations and site boundaries are shown on Figure 18. Blue indicates attended and red indicates unattended measurement locations.

Figure 18: Measurement locations and site boundary

B.1.3 Instrumentation

The sound level meters (SLMs), microphones and sound pressure level calibrators used by Arup are Class 1 instruments, conforming to BS EN 61672-1:2013. All Arup instrumentation is calibrated annually and has full traceable calibration to national and international standards, which are undertaken by an accredited calibration laboratory. Calibration certificates can be provided upon request.

The SLM was checked for correct calibration before and after each series of measurements. No significant fluctuation in level was noted throughout each survey period.

The instrumentation used to undertake the survey is described in Table 6 below.

Description	Serial number	Item type
Sound Level Meter	00930483	RION NL-62
Pre-amp	00525	RION NH-26
Calibrator	34246494	RION NC-74
Microphone	00440	RION UC-59L
Sound Level Meter	00721057	RION NL-52
Pre-amp	22163	RION NH-25
Calibrator	34824366	RION NC-75
Microphone	22045	RION UC-59
Sound Level Meter	3011327	B&K 2250
Pre-amp	25776	B&K ZC-0032
Calibrator	3018054	B&K 4231
Microphone	3087165	B&K 4189
Kestrel 5500	2119013	Weather Station

Table 6: Measurement instrumentation

B.1.4 Measurement methodology

At each location, the L_{Aeq}, L_{A90}, L_{A10} and L_{Amax} metric parameters were measured and recorded. All broadband measurements were A-weighted and used a fast time constant (0.125s).

At each measurement location, the SLM was mounted on a tripod with the microphone set between 1.2m to 1.5m above local ground level. All measurements were taken under acoustically free-field conditions, except where otherwise stated. The appropriate windshield for the SLM was fitted to the microphone throughout to minimise wind-induced noise.

Unattended contiguous measurements of 15 minutes duration were made at each location. The time period was appropriate to provide a good representation of the typical noise climate at each measurement location.

A Kestrel weather station was set up at location U1 to record weather conditions during the measurement period. Metrics recorded include wind speed, wind direction, temperature and humidity. Measurements were taken every 5 minutes and timing synchronised with the unattended logging sound level meters.

B.1.5 Measurement results

B.1.5.1 Attended measurements

The summary tables for each measurement location provide the arithmetic average of the individual measurements during each time period for L_{A90} and L_{A10}, logarithmic average for L_{Aeq} and range for L_{Amax}.

B.1.5.1.1 Location A1

Location description:

Measurement taken in the southwest of the site, with open fields to the south, an access road to the north and the Conoco Phillips site to the east.

Measurement duration:

Wed 03/04/2024 15:30 to

Thu 04/04/2024 12:30

Environment and observations:

Dominant noise source was plant at the Conoco Phillips site. Occasional vehicle noise observed as well as the overhead aircraft.

Weather conditions:

Wind speed: 1.5 m/s

Wind direction: East

Summary: Dry and overcast, no rain observed with minimal wind. Wind levels fairly consistent throughout.

Personnel:

Josh Heenan, Owain Squire

Figure 19: Measurement location A1

Period	Sound Pressure Level, dB(A) (re 20 µPa)			
	L_{90}	L_{eq}	L_{10}	L_{max}
Day (07:00-19:00)	42	47	47	56 - 67

Table 7: Summary of averaged sound pressure levels at location A1

Date	Time		Sound Pressure Level, dB(A) (re 20 µPa)				Comments
	Start [hh:mm]	Duration [hh:mm:ss]	L_{90}	L_{eq}	L_{10}	L_{max}	
Day							
03/04/2024	15:30	00:15:00	46.3	49.7	51.9	57.5	Dominant noise source plant on ConocoPhillips site. Aircraft overhead as well as forklift across road. High pitched beeping from forklift reversing.
04/04/2024	10:15	00:15:00	40.7	43.8	45.3	59.4	Conoco Phillips plant dominant source. Forklift continues to drive around across road near to location U2.
04/04/2024	11:15	00:15:00	41.9	47.4	48.0	66.9	Conoco Phillips plant still dominant source, nothing audible from the CATS terminal to the west. Aircraft overhead.
04/04/2024	12:15	00:15:00	40.1	42.1	43.6	56.0	Plant noise from Conoco Phillips dominant.

