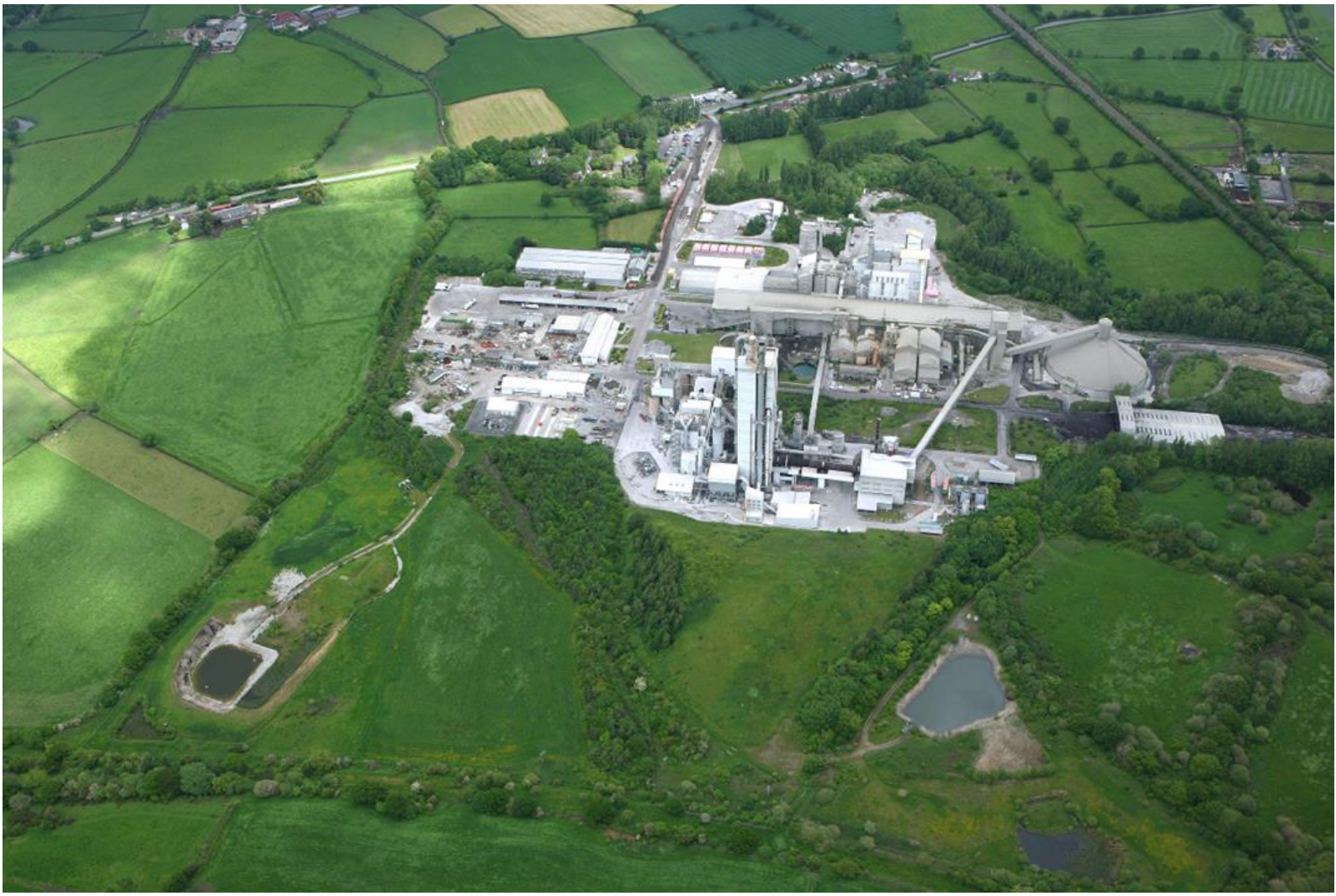

ENVIRONMENTAL PERMIT VARIATION APPLICATION

PADESWOOD CSS PROJECT

Heidelberg Materials

2960956-RSKA-RP-002-(02)

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General notes

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Client:	Heidelberg Materials
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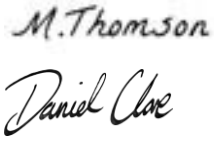
Author(s):	Ceri Jones, MIOA Acoustic Consultant	Technical reviewer:	Matthew Thomson MIOA, Daniel Clare MIOA, Managing Director
Signature:		Signature:	
Date:	23/12/2024	Date:	23/12/2024

Contents

1 Introduction

1.1 Instruction

RSK Acoustics have been instructed by Heidelberg Materials to undertake a noise impact assessment to support an environmental permitting variation application. The environmental permit application is required in support of the proposed Carbon Capture and Storage development adjacent to the Padeswood Cement Works site. This report has been prepared following the methodology as outlined in BS 4142:2014+A1:2019.

This assessment considers the potential noise impacts of the new site at the closest noise sensitive receptors. Noise emissions from the cement works site are controlled through the existing permit and noise management plan.

This report is informed by a baseline noise survey carried out between 7 September 2023 and 15 September 2023.

1.2 Development Overview

The proposed development aims to capture up to 800,000 tonnes of carbon dioxide (CO2) per year from the current cement works and will require the construction of a Carbon Capture Plant; comprising of the following components:

- A Combined Heat and Power plant with 15MWe (minimum) and 83MW (minimum) thermal of installed capacity, to produce electricity and heat to power the carbon capture equipment; and
- A Post Combustion Carbon Capture and Compression plant, to extract CO2 from waste gases and compress it for transport and storage.

The proposed Combined Heat and Power plant is required to power the carbon capture process. Emissions generated by the Combined Heat and Power plant will be captured through the same process. The proposed development intends to operate 24 hours a day. It is intended that the new site and the existing facility will operate independently of each other.

1.3 Site Location and Description

Padeswood Cement Works is located to the south of Buckley, near Mold, Flintshire, Wales (329031E, 362298N). The cement works is owned by Castle Cement Limited, part of Heidelberg Materials, and trades under the name Heidelberg Materials UK. Heidelberg Materials UK is a leading supplier of low carbon building materials to the UK.

The site is currently an existing operational cement production facility. The site is bounded by the following:

- Northern boundary – A5118 road and residential receptors
- Eastern boundary – A550 road, an operational train line and residential receptors.
- Western boundary – Isolated dwellings and agricultural land
- Southern boundary – A5104 road, isolated dwellings and agricultural land.

The selected sensitive receptors have been chosen and assessed to represent properties within the vicinity of each location, owing to being exposed to the same existing conditions. The sensitive receptors have been presented in Table 1.1 below.

ID Number	Address	Distance from Site (m)	Direction
R1	2 Padeswood Drive	605	NE
R2	3 Padeswood Drive	630	NE
R3	6 Padeswood Drive	655	NE
R4	7 Padeswood Drive	680	NE
R5	10 Padeswood Drive	555	NE
R6	11 Padeswood Drive	575	NE
R7	14 Ffordd Derwyn	910	E
R8	33 Ffordd Derwyn	905	SE
R9	34 Plas Yn Rhos	950	E
R10	38 Plas Yn Rhos	940	E
R11	40 Plas Yn Rhos	930	E
R12	44 Plas Yn Rhos	920	E
R13	Bannel Farm	720	N
R14	Beudy Coch, Padeswood Lake Road	785	S
R15	Camfa Rheinallt Farm, Padeswood Lake Road	750	S
R16	Dyke Farm, Padeswood Lake Road	180	SW
R17	Hendy Cottage, Padeswood Lake Road	590	SW
R18	Homelea	565	N
R19	Laburnam Cottage	410	NW
R20	Brook Meadow Housing Estate	900	SE
R21	Oak Drive	1,010	E
R22	Oak Tree Farm, Bannel Lane	755	NE
R23	Oak Tree Farm	365	NW
R24	Pen-Yr-Allt Farm, Padeswood Lake Road	780	SW
R25	The Gables, Padeswood Lake Road	700	SW
R26	The Old Barn, Padeswood Lake Road	770	SW
R27	Toll Bar Cottage, Chester Road	765	S
R28	Ty Gwyn Farm	490	W
R29	Well House Farm, Padeswood Lake Road	500	S
R30	Springfield	710	NE

Table 1.1 Noise sensitive receptors

Figure 1. 1 presents the boundary of the site and location of the nearest identified receptors. The facility masterplan is presented in Appendix A – Site Layout Plan.

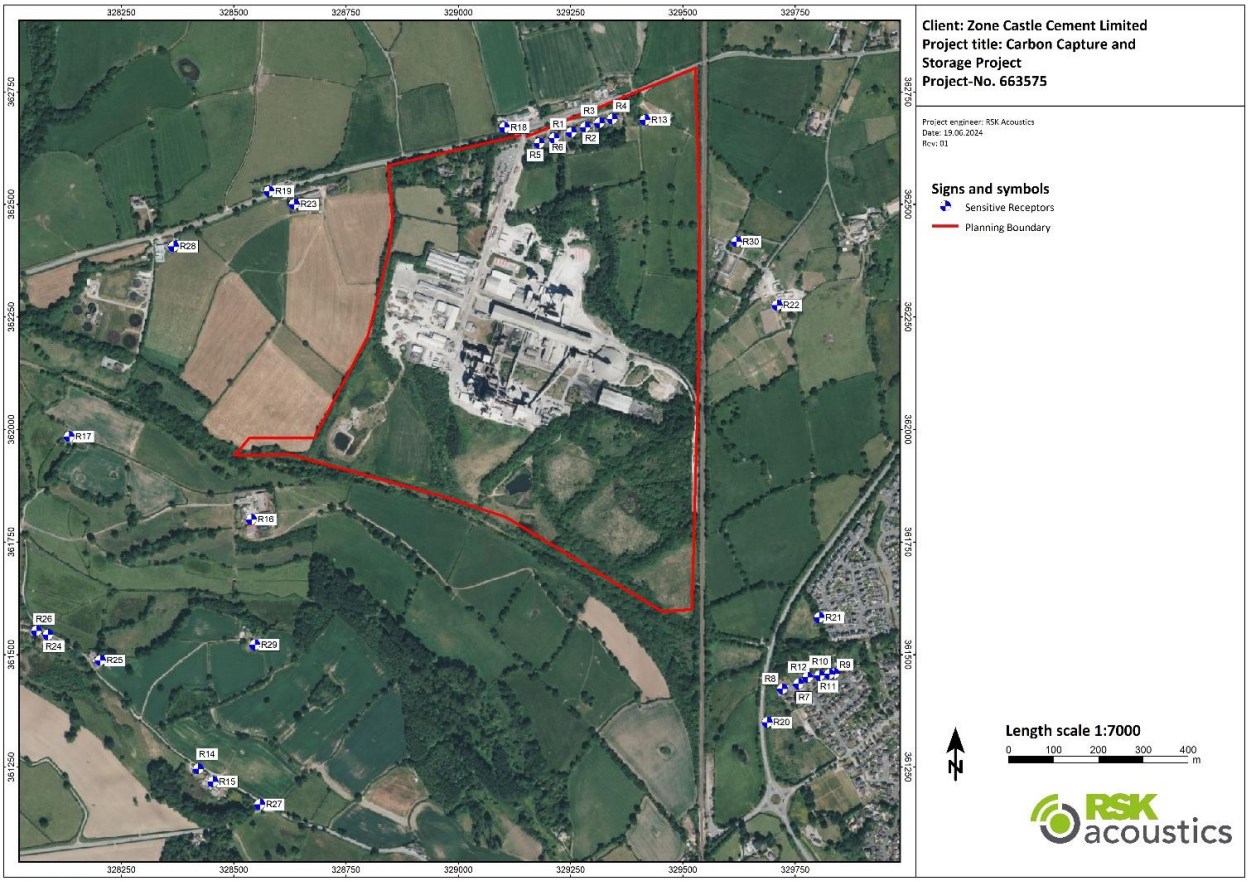


Figure 1. 1 Site location and sensitive receptors

2 Standards and Guidance

Document	Summary
Standards and guidance	
Guidance - Noise and vibration management: environmental permits July 2021 (updated January 2022)	Assessment to be undertaken in line with the 4-step summary as identified within the Guidance. This guidance replaces 'Environment Agency Horizontal Guidance for Noise (H3) Parts 1 and 2'.
BS 4142:2014+A1:2019 *'Methods for rating and assessing industrial and commercial sound'*	BS 4142 provides a method for rating industrial and commercial sound and a method for assessing resulting impacts upon people. The method is applicable to fixed plant installations, sound from industrial and manufacturing process and other associated activities. The rating method takes into account specific source characteristics, such as tonality, impulsivity and intermittency. The impact assessment procedure described in BS 4142 is based on the comparison of the rating sound level with the background sound level prevailing at the assessment locations.
BS 7445-1:2003 *'Description and measurement of environmental noise'*	BS 7445 defines the basic quantities to be used for the description of noise in community environments and describes basic procedures for the determination of these quantities.
BS 8233:2014 *'Guidance on sound insulation and noise reduction for buildings'*	BS 8233 provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings, or refurbished buildings undergoing a change of use.
BS EN IEC 60942:2018 *'Electroacoustics – Sound calibrators'*	BS EN IEC 60942 specifies the performance requirements for sound calibrators.
BS EN 61672-1:2013 *'Electroacoustics – Sound level meters'*	BS EN 61672-1 provides electroacoustic performance specifications for sound measuring instruments.
ISO 9613-2:2024 *'Acoustics – Attenuation of sound during propagation outdoors'*	The noise prediction method described in this part of the standard is general and is suitable for a wide range of engineering applications where the noise level outdoors is of interest. The noise source(s) may be moving or stationary and the method considers the following major mechanisms of noise attenuation: ▪ Geometrical divergence (also known as distance loss or geometric damping); ▪ Atmospheric absorption; ▪ Ground effect; ▪ Reflection from surfaces; and ▪ Screening by obstructions, barriers and buildings. The method predicts noise levels under metrological conditions favourable to noise propagation from the sound source to the receiver, such as downwind propagation, or

Document	Summary
	equivalently, propagation under a moderate ground-based temperature inversion as commonly occurs at night
World Health Organisation (WHO) *'Guidelines for Community Noise'*, 1999	The WHO Guidelines for Community Noise sets out guidance on appropriate noise levels for different scenarios to ensure that communities are not subjected to unacceptable levels of noise.
WHO *'Night Noise Guidelines for Europe'* (NNG), 2009	The NNG aims to present the conclusions of the WHO working group responsible for preparing guidelines for exposure to noise during the night. This document forms an extension to the WHO Guidelines for Community Noise.

Table 2.1 Planning policies, standards and guidance

2.1 Consultation

A '*Not Duly Made'* letter was received by the client on 9 October 2024 in relation to the submitted Environmental Noise Permit Variation Application. The document stated that further information relating to the noise impact assessment is required. The required information is as follows:

"Propose an approach and timetable for submitting Noise Impact Assessment information that meets the requirements of BS 4142, with due regard for the permitting requirements and timelines.

a. The information that you provided, as prepared for the planning application, on initial review appears to contain the basic content required for permitting, but bespoke report is needed, that meets the requirements of our guidance (Noise and vibration management: environmental permits - GOV.UK (www.gov.uk)).

b. The soundscape requirements are relatively new and by exception in this case may be addressed following our duly making decision; it is the basic 4142 operational noise & vibration report and associated modelling files that we require before we can proceed with your application.

c. Report/narrative should address any instances where, if the impact of proposed change is <+5dB increase, this is on top of "high" background, if the background is or could be attributed to existing noise issues from the Cement works. If this is the case you should address how and whether these existing noise issues will be addressed, and whether then any proposed "new" sources could become dominant / future issues. Note Baseline may include cement works but consider that "background" is with the cement works off."

3 Baseline Noise Survey

3.1 Methodology

A baseline noise survey has been undertaken to define the existing noise levels at the closest noise sensitive receptors to the site location. The resulting measurement data set has been used to inform the assessment.

The survey comprised unattended measurements at four locations at the closest properties to the existing Cement site, as defined in Table 3.1. The noise survey was undertaken between 7 September and 15 September 2023. Weather data was also obtained at one receptor location (MP4) using a portable Davis Vantage Pro 2 weather station.

It should be noted that the existing Heidelberg Materials Cement Site was in operation through the survey period. Observations were undertaken during installation and collection of the noise monitoring equipment.

The baseline noise survey locations have been presented in Table 3.1 below. Noise monitoring installation photographs can be found in Appendix B – Noise Monitoring Installation Photographs.

Noise Monitoring Location	Property Address	Co-ordinates	Notes
MP1	Field to west of Heidelberg Materials Cement site (covering Heidelberg Materials owned properties)	53.154795, -3.06277	Installed in free-field conditions
MP2	Dyke Farm	53.148569, -3.070141	Installed 1m from the façade of the property
MP3	Oak Tree Farm	53.152962, -3.052522	Installed 1m from the façade of the property
MP4	Agricultural land to SE of the Cement site	53.147572, -3.051802	Installed in free-field conditions

Table 3.1 Baseline noise survey locations

The site location along with the unattended noise monitoring positions are presented in Photographs showing the measurement locations are presented in Appendix B – Noise Monitoring Installation Photographs.

The noise monitoring equipment at MP1 and MP4 were located at least 3.5 m from any significant reflective surfaces, other than the ground. Where façade measurements were undertaken a free-field correction (-3 dB(A)) has been applied in accordance with BS 4142. All measurements were taken with the microphone situated approximately 1.5 m above the local ground level.

Figure 3. 1 Noise Monitoring Locations

3.2 Noise Monitoring Equipment

The noise monitoring equipment and the calibration information has been presented below in Table 3.2. Calibration of the noise equipment was completed before and after the noise survey, with the calibration drift for each meter noted below.

Equipment	Brand / Model	Serial No.	Calibration Date	Noise Monitoring Location	Calibration Drift
Sound Level Meter	Rion NL-52	00976247	25/08/2023	MP1	0.0 dB
Sound Level Meter	Rion NL-52	01021276	30/11/2021	MP2	+0.1 dB
Sound Level Meter	Rion NL-52	01054197	28/01/2022	MP3	0.0 dB
Sound Level Meter	Rion NL-52	00197783	24/01/2023	MP4	0.0 dB
Calibrator	Rion NC-75	34524164	15/08/2023	-	-

Table 3.2 Noise Monitoring Equipment

The surveys were carried out using Class 1 sound level meters conforming to the requirements of BS EN 61672-1:2013. The meters had been calibrated to traceable standards within the preceding two years

and the calibrator within the previous 12 months. The sound level meters were field calibrated once set up in the measurement positions and on completion of the survey. No significant calibration drift was observed i.e. within a +/- 0.5 dB tolerance.