Table 8: Measured sound pressure levels at location A1

B.1.5.1.2 Location A2

Location description:

Measurement taken in the southwest of the site.

Measurement duration:

Wed 03/04/2024 15:00
to
Thu 04/04/2024 12:00

Environment and observations:

Dominant noise source was general plant noise from the Conoco Phillips site. Some on-site vehicle movements observed as well as the occasional overhead aircraft.

Weather conditions:

Wind speed: 2.1 m/s

Wind direction: East

Summary: Dry and overcast, slightly more exposed than A1 so slightly higher windspeed measured though still consistently low.

Personnel:

Josh Heenan, Owain Squire

Figure 20: Measurement location A2

Period	Sound Pressure Level, dB(A) (re 20 µPa)			
	L_{90}	L_{eq}	L_{10}	L_{max}
Day (07:00-19:00)	48	50	51	62 - 69

Table 9: Summary of averaged sound pressure levels at location A2

Date	Time		Sound Pressure Level, dB(A) (re 20 µPa)				Comments
	Start [hh:mm]	Duration [hh:mm:ss]	L_{90}	L_{eq}	L_{10}	L_{max}	
Day							
03/04/2024	15:00	00:15:00	49.7	51.4	52.8	62.4	Plant noise from the Conoco Philips site the dominant. Vehicle approximately 20m away from microphone, moving away.
04/04/2024	09:45	00:15:00	46.4	48.5	49.6	65.8	Plant audible throughout, no impulsive noise observed. Distant airplane and forklift at approximately 20m observed.
04/04/2024	10:45	00:15:00	47.4	49.7	51.0	69.2	Plant noise still dominant though slightly quieter. Discussion with the site manager suggested that a boiler may have 'tripped' the previous day, resulting in higher noise levels the previous day. Forklift heard approx. 100m away.
04/04/2024	11:45	00:15:00	47.0	48.5	49.7	66.7	Plant dominant source, forklift and light goods vehicle movement observed in distance

Table 10: Measured sound pressure levels at location A2

B.1.5.2 Unattended measurements

The summary tables for each measurement location provide an arithmetic average of the individual measurements during each time period for L_{A10}, typical background sound level during each time period for L_{A90}, a logarithmic average for L_{Aeq} and a range of the values for L_{Amax}. A graph showing the time history of the four metrics is provided for each unattended location.

B.1.5.2.1 Location U1

Location description:

Located at the north-western boundary of the Conoco Phillips Oil Refinery Terminal. Teesmouth National Nature Reserve is located to the north with other industrial sites to the east, south and south-west

Measurement duration:

Wed 03/04/2024 13:15 to

Thu 04/04/2024 14:00

Environment and observations:

Plant noise from the Conoco Phillips site dominant, no other consistent sources, occasional aircraft noise audible otherwise very few other sources. Two flare towers close to loggers were particularly noticeable which are considered as typical activities on site.

Weather conditions:

General overcast conditions with blue sky periods, short burst of drizzle though not long or significant enough to affect measurement conditions. Wind speeds were low with no real gusts. Prevailing wind direction was to the SW.

Wind speed: < 3.5 m/s

Wind direction: South west

Personnel:

Josh Heenan, Owain Squire

Figure 21: Measurement location U1, logger and weather station

Period	Sound Pressure Level, dB(A) (re 20 µPa)			
	L_{90}*	L_{eq}	L_{10}	L_{max}
Day (07:00 – 19:00)	44	49	50	51 - 70
Evening (19:00 – 23:00)	44	46	47	50 - 62
Night (23:00 – 07:00)	44	46	47	51 - 62