3.3 Weather Conditions

Weather information has been obtained through a Davis Vantage Pro 2 weather station installed on site at MP4 for the duration of the noise survey.

Throughout the measurement period, wind speeds were noted to be less than 5m/s in a predominantly SW wind direction. Some precipitation was measured during the night time period between 23:00 on 11 September 2023 and 04:45 on 12 September 2023. All other weather conditions were generally considered conducive to noise monitoring. Weather conditions throughout the survey have been presented in Appendix C – Weather Data.

3.4 Noise Survey Observations

The following observations were noted with regards to the dominant noise sources at each noise monitoring location during installation and collection of equipment:

- MP1 – Heidelberg Materials site activities and vehicle movements accessing the site were dominant at this location. *Note: A5118 is not audible at this location.*
- MP2 – A combination of both Heidelberg Materials operational activities and local farming activities adjacent to this location were noted to be dominant. Heidelberg Materials site activities were noted to be audible at this location.
- MP3 – Livestock from an adjacent field, an outdoor horse riding area and barking dogs were noted during the noise equipment installation. Site activities from Heidelberg Materials were not noted to be audible at this location.

  Although, no pass-bys were observed during the site visit, it should be highlighted that there is a trainline directly west of the noise monitoring location. Train operations are approximately every 30 minutes between 06:00-00:00. The A550 road is also situated to the east of the monitoring location, which could have had influence during the rush hour morning periods.
- MP4 – Road traffic noise from the A550 (Wrexham Road) was noted to be the dominant noise source at this location. Heidelberg Materials activities were not noted to be audible at this location.

3.5 Noise Summary Results

3.5.1 Baseline noise measurements MP1

A summary of the measured noise levels at MP1 are presented below. Further survey information has been appended to this document in Appendix D – Measured Noise Levels.

Date	MP1 Measurement Summary				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB
07/09/2023	13:30-23:00	55	85	51	58
	23:00-07:00	55.	84	51	57
08/09/2023	07:00-23:00	56	83	52	58
	23:00-07:00	54	78	49	56

Date	MP1 Measurement Summary				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB
09/09/2023					
	07:00-23:00	53	77	49	55
	23:00-07:00	51	73	48	53
10/09/2023	07:00-23:00	53	93	50	55
	23:00-07:00	55	74	50	56
11/09/2023	07:00-23:00	56	86	52	58
	04:45-07:00*	58	72	55	60
12/09/2023	07:00-23:00	58	83	54	60
	23:00-07:00	55	79	51	57
13/09/2023	07:00-23:00	57	86	54	59
	23:00-07:00	55	80	52	57
14/09/2023	07:00-23:00	56	80	52	58
	23:00-07:00	54	78	50	57
15/09/2023	07:00-07:45	57	79	54	59

Notes:

Daytime period: 07:00 – 23:00 hrs, night-time: 23:00 – 07:00 hrs

Daytime measurements taken on the 07/09/2023 and 15/09/2023 were not taken throughout full 16hr daytime period.

$L_{Aeq,T}$ values are the logarithmic average of $L_{Aeq,15min}$ samples, and the LA90,T values are the arithmetic average of $L_{A90,15min}$ samples.

*Considers data between 04:45-07:00 due to adverse weather conditions.

Table 3.3 Noise monitoring results at MP1

3.5.2 Baseline noise measurements MP2

A summary of the measured noise levels at MP2 are presented below. Further survey information has been appended to this document in Appendix D – Measured Noise Levels.

Date	MP2 Measurement Summary				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB
07/09/2023	12:45-23:00	71	87	42	47
	23:00-07:00	44	71	41	45
08/09/2023	07:00-23:00	48	83	41	46
	23:00-07:00	44	81	39	44
09/09/2023	07:00-23:00	51	85	41	46
	23:00-07:00	43	78	39	42
10/09/2023	07:00-23:00	47	85	40	46
	23:00-07:00	43	77	34	39
11/09/2023	07:00-23:00	48	83	40	46
	04:45-07:00*	47	66	45	49
12/09/2023	07:00-23:00	50	84	46	50
	23:00-07:00	46	84	41	44
13/09/2023	07:00-23:00	50	90	41	47
	23:00-07:00	43	76	37	42
14/09/2023	07:00-23:00	48	86	40	46
	23:00-07:00	44	67	42	45
15/09/2023	07:00-07:45	50	87	43	50

Notes:

1. Daytime period: 07:00 – 23:00 hrs, night-time: 23:00 – 07:00 hrs
2. Daytime measurements taken on the 07/09/2023 and 15/09/2023 were not taken throughout full 16hr daytime period.
3. $L_{Aeq,T}$ values are the logarithmic average of $L_{Aeq,15min}$ samples, and the $L_{A90,T}$ values are the arithmetic average of $L_{A90,15min}$ samples.
4. It is anticipated that local activities caused the elevated noise levels during the daytime on 07 September 2023, however, the origin of the increased noise levels is not known.

*Considers data between 04:45-07:00 due to adverse weather conditions.

Table 3.4 Noise monitoring results at MP2

3.5.3 Baseline noise measurements MP3

A summary of the measured noise levels at MP3 are presented below. Further survey information has been appended to this document in Appendix D – Measured Noise Levels.

Date	MP3 Measurement Summary				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB
07/09/2023	14:45-23:00	60	98	49	54
	23:00-07:00	52	86	46	52
08/09/2023	07:00-23:00	59	99	49	54
	23:00-07:00	50	83	46	51
09/09/2023	07:00-23:00	69	101	46	54
	23:00-07:00	51	83	47	52
10/09/2023	07:00-23:00	61	101	49	55
	23:00-07:00	52	84	48	53
11/09/2023	07:00-23:00	58	100	48	54
	04:45-07:00*	56	81	50	56
12/09/2023	07:00-23:00	54	95	47	53
	23:00-07:00	52	82	47	51
13/09/2023	07:00-23:00	65	102	52	58
	23:00-07:00	51	89	46	52
14/09/2023	07:00-23:00	67	103	48	55
	23:00-07:00	51	72	42	49
15/09/2023	07:00-07:45	60	81	57	61

Notes:

1. Daytime period: 07:00 – 23:00 hrs, night-time: 23:00 – 07:00 hrs
2. Daytime measurements taken on the 07/09/2023 and 15/09/2023 were not taken throughout full 16hr daytime period.
3. $L_{Aeq,T}$ values are the logarithmic average of $L_{Aeq,15min}$ samples, and the $L_{A90,T}$ values are the arithmetic average of $L_{A90,15min}$ samples.

*Considers data between 04:45-07:00 due to adverse weather conditions.

Table 3.5 Noise monitoring results at MP3

3.5.4 Baseline noise measurements MP4

A summary of the measured noise levels at MP4 are presented below. Further survey information has been appended to this document in Appendix D – Measured Noise Levels.

Date	Measurement Summary MP4				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB
07/09/2023	15:30-23:00	68	85	57	71
	23:00-07:00	62	81	40	61
08/09/2023	07:00-23:00	68	99	58	71
	23:00-07:00	60	82	39	62
09/09/2023	07:00-23:00	68	100	57	71
	23:00-07:00	59	80	40	61
10/09/2023	07:00-23:00	67	100	55	70
	23:00-07:00	61	80	43	60
11/09/2023	07:00-23:00	68	87	58	71
	04:45-07:00*	67	79	55	70
12/09/2023	07:00-23:00	69	84	61	72
	23:00-07:00	63	81	44	62
13/09/2023	07:00-23:00	68	93	59	71
	23:00-07:00	62	80	40	61
14/09/2023	07:00-23:00	68	90	59	71
	23:00-07:00	62	80	40	61
15/09/2023	07:00-08:15	71	80	64	73

Notes:

1. Daytime period: 07:00 – 23:00 hrs, night-time: 23:00 – 07:00 hrs
2. Daytime measurements taken on the 07/09/2023 and 15/09/2023 were not taken throughout full 16hr daytime period.

Date	Measurement Summary MP4				
	Time Considered	$L_{Aeq,T}$, dB	L_{AFMAX}, dB	L_{A90}, dB	L_{A10}, dB

3. $L_{Aeq,T}$ values are the logarithmic average of $L_{Aeq,15min}$ samples, and the $L_{A90,T}$ values are the arithmetic average of $L_{A90,15min}$ samples.

*Considers data between 04:45-07:00 due to adverse weather conditions.

Table 3.6 Noise monitoring results at MP4

3.6 Background Noise Levels at Noise Sensitive Receptors

Statistical analysis has been undertaken on the measured background noise levels ($L_{A90,T}$) to establish a representative value for the BS 4142 assessment.

Appendix E - Statistical Analysis illustrates the analysis for the daytime and night-time periods respectively and Table 3.7 presents the result of the final background noise levels that have been utilised as part of the BS 4142 assessment for the considered noise sensitive receptors.