*lowest modal value of $L_{90,15min}$ during each time period

Table 11: Summary of averaged sound pressure levels at Location U1

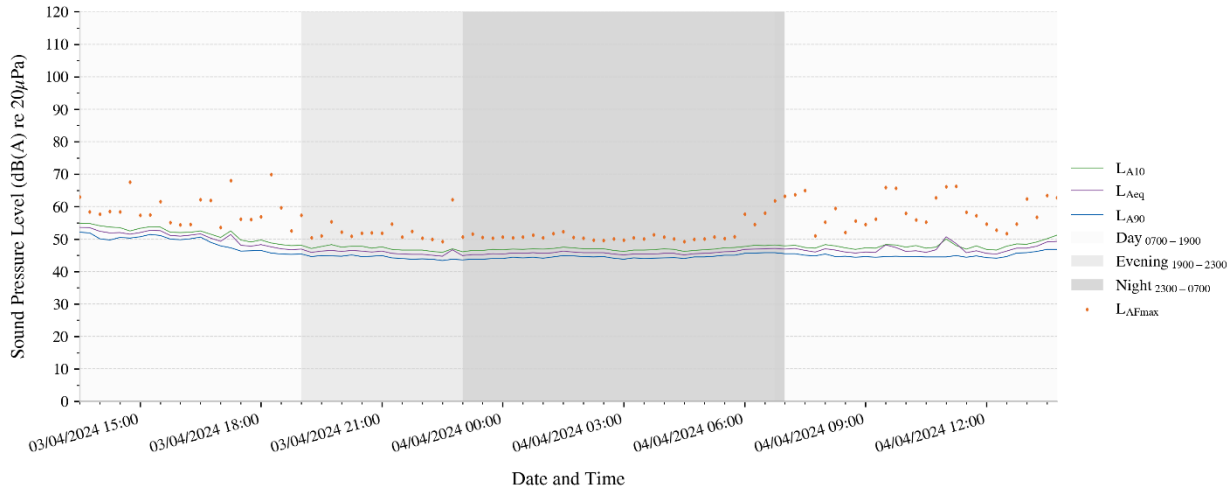


Figure 22: time history for the unattended measurement at location U1

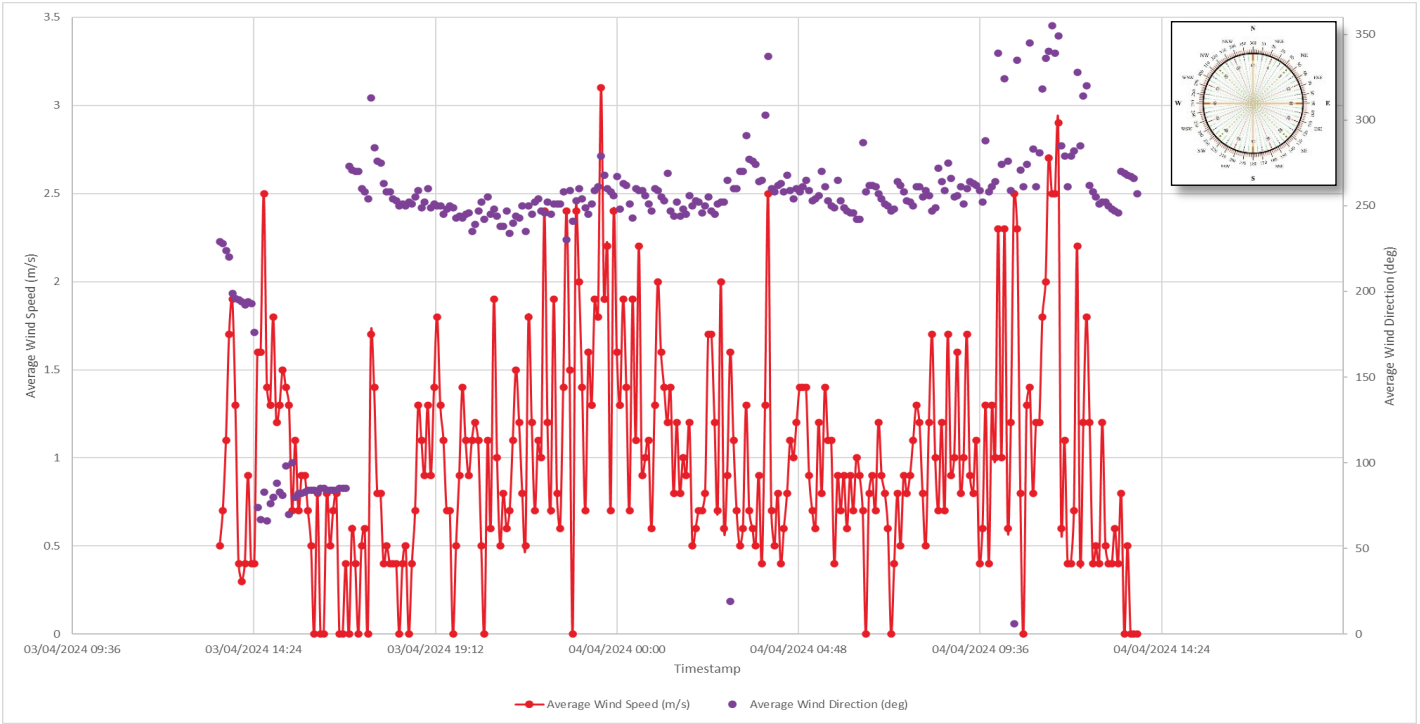


Figure 23: Time history for unattended weather measurements at location U1

B.1.5.2.2 Location U2

Location description:

Located at the western boundary of the Conoco Phillips Oil Terminal, to the south of location U1. Teesmouth National Nature Reserve is located to the north with other industrial sites to the east, south and south-west.

Measurement duration:

Wed 03/04/2024 13:45 to

Thu 04/04/2024 14:15

Environment and observations:

Plant noise from the Conoco Phillips site dominant, no other consistent sources, occasional aircraft noise could be heard otherwise very few other sources. Two flare towers close to loggers were particularly noticeable.

Weather conditions:

General overcast conditions with blue sky periods, short burst of drizzle though not long or significant enough to affect measurement conditions. Wind speeds were low with no real gusts. Prevailing wind direction was to the SW.

Personnel:

Josh Heenan, Owain Squire

Additional comments:

High L_{Amax} between 10:00 and 11:00 (04/04/24) attributed to forklift driving near to logger, affecting measurements, as observed during attended measurements. These events being close to the logger are not typical of normal site operation, so these noise levels are not reflected in the analysis.

Figure 24: Logger at location U2

Period	Sound Pressure Level, dB(A) (re 20 μPa)			
	L_{90}*	L_{eq}	L_{10}	L_{max}
Day (07:00 – 19:00)	41	50	49	50 - 70
Evening (19:00 – 23:00)	41	45	45	48 - 68
Night (23:00 – 07:00)	41	44	45	47 - 67

* lowest modal value of L90,15min during each time period

Table 12: Summary of averaged sound pressure levels at location U2

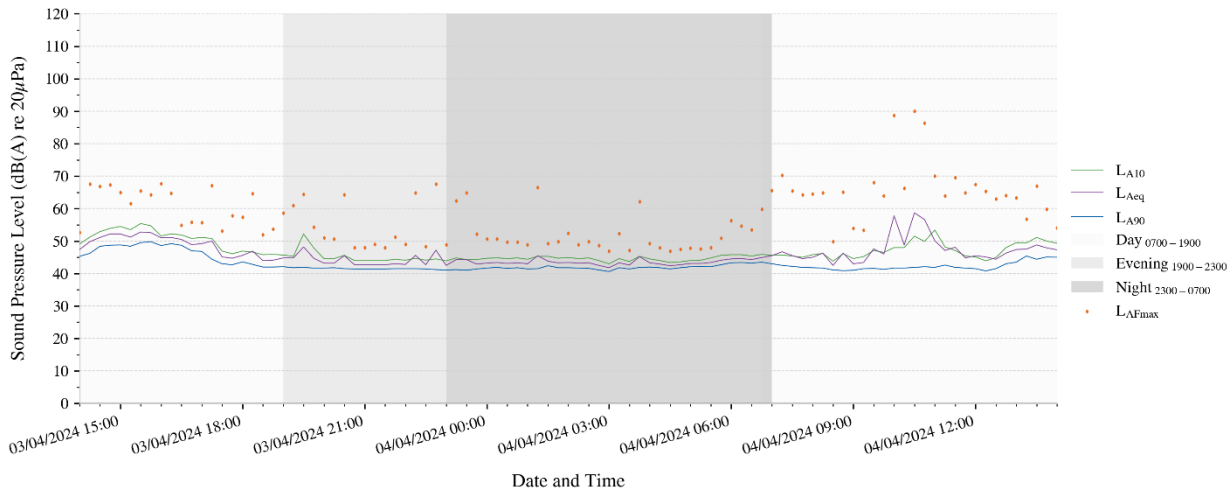


Figure 25: Time history for the unattended measurement at location U2

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