Adopted representative background noise levels have been chosen based on the results of the statistical analysis within the existing industrial/commercial setting. Representative background levels ($L_{A90,15min}$ samples) adopted for each receptor are broadly 20-30% of the cumulative data obtained, allowing for the fluctuation in residual noise levels. At all receptors, the adopted background noise levels are below the averaged background noise levels (daytime and night) at each measurement position. Adopted background levels are therefore considered robust and suitable for assessment purposes

The adopted background noise levels at the considered noise sensitive receptors are provided in the table below.

ID Number	Address	Representative monitoring location	Daytime (07:00-23:00) $L_{A90,1hr}$ dB	Night-time (23:00-07:00) $L_{A90,15min}$ dB
R1	2 Padeswood Drive	MP1	49	48
R2	3 Padeswood Drive	MP1	49	48
R3	6 Padeswood Drive	MP1	49	48
R4	7 Padeswood Drive	MP1	49	48
R5	10 Padeswood Drive	MP1	49	48
R6	11 Padeswood Drive	MP1	49	48
R7	14 Ffordd Derwyn	MP4	57	36
R8	33 Ffordd Derwyn	MP4	57	36
R9	34 Plas Yn Rhos	MP4	57	36
R10	38 Plas Yn Rhos	MP4	57	36
R11	40 Plas Yn Rhos	MP4	57	36
R12	44 Plas Yn Rhos	MP4	57	36
R13	Bannel Farm	MP1	49	48
R14	Beudy Coch, Padeswood Lake Road	MP2	36	34
R15	Camfa Rheinallt Farm, Padeswood Lake Road	MP2	36	34
R16	Dyke Farm, Padeswood Lake Road	MP2	36	34
R17	Hendy Cottage, Padeswood Lake Road	MP2	36	34
R18	Homelea	MP1	49	48
R19	Laburnam Cottage	MP1	43	42
R20	Brook Meadow Housing Estate	MP4	57	36

ID Number	Address	Representative monitoring location	Daytime (07:00-23:00) $L_{A90,1hr}$ dB	Night-time (23:00-07:00) $L_{A90,15min}$ dB
R21	Oak Drive	MP4	57	36
R22	Oak Tree Farm, Bannel Lane	MP3	43	42
R23	Oak Tree Farm	MP3	43	42
R24	Pen-Yr-Allt Farm, Padeswood Lake Road	MP2	36	34
R25	The Gables, Padeswood Lake Road	MP2	36	34
R26	The Old Barn, Padeswood Lake Road	MP2	36	34
R27	Toll Bar Cottage, Chester Road	MP2	36	34
R28	Ty Gwyn Farm	MP1	49	48
R29	Well House Farm, Padeswood Lake Road	MP2	36	34
R30	Springfield	MP3	43	42

Table 3.7 Background noise levels at receptors

4 Noise Emission Data

4.1 Operational Phase Noise

The proposed development will introduce a range of noise sources that will operate on a 24-hour basis, generally under steady state conditions.

The location, dimensions and sound power level associated with noise generating equipment item has been provided by the design team, along with the typical operating duty for day and night time periods, operational requirements and number of each equipment operating simultaneously. As some of the equipment operating duties are contingent on the ambient temperature, daytime and night-time periods have been considered for the determination of impacts. For the purpose of this assessment, daytime considers 07:00-23:00 and night-time considers 23:00-07:00.

Further information surrounding the characteristics of noise emissions has been provided by the design team. It is understood that the blowers have the potential to display tonal characteristics, however all other proposed equipment is unlikely to have distinguishable sound characteristics.

The noise emitting sources are defined in

Table 4.1 below. Further detail can be found in Planning Drawing Ref: 215000-00190-000-PI-PLN-00002_Rev E, reproduced in Appendix A – Site Layout Plan. All noise data has been provided by the design team.

ID Item	Equipment Name	Number of Units Running Simultaneously	Noise Level SWL per unit[1] (dB(A))	Embedded Mitigation
710-BL-001	Flue Gas Blower	1	93	-
720-BL-001	CCU Flue Gas Blower	1	93	-
720-PU-001AB	Quencher Circulation Pump	1	86	-17 dB(A) lagging + localised screening (from other structures)
720-PU-002AB	1st Wash Water Pump	1	86	-11 dB(A) lagging
720-PU-003AB	Rich Pump	1	90	-17 dB(A) lagging + localised screening (from other structures)
720-PU-004AB	Reflux Distribution Pump	1	81	-11 dB(A) lagging
720-PU-005AB	Lean Pump	1	90	-17 dB(A) lagging + localised screening (from other structures)
720-PU-006	Solvent Sump Pump	1	80	-8 dB(A) lagging
720-PU-007AB	2nd Wash Water Pump	1	89	-
720-PU-008AB	Steam Condensate Pump	1	84	-17 dB(A) lagging + localised screening
720-PU-009AB	Reflux Circulation Pump	1	83	-11 dB(A) lagging + localised screening (from other structures)
720-PU-010AB	Reclaimer Caustic Soda Pump	1	67	-

ID Item	Equipment Name	Number of Units Running Simultaneously	Noise Level SWL per unit[1] (dB(A))	Embedded Mitigation
720-PU-011ABC	Reclaimed Waste Pump	2	82	-17 dB(A) lagging + localised screening from structures
720-PU-012AB	Reclaimed Solvent Pump	1	85 74	-11 dB(A) lagging + localised screening from structures
720-PU-013AB	Reclaimed Vacuum Pump	1	100 89	-11 dB(A) lagging + localised screening from structures
720-PU-014AB	Reclaimer Steam Condensate Pump	1	92	-
720-PU-016AB	Intercooling Pump	1	89	-11 dB(A) lagging + localised screening from structures
720-PU-017AB	Filtration Booster Pump	1	87	-
720-PU-018AB	Filter Wash Water Pump	1	66	-
720-PU-019	Solvent Unloading Pump	1	65	-
720-PU-021ABC	Flue Gas Pre-Treatment Pump	2	85	-17 dB(A) lagging + equipment specific localised screening
720-PU-023AB	3rd Wash Water Pump	1	79	-17 dB(A) lagging + equipment specific localised screening
720-PU-024AB	CO2 Wash Water Pump	1	87	-
720-PU-025AB	Reclaimed Waste Transfer Pump	1	84	-
720-PU-027AB	Storage Area Solvent Sump pump	1	88	-
720-PU-029AB	Sulphuric Acid Make-Up Pump	1	64	-
720-PU-032AB	Acid Wash Water Transfer Pump	1	72	-
720-PU-33	Acid Wash Water Sump Pump	1	88	-
720-PU-34	Reclaimed Waste Sump Pump	1	79	-
720-PU-35AB	Solvent Waste Water Transfer Pump	1	standby	-
720-PU-41	Wet Esp Washing Pump	1	79	-17 dB(A) lagging + localised screening from structures

ID Item	Equipment Name	Number of Units Running Simultaneously	Noise Level SWL per unit[1] (dB(A))	Embedded Mitigation
720-PU-51	Quencher FGD Section Bleed Pump	1	81	-
720-PU-52	Slaked Lime Slurry Pump	1	81	-
720-PU-53	Quencher FGD Section Area Sump Pump	1	81	-
720-PU-54	Quencher FGD Section Drain Tank Pump	1	85	-
720-PU-090	Sulphuric Acid Pump to WWTP	1	81	-
Transformers		7	62	Low noise plant
Water Treatment Pumps - Small		4	76	-
Water Treatment Pumps - Medium		6	87	-
710-PU-002AB	HP Boiler Feed Water Pumps	1	105	-17 dB(A) lagging + localised screening from structures
710-PU-003AB	LP Boiler Feed Water Pumps	1	80	-
710-PU-004AB	Condensate Return pumps	1	90	-11 dB(A) lagging
710-PU-005AB	Blowdown Vessel Pump	1	76	-
720-HE-001A/B/C/D	Quencher Cooler	1	83	-
720-HE-002A/B	Wash Water Cooler	1	83	-
710-HE-008	Upper Semi-Lean Lean Exchanger	1	88	-
720-HE-014	Intercooler	1	73	-
720-HE-201-A-F	Quencher Air Fin Cooler	1 bay	• Day: 87 • Night: 85	-
720-HE-202-A-F	Wash Water Air Fin Cooler	1 bay	• Day: 87 • Night: 85	-
720-HE-204-A-E	Reflux Cooler	1 bay	• Day: 87 • Night: 85	-
720-HE-206-A-F	Lean Cooler	1 bay	• Day: 86 • Night: 84	-
720-HE-211-AB	Reclaimed Waste Cooler	1 bay	• Day: 87 • Night: 85	-
720-HE-212-A-F	Reclaimer Condenser	1 bay	• Day: 87 • Night: 85	-

ID Item	Equipment Name	Number of Units Running Simultaneously	Noise Level SWL per unit[1] (dB(A))	Embedded Mitigation
720-HE-214-A-N	Air Fin Intercooler	1 bay	• Day: 86 • Night: 84	-
720-HE-215-AB	Steam Condensate Cooler	1	88	-
740-PU-001AB	Raw Water Buffer Tank Pimps	1	92	-11 dB(A) lagging
740-PU-002AB	Demineralised Water Pump	1	81	-11 dB(A) lagging
740-PU-004AB	Cooling Water Pumps	1	95	-11 dB(A) lagging
740-PU-010AB	Fire Water Jockey Pumps	1	82	-
740-PU-0011ABC	CCP Effluent Pumps	2	78	-
740-PU-012AB	Flue Gas Condensate Feed to WWTP Pumps	1	82	-11 dB(A) lagging
740-PU-013AB	RO and UF Reject to DCC Pumps	1	86	-
740-PU-015AB	Raw Water Transfer Pumps	1	91	-
740-PU-016AB	Pond Transfer Pumps	1	(submerged and low emission, not included)	-
710-ME-002	LP Steam Desuperheater	1	58	-
710-ME-003	LP Steam Bypass Desuperheater	1	58	-
710-TB-001	Steam Turbine Generator	1	Building	Minimum of 47 dB R_w specification for walls and a minimum of 44 dB R_w the roof
			Turbine: 90	-20 dB(A) reduction through enclosure or equivalent
			Gearbox: 94	-10 dB(A) reduction through enclosure or equivalent
			Generator 91	-10 dB(A) reduction through enclosure or equivalent

ID Item	Equipment Name	Number of Units Running Simultaneously	Noise Level SWL per unit[1] (dB(A))	Embedded Mitigation
710-ZZ-001	CHP Package	2	Building	Minimum of 45 dB Rw specification for walls and a minimum of 44 dB Rw the roof
			113	-28 dB(A) reduction through enclosure or equivalent
710-ZZ-002	BFW Dosing Package	1	83	-
720-ZZ-001	Filtration Unit	1	88	-17 dB(A) lagging + equipment specific localised screening
720-ZZ-002	Acid Wash Concentrator	1	85	-
740-TK-010-MX1	CCP Effluent Storage Tank Agitator	1	62	-
720-MX-001-A	Quencher FGD Section Tank Agitator	1	62	-
720-MX-001-B	Quencher FGD Section Tank Agitator	1	62	-
720-MX-002	Slaked Lime Slurry Tank Agitator	1	62	-
720-MX-003	Quencher FGD Section Area Sump Agitator	1	62	-
720-MX-004	Quencher FGD Section Drain Tank Agitator	1	62	-
720-ZZ-011	Anti-foam Injection Unit	1	93	-
730-CP-001	Compressor Building	1	Building	Minimum of 47 dB R_w specification for walls and roof
		1	Motor: 82	-
		1	Compressor: 106	-15 dB(A) enclosure or equivalent
		4	Intercoolers (4): 138 139 138 138	-45 dB(A) lagging, enclosure or combination
730-ZZ-001	H2 Generation Unit	1	84	-17 dB(A) lagging + equipment specific localised screening

ID Item	Equipment Name	Number of Units Running Simultaneously	Noise Level SWL per unit[1] (dB(A))	Embedded Mitigation
730-ZZ-002	Dehydration Unit	1	86	-17 dB(A) lagging + equipment specific localised screening
740-TW-001	Cooling Tower	1	• Air outlet: 73 • Wet air inlet: 97 • Dry air inlet: 84 dB(A)	Water splash noise abatement and includes temperature-based operations – 5dB(A)
740-ZZ-002	Instrument Air Compressor Package	1	84	-
740-ZZ-003	Instrument Air Dryer Package	1	88	-
740-ZZ-004	Nitrogen Generation Package	1	88	-
740-ZZ-005	Cooling Water Chemical Dosing	1	60	-
740-ZZ-008	Electro Chlorination Package	1	60	-
800-BL-001	Coal Mill Flue Gas Booster Fan	1	99	-
800-PU-001AB	HTF Circulation Pump	1	99	-
800-PU-002AB	HTF to Clinker Gas/ HTF Heat Exchanger Feed Pumps	1	97	-
800-PU-003AB	HTF to PHT/HTF Heater Exchanger Feed Pumps	1	89	-11 dB(A) lagging
800-PU-004	HTF Transfer Pump	1	89	-
800-PU-005	HTF Collection Sump Drain Pump	1	79	-
KS-FLT-0001-PM2-002	Circulation pump	1	-	-
40-KS-FLT-0001-PM2-002	Water wash pump	1	-	-
710-zz-002	BFW Dosing Package	1	-	-

Notes:

1) The sound power levels provided account for the embedded mitigation outlined above, with the exception of the following items:
   - 730-CP-001
   - 710-ZZ-001
   - 710-TB-001

ID Item	Equipment Name	Number of Units Running Simultaneously	Noise Level SWL per unit[1] (dB(A))	Embedded Mitigation
2) Where day/night levels have been provided, it has been advised that temperature fluctuations will influence the operation of specific plant items				

Table 4.1 Noise emitting sources

4.2 Building Specifications

The minimum acoustic performance of the buildings adopted in the assessment of residual impacts have been presented in Appendix F – Recommended Building Specifications. The recommended reductions are to be achieved through design.

Where further reductions are required to specific equipment, attenuation requirements have been outlined in Table 4.1. Performance specifications of the proposed mitigation are to be refined once vendor spectral emission data has been finalised.

4.3 Assumptions and Limitations

The noise survey has been undertaken with the understanding that equipment on the existing Padeswood Cement Works site was operating at typical duty.

At this stage in the design of the proposed development, final vendor spectral data is not available for the proposed operational equipment installations. To inform the operational phase assessment, where possible vendor data has been utilised regarding the expected plant/ equipment installations, including typical sound emission data and attainable acoustic attenuation measures, if required. Where spectral emission data has not been provided, spectral emission data from similar equipment has been adopted.

5 Noise Modelling

To inform the BS 4142 assessment, the noise emissions at surrounding sensitive receptors have been calculated using a noise prediction model. Modelling has been undertaken using nationally recognised modelling software (SoundPLAN) which implements widely accepted modelling algorithms. The modelling software calculates industrial noise in accordance with the methodology set out in ISO 9613-2.

The ISO 9613-2 method predicts noise levels under meteorological conditions favourable to noise propagation from the sound source to the receiver, such as downwind conditions. The modelling parameters are presented in Table 5.1.

Element	Setting
Algorithm	International Standard: ISO 9613-2: 2024 'Acoustics – Attenuation of sound during propagation outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors'.
Met conditions	70 Humidity. 10 Degrees Celsius. Wind from source to receiver.
Ground absorption	The ground absorption in the noise model has been assumed 0 on-site and 0.8 across all areas surrounding the Site.
Façade corrections	Free-field conditions.
Receptor height	The offsite receptors have been modelled as two storey buildings with a receiver height of 1.5m and 4m above external ground level, respectively.
Hours of operation	For the purpose of this assessment, it is assumed that the Site will operate 24-hours a day.
Site layout	As per Appendix A – Site Layout Plan.
Terrain	1m DTM LiDAR data. It is not anticipated that there would be any significant changes to the terrain as a result of the Proposed Development.
Exclusions from the model	Vehicle movements have not been accounted for within the noise model as it is assumed that only limited vehicle movements associated with maintenance will be undertaken. Emergency pumps have been excluded as they will only be in operation on an ad-hoc basis during emergency periods and therefore is not considered a regular operation.

Table 5.1 Modelling parameters

6 Noise Assessment

6.1 Rating Corrections

According to BS 4142:2014+A1: 2019, where certain features of the specific noise level can increase the significance of impact of a sound level, a character correction is applied to provide a rating noise level. The characteristics of a sound that are likely to cause an increase in the significance of impact are tonality, impulsivity, intermittency or other characteristic features such as an identifiable 'hiss'. The character corrections are applied on the basis of perceptibility at the surrounding noise receptors.

Taking the above acoustic features into consideration, the application of rating penalties is as follows:

- Tonality – as the proposed equipment source level is to be achieved through design, it is assumed any tonal elements within the proposed installation will be mitigated sufficiently;
- Impulsivity – the character of the sound from the proposed equipment is generally thought to be of a constant level, with no rapid change in the level or character of noise. It is therefore considered unnecessary to apply an impulsivity correction;
- Intermittency – as the proposed equipment is steady state with no noticeable on/off characteristics, it is considered unnecessary to apply an intermittency correction; and
- Other - where neither tonal nor impulsive corrections apply.

With consideration to rating corrections, the specific level contribution at receptors has been considered individually for each item of equipment. The noise contributions from the highest predicted individual equipment at the considered receptors has been presented in Appendix G – Equipment Contribution at Receptors.

6.2 Noise Predictions

The rating noise level predicted at nearest noise sensitive receptors has been assessed against existing background noise levels in order to assess the likelihood for impact in accordance with BS 4142. The assessment utilises the closest noise sensitive receptors to the site.

The table below presents the predicted free-field specific and rating noise levels alongside the measured background, which have been used to derive the level difference between background and rating levels during daytime and night-time periods. Noise contour plots depicting the propagation of noise from the site are presented in Appendix H – Noise Contour Maps.

Receptor	Period	Background Sound Level[1]	Rating Correction	Predicted Rating Level	Excess of Rating of Background Sound Level
R1	Daytime	49 dB $L_{A90,T}$	0 dB	36 dB $L_{Ar,Tr}$	-13 dB
	Night-time	48 dB $L_{A90,T}$	0 dB	36 dB $L_{Ar,Tr}$	-12 dB
R2	Daytime	49 dB $L_{A90,T}$	0 dB	35 dB $L_{Ar,Tr}$	-14 dB
	Night-time	48 dB $L_{A90,T}$	0 dB	35 dB $L_{Ar,Tr}$	-13 dB
R3	Daytime	49 dB $L_{A90,T}$	0 dB	34 dB $L_{Ar,Tr}$	-15 dB
	Night-time	48 dB $L_{A90,T}$	0 dB	34 dB $L_{Ar,Tr}$	-14 dB
R4	Daytime	49 dB $L_{A90,T}$	0 dB	34 dB $L_{Ar,Tr}$	-15 dB
	Night-time	48 dB $L_{A90,T}$	0 dB	34 dB $L_{Ar,Tr}$	-15 dB
R5	Daytime	49 dB $L_{A90,T}$	0 dB	37 dB $L_{Ar,Tr}$	-12 dB
	Night-time	48 dB $L_{A90,T}$	0 dB	37 dB $L_{Ar,Tr}$	-11 dB
R6	Daytime	49 dB $L_{A90,T}$	0 dB	37 dB $L_{Ar,Tr}$	-12 dB

Receptor	Period	Background Sound Level[1]	Rating Correction	Predicted Rating Level	Excess of Rating of Background Sound Level
	Night-time	48 dB $L_{A90,T}$	0 dB	37 dB $L_{Ar,Tr}$	-11 dB
R7	Daytime	57 dB $L_{A90,T}$	0 dB	30 dB $L_{Ar,Tr}$	-27 dB
	Night-time	36 dB $L_{A90,T}$	+3 dB	33 dB $L_{Ar,Tr}$	-3 dB
R8	Daytime	57 dB $L_{A90,T}$	0 dB	30 dB $L_{Ar,Tr}$	-27 dB
	Night-time	36 dB $L_{A90,T}$	+3 dB	33 dB $L_{Ar,Tr}$	-3 dB
R9	Daytime	57 dB $L_{A90,T}$	0 dB	30 dB $L_{Ar,Tr}$	-27 dB
	Night-time	36 dB $L_{A90,T}$	+3 dB	33 dB $L_{Ar,Tr}$	-3 dB
R10	Daytime	57 dB $L_{A90,T}$	0 dB	30 dB $L_{Ar,Tr}$	-27 dB
	Night-time	36 dB $L_{A90,T}$	+3 dB	33 dB $L_{Ar,Tr}$	-3 dB
R11	Daytime	57 dB $L_{A90,T}$	0 dB	30 dB $L_{Ar,Tr}$	-27 dB
	Night-time	36 dB $L_{A90,T}$	+3 dB	33 dB $L_{Ar,Tr}$	-3 dB
R12	Daytime	57 dB $L_{A90,T}$	0 dB	30 dB $L_{Ar,Tr}$	-27 dB
	Night-time	36 dB $L_{A90,T}$	+3 dB	33 dB $L_{Ar,Tr}$	-3 dB
R13	Daytime	49 dB $L_{A90,T}$	0 dB	33 dB $L_{Ar,Tr}$	-16 dB
	Night-time	48 dB $L_{A90,T}$	0 dB	33 dB $L_{Ar,Tr}$	-15 dB
R14	Daytime	36 dB $L_{A90,T}$	0 dB	33 dB $L_{Ar,Tr}$	-3 dB
	Night-time	34 dB $L_{A90,T}$	0 dB	33 dB $L_{Ar,Tr}$	-1 dB
R15	Daytime	36 dB $L_{A90,T}$	0 dB	33 dB $L_{Ar,Tr}$	-3 dB
	Night-time	34 dB $L_{A90,T}$	0 dB	33 dB $L_{Ar,Tr}$	-1 dB
R16	Daytime	36 dB $L_{A90,T}$	0 dB	38 dB $L_{Ar,Tr}$	+2 dB
	Night-time	34 dB $L_{A90,T}$	0 dB	38 dB $L_{Ar,Tr}$	+4 dB
R17	Daytime	36 dB $L_{A90,T}$	0 dB	34 dB $L_{Ar,Tr}$	-2 dB
	Night-time	34 dB $L_{A90,T}$	0 dB	34 dB $L_{Ar,Tr}$	0 dB
R18	Daytime	49 dB $L_{A90,T}$	0 dB	37 dB $L_{Ar,Tr}$	-12 dB
	Night-time	48 dB $L_{A90,T}$	0 dB	37 dB $L_{Ar,Tr}$	-11 dB
R19	Daytime	43 dB $L_{A90,T}$	0 dB	38 dB $L_{Ar,Tr}$	-5 dB
	Night-time	42 dB $L_{A90,T}$	0 dB	38 dB $L_{Ar,Tr}$	-4 dB
R20	Daytime	57 dB $L_{A90,T}$	0 dB	30 dB $L_{Ar,Tr}$	-27 dB
	Night-time	36 dB $L_{A90,T}$	+3 dB	33 dB $L_{Ar,Tr}$	-3 dB
R21	Daytime	57 dB $L_{A90,T}$	0 dB	30 dB $L_{Ar,Tr}$	-27 dB
	Night-time	36 dB $L_{A90,T}$	+3 dB	33 dB $L_{Ar,Tr}$	-3 dB
R22	Daytime	43 dB $L_{A90,T}$	+3 dB	42 dB $L_{Ar,Tr}$	-1 dB
	Night-time	42 dB $L_{A90,T}$	+3 dB	42 dB $L_{Ar,Tr}$	-0 dB
R23	Daytime	43 dB $L_{A90,T}$	+3 dB	32 dB $L_{Ar,Tr}$	-11 dB
	Night-time	42 dB $L_{A90,T}$	+3 dB	32 dB $L_{Ar,Tr}$	-10 dB
R24	Daytime	36 dB $L_{A90,T}$	0 dB	32 dB $L_{Ar,Tr}$	-4 dB
	Night-time	34 dB $L_{A90,T}$	0 dB	32 dB $L_{Ar,Tr}$	-2 dB
R25	Daytime	36 dB $L_{A90,T}$	0 dB	33 dB $L_{Ar,Tr}$	-3 dB
	Night-time	34 dB $L_{A90,T}$	0 dB	33 dB $L_{Ar,Tr}$	-1 dB
R26	Daytime	36 dB $L_{A90,T}$	0 dB	32 dB $L_{Ar,Tr}$	-4 dB
	Night-time	34 dB $L_{A90,T}$	0 dB	32 dB $L_{Ar,Tr}$	-2 dB
R27	Daytime	36 dB $L_{A90,T}$	0 dB	33 dB $L_{Ar,Tr}$	-3 dB
	Night-time	34 dB $L_{A90,T}$	0 dB	33 dB $L_{Ar,Tr}$	-1 dB

Receptor	Period	Background Sound Level[1]	Rating Correction	Predicted Rating Level	Excess of Rating of Background Sound Level
R28	Daytime	49 dB $L_{A90,T}$	0 dB	37 dB $L_{Ar,Tr}$	-12 dB
	Night-time	48 dB $L_{A90,T}$	0 dB	37 dB $L_{Ar,Tr}$	-11 dB
R29	Daytime	36 dB $L_{A90,T}$	0 dB	38 dB $L_{Ar,Tr}$	+2 dB
	Night-time	34 dB $L_{A90,T}$	0 dB	38 dB $L_{Ar,Tr}$	+4 dB
R30	Daytime	43 dB $L_{A90,T}$	0 dB	30 dB $L_{Ar,Tr}$	-13 dB
	Night-time	42 dB $L_{A90,T}$	0 dB	30 dB $L_{Ar,Tr}$	-12 dB
[1] – representative background sound level accounting for 1-hour period during the daytime and 15-minutes at night, in accordance with BS 4142					

Table 6.1 Operational predicted sound levels

Table 6.1 above shows that the predicted rating level of 38 dB $L_{Ar,Tr}$ at Dyke Farm and 38 dB $L_{Ar,Tr}$ at Well House Farm are predicted to be +4 dB above the prevailing background night-time sound levels.

No rating correction has been applied to the predicted noise levels for tonality, intermittency or impulsivity. This is due to the contribution from individual sources exceeding of 10 dB(A) below background. To further this, no single source would be theoretically audible at the receptor, therefore, no correction is deemed necessary. The highest contributing sources at each receptor can be found in Appendix G – Equipment Contribution at Receptors.

In terms of the rating correction for general industrial sound, the location for the proposed development is already influenced by the existing industrial facility at a number of receptor locations, therefore, the proposed development is not introducing a new noise character.

At baseline noise monitoring locations MP1 and MP2 it was noted during the observations that the existing site was audible. This suggests that the existing environment is characterised by the existing industrial facility. Therefore, the proposed development would be in keeping with the existing character of noise. As a result, it is not deemed necessary to apply a character correction for general industry at receptors associated with MP1 and MP2 monitoring locations.

During observations at MP3 and MP4 activities associated with the existing facility were not noted, and therefore a +3 dB(A) has been applied to all relevant receptors where the specified noise level is less than 10 dB(A) below background.

The change in ambient noise levels have also been included as part of impact assessment. Table 6.2 outlines the change in ambient noise levels associated with the proposed development at Dyke Farm.

Element	Results
Ambient Sound Level (Dyke Farm)	40 dB $L_{Aeq,T}$
Highest Predicted Specific Level	38 dB $L_{Aeq,T}$
Predicted Future Ambient Sound Level	42 dB(A)
Change in Ambient Sound Level	+2 dB(A)

Table 6.2 Change in ambient noise level

The increase in ambient noise levels is expected to be up to +2 dB(A), which would be experienced as a barely perceptible change. The proposed development is projected to be above background noise levels, however, is not predicted to cause a significant adverse impact.

In accordance with BS 4142: 2014+A1: 2019, where the rating level does not exceed +5 dB(A) above background sound level, this is an indication of the development having a low impact on the existing (and nearest) sensitive receptors, subject to context.

7 Uncertainty

BS 4142 requires that the assessment considers the level of uncertainty in the data and associated calculations. Consideration of the uncertainty can enable a more informed decision regarding the likely significance of impact, within the context of assessment. It is accepted that uncertainty may arise from all levels of measurement and assessment and reasonably practicable steps have therefore been made with the aim of reducing uncertainty.

It was confirmed by the client that operations on-site were typical of normal operating conditions for the duration of the background noise survey. Additionally, to ensure that all noise monitoring data was valid, weather conditions were noted throughout the monitoring period. Where weather conditions were unsuitable for noise monitoring, the data associated with the corresponding time periods were removed from the dataset. It was also ensured that the data either side of the bad weather was typical of the environment during periods where weather was conducive for noise monitoring.

At this stage in the design, specific vendor noise data for the operational phase is not available and hence there is uncertainty regarding the proposed equipment installations, including setting out, sound power levels and sound emission characteristics. To overcome this throughout the assessment phase, RSK has worked alongside MHI and Worley to ensure the input noise information and required mitigation can be achieved through design. The resulting information has been used as part of the assessment to demonstrate that a workable solution can be achieved through attenuation.

If the noise emissions generated by certain items of plant exceed those used to inform the assessment, an enhanced level of acoustic mitigation could be introduced to offset this i.e., enhanced building fabric or enclosure combination. On this basis, it is considered that the uncertainty associated with the operational phase noise levels will not have a significant outcome on the impact assessment for permitting.

The prediction model assumes downwind propagation from source to receiver for all receptors included in the assessment. This may result in over prediction at some receptors during typical conditions, however, the results present a robust assessment.

8 BAT Assessment

In addition to the noise impact assessment, a BAT assessment is required to demonstrate that best available techniques have been included as part of project proposals. The BAT assessment has been undertaken in accordance with NRW Guidance and BAT reference documents (BREFs) in respect of operations taking place at the Padeswood CCS Site, in Padeswood.

As part of the assessment, BREF documents referenced below are only applicable to the proposed site and were included as part of the BAT assessment for the proposed site undertaken by Worley/ MHI (Document Ref. *Padeswood Carbon Capture Plant – FEED Phase. BAT Demonstration Report. Rev 0: CCS-C3-3a-01 and 215000-00190-000-EN-REP-00005).* It should be noted that an additional BREF document was referenced within this demonstration report (*Emerging Techniques for Blue H_2*), however, the document is only in draft form and has therefore, not be included as part of this assessment.

8.1 BREF

There are four BAT/BREF documents that are relevant to the Padeswood CCS site:

- Best Available Techniques (BAT) Reference Document for Common Waste Water and Waste Gas Treatment/ Management Systems in the Chemical Sector, 2016 – Industrial Emissions Directive 2010/75/EU. Code: CWW.
- Best Available Techniques (BAT) Reference Document for Waste Treatment, 2018 – Industrial Emissions Directive 2010/75/EU. Code: WT.
- Best Available Techniques (BAT) Reference Document for Large Combustion Plants, 2017 – Industrial Emissions Directive 2010/75/EU. Code: CLM.
- Reference Document on the Application of Best Available Technique to Industrial Cooling Systems, 2001 – under directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC). Code: ICS.

Section 4.5.6 of The BREF document on '*Common Waste Water and Waste Gas Treatment/ Management Systems in the Chemical Sector*' sets out the best available techniques for the control of noise and vibration during the operations. The requirements/recommendations outlined in this document are also presented in the other documents and therefore will form the basis for the below table. This document will be referred to as '*The BREF'* document herein.

Table BAT 23 from The BREF is replicated below. In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to use one or a combination of the techniques given below:

Technique		Description	Applicability
a.	Appropriate location of equipment and buildings	Increasing the distance between the emitter and the receiver and using buildings as noise screens.	For existing plants, the relocation of equipment may be restricted by a lack of space or excessive costs.
b.	Operational measures	This includes: ▪ Improved inspection and maintenance of equipment. ▪ Closing of doors and windows of enclosed areas, if possible. ▪ Equipment operation by experienced staff.	Generally applicable.

Technique		Description	Applicability
		▪ Avoidance of noisy activities at night, if possible. ▪ Provisions for noise control during maintenance activities.	
c.	Low-noise equipment	This includes low-noise compressors, pumps and flares.	Applicable only when the equipment is new or replaced.
d.	Noise-control equipment.	This includes: ▪ Noise-reducers ▪ Equipment insulation ▪ Enclosure of noisy equipment ▪ Soundproofing of buildings	Applicability may be restricted due to space requirements (for existing plants), health, and safety issues.
e.	Noise abatement	Inserting obstacles between emitters and receivers (e.g. protection walls, embankments and buildings).	Applicable only to existing plants, since the design of new plants should make this technique unnecessary. For existing plants, the insertion of obstacles may be restricted by a lack of space.

Table 8.1 BAT Noise and Vibration (BAT 23)

As per The BREF document, applicability is restricted to cases where a noise or vibration nuisance at sensitive receptors is expected and/or has been substantiated, and or a source is distinctly audible at or beyond the development boundary (i.e. where a significant or adverse effect is determined). This does not conclude that all sources audible beyond the development boundary require to be controlled, but should be considered as part of the BAT assessment.

8.2 BAT Assessment

Table 8.2 details the noise abatement measures that have been implemented as part of the embedded mitigation for each piece of equipment that is a significant noise source alongside the relevant BREF/ BAT reference as per above.

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
BL	Flue Gas Blower Blower	710-BL-001 800-BL-001	Continuous	N/A - Not considered a significant noise source outside of the site.	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	-
BL	Combustion Air Blower	720-BL-001	Continuous	N/A - Not considered a significant noise source outside of the site.	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	-
ZZ3	CHP Package	710-ZZ-001/ 710-BR-001	Continuous	Building specification requires a minimum of 45 dB Rw specification for walls and a minimum of 44 dB Rw roof performance. -28 dB(A) reduction through enclosure or equivalent	**BAT 23** **d.** Noise and vibration control equipment	High	Yes	No further action required	-

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
TB	CHP Steam Turbine Building: Turbine Gearbox Generator	710-TB-001	Continuous	Building specification requires a minimum of 44 dB R_w specification for walls and roof performance Turbine: -20 dB(A) reduction through enclosure of equivalent Gearbox: -10 dB(A) reduction through enclosure of equivalent Generator: -10 dB(A) reduction through enclosure of equivalent	**BAT 23** **d.** Noise and vibration control equipment	High	Yes	No further action required	-
HE	Air Coolers: Quencher Cooler Quencher Air Fin Cooler Reclaimed Waste Cooler Reflux Cooler Wash Water Air Fin Cooler Lean Cooler Reclaimer Condenser Air Fin Intercooler	720-HE-201-A-F 720-HE-202-A-F 720-HE-204-A-E 720-HE-206-A-F 720-HE-211-AB 720-HE-212-A-F 720-HE-214-A-N	Continuous	Air Coolers will only operate as required based on temperature for day and night-time periods.	**BAT 23** **b.** Operational measures **BAT 23** **d.** Noise and vibration control equipment	High	Yes	No further action required	-

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
				VSDs have been applied, inclusion of low noise motors, reduced fan speed has been proposed by increased number of bays, detailed temperature modelling to determine noise emissions for daytime and night-time period and lower noise transmission have been implemented.	**BAT 23** **e.** Noise abatement				
TW	Quencher	720-TW-001	Continuous	Inlet and outlet attenuators	**BAT 23** **d.** Noise and vibration control equipment	High	Yes	No further action required	No alternative attenuator can be used due to limited pressure drop allowances.
TW	Absorber	720-TW-002A	Continuous	Inlet and outlet attenuators	**BAT 23** **d.** Noise and vibration control equipment	High	Yes	No further action required	No alternative attenuator can be used due to limited pressure drop allowances.

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
TW	Treated Gas Wash Tower	720-TW-002B	Continuous	Inlet and outlet attenuators	**BAT 23** **d.** Noise and vibration control equipment	High	Yes	No further action required	No alternative attenuator can be used due to limited pressure drop allowances.
TW	Ducting	-	Continuous	Inlet and outlet attenuators	**BAT 23** **d.** Noise and vibration control equipment	High	Yes	No further action required	No alternative attenuator can be used due to limited pressure drop allowances.
PU	Pumps	710-PU-002AB 710-PU-003AB 710-PU-004AB 710-PU-005AB	All equipment packages run continuously. VSD applied where operation allows.	Sympathetic plant location has been adopted for this equipment i.e., location of equipment considers location of other equipment and buildings in the vicinity for screening. Low noise emission plant selection considered within the design process. The equipment is not considered a	**BAT 23** **a.** Appropriate location of equipment and buildings **BAT 23** **b.** Operational measures	Low	Yes	No further action required	Equipment maintenance plans in place as appropriate.

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
				significant noise source outside of the site.	**BAT 23** **c.** Low-noise equipment				
PU2	Pumps	740-PU-002AB 740-PU-001AB 740-PU-0010AB 740-PU-0011ABC 740-PU-0012AB 740-PU-0013AB	All running continuously with the exception of: 740-PU-0010AB – Intermittently 740-PU-0014AB – 1-hour per day. Daytime only	Where plant is not running continuously, consideration has been made so that when equipment is needing to be operational for certain periods, this is to be during daytime only and not during the most sensitive time period. I.e., night-time. Low noise emission plant selection considered within the design process.	**BAT 23** **a.** Appropriate location of equipment and buildings **BAT 23** **b.** Operational measures	Low	Yes	No further action required	Equipment maintenance plans in place as appropriate.
PU3	Pumps	800-PU-001AB 800-PU-002AB 800-PU-003AB 800-PU-004 800-PU-005	All running continuously with the exception of: 800-PU-004 – 2-hours per daytime 800-PU-005 – 2hours per daytime		**BAT 23** **a.** Appropriate location of equipment and buildings **BAT 23** **b.** Operational measures	Low	Yes	No further action required	Equipment maintenance plans in place as appropriate.

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
				Where plant is not running continuously, consideration has been made so that when equipment is needing to be operational for certain periods, this is to be during daytime only and not during the most sensitive time period. I.e., night-time.	**BAT 23** **c.** Low-noise equipment				
PU4	Pumps	720-PU-004AB 720-PU-006 720-PU-007AB 720-PU-009AB 720-PU-010AB 720-PU-012AB 720-PU-013AB 720-PU-016AB 720-PU-017AB 720-PU-018AB 720-PU-019	Continuously	Sympathetic plant location has been adopted for this equipment i.e., location of equipment considers location of other equipment and buildings in the vicinity for screening. Low noise emission plant selection considered within the design process. The equipment is not considered a significant noise source outside of the site.	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	Equipment maintenance plans in place as appropriate.

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
		720-PU-024AB 720-PU-025AB 720-PU-027AB 720-PU-029AB 720-PU-032AB 720-PU-033 720-PU-034 720-PU-051 720-PU-052 720-PU-053 720-PU-054 720-PU-35AB 720-PU-002AB			**BAT 23** **c.** Low-noise equipment				
PU5	Pumps	720-PU-008AB 720-PU-041 720-PU-001AB 720-PU-003AB	Continuous	Inclusion of -17 dB(A) lagging as part of the design. Sympathetic plant location has been adopted for this	**BAT 23** **a.** Appropriate location of equipment and buildings	Medium	Yes	No further action required	-

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
				equipment i.e., location of equipment considers location of other equipment and buildings in the vicinity for screening.	**BAT 23** **d.** Noise and vibration control equipment **BAT 23** **c.** Low-noise equipment				
PU7	Pumps	720-PU-016AB 720-PU-009AB 720-PU-012AB 720-PU-013AB 740-PU-004AB	Continuous	Inclusion of -11 dB(A) lagging as part of the design.	**BAT 23** **d.** Noise and vibration control equipment	Medium	Yes	No further action required	-
PU7	Pumps	720-PU-023AB 720-PU-005AB 720-PU-011ABC 720-PU-021ABC	Continuous	Inclusion of -17 dB(A) lagging as part of the design. Equipment specific localised screening i.e., the equipment accounts for specific screening localised at the equipment.	**BAT 23** **a.** Appropriate location of equipment and buildings	Medium	Yes	No further action required	-

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
					BAT 23 **d.** Noise and vibration control equipment				
PU8	Pumps	Water Treatment Pumps - Small Water Treatment Pumps - Medium	Continuous	Equipment is enclosed in a building.	**BAT 23** **a.** Appropriate location of equipment and buildings **BAT 23** **d.** Noise and vibration control equipment	Low	Yes	No further action required	-
ME	LP Steam Desuperheater	710-ME-002	Continuous	The equipment is not considered a significant noise source outside of the site and therefore, no mitigation has been considered.	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	-
ME	LP Steam By-pass Desuperheater	710-ME-003	Continuous	The equipment is not considered a significant noise source outside of the site and therefore, no mitigation has been considered.	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	-

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
ZZ1	Filtration Unit	720-ZZ-001	Continuous	Inclusion of -17 dB(A) lagging as part of the design. Equipment specific localised screening i.e., the equipment accounts for specific screening localised at the equipment.	**BAT 23** **a.** Appropriate location of equipment and buildings **BAT 23** **d.** Noise and vibration control equipment	Medium	Yes	No further action required	-
	Acid Wash Concentrator	720-ZZ-002	Wash water pump - few hours every 6 days 40-KS-FLT-0001-PM2-002 Circulation pump KS-FLT-0001-PM2-002	The equipment is not considered a significant noise source outside of the site and therefore, no mitigation has been considered.	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	-
ZZ	Cooling Water Chemical Dosing	740-ZZ-005	Continuous	Sympathetic plant location has been adopted for this equipment i.e., location of equipment considers location of other equipment and buildings in the vicinity for screening. Low noise emission plant selection considered within the design process.	**BAT 23** **a.** Appropriate location of equipment and buildings **BAT 23** **c.** Low-noise equipment	Low	Yes	No further action required	-

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
				The equipment is not considered a significant noise source outside of the site.					
ZZ	Oxygen Scavenger Injection Package	710-ZZ-002	Continuous	The equipment is not considered a significant noise source outside of the site and therefore, no mitigation has been considered.	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	-
ZZ	Anti-Foam Injection Unit	720-ZZ-011	Continuous	Sympathetic plant location has been adopted for this equipment i.e., location of equipment considers location of other equipment and buildings in the vicinity for screening. The equipment is not considered a significant noise source outside of the site.	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	-

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
ZZ	H2 Generation Unit	730-ZZ-001	Continuous	Inclusion of -17 dB(A) lagging. Equipment specific localised screening i.e., the equipment accounts for specific screening localised at the equipment.	**BAT 23** **a.** Appropriate location of equipment and buildings **BAT 23** **d.** Noise and vibration control equipment	Medium	Yes	No further action required	-
ZZ	Dehydration Unit	730-ZZ-002	Continuous	Inclusion of -17 dB(A) lagging. Equipment specific localised screening i.e., the equipment accounts for specific screening localised at the equipment.	**BAT 23** **a.** Appropriate location of equipment and buildings **BAT 23** **d.** Noise and vibration control equipment	Medium	Yes	No further action required	-
ZZ	Instrument Air Compressor Package	740-ZZ-002	Continuous	Sympathetic plant location has been adopted for this equipment i.e., location of equipment considers location of other equipment and buildings in the vicinity for screening. The equipment is not considered a	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	-

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
				significant noise source outside of the site.					
ZZ	Instrument Air Dryer Package	740-ZZ-003	Venting 1-minute every 4-hours	Sympathetic plant location has been adopted for this equipment i.e., location of equipment considers location of other equipment and buildings in the vicinity for screening. Silencer on the Air Dryer package vent The equipment is not considered a significant noise source outside of the site.	**BAT 23** **a.** Appropriate location of equipment and buildings	Medium	Yes	No further action required	-
ZZ	Nitrogen Generation Package	740-ZZ-004	Continuous	Sympathetic plant location has been adopted for this equipment i.e., location of equipment considers location of other equipment and	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	-

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
				buildings in the vicinity for screening. The equipment is not considered a significant noise source outside of the site.					
ZZ	Electro Chlorination Package	740-ZZ-008	Continuous	The equipment is not considered a significant noise source outside of the site and therefore, no mitigation has been considered.	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	-
TR	Transformer	Transformer	Continuous	Sympathetic plant location has been adopted for this equipment i.e., location of equipment considers location of other equipment and buildings in the vicinity for screening. Low noise plant selection.	**BAT 23** **a.** Appropriate location of equipment and buildings **BAT 23** **c.** Low-noise equipment	Low	Yes	No further action required	-

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
CP	Compressor	730-CP-001	Continuous	Building requires a minimum of 47 dB R_w specification for walls and roof performance Motor: 0 dB(A) attenuation Compressor: -15 dB(A) attenuation Intercoolers: -45 dB(A) attenuation The compressor will only be operational when all doors and primary roller shutter door are closed. Inclusion of silencers	**BAT 23** **d.** Noise and vibration control equipment	High	Yes	No further action required	-
MX	Agitator motor sitting on top of each tank	740-TK-010-MX1 720-MX-001-A 720-MX-001-B 720-MX-002 720-MX-003 720-MX-004	Continuous	N/A - Not considered a significant noise source outside of the site.	**BAT 23** **a.** Appropriate location of equipment and buildings	Low	Yes	No further action required	-

Noise Source Ref.	Noise Source	Source ID Tag	Operational Frequency	Mitigation Currently Implemented	Relevant BREF/BAT Ref.	Subjective Contribution to Off-site Receptors	BAT Implemented – Yes/No?	Additional actions to be taken to meet BAT and timescales	Further Comments
TW	Cooling towers (inclusion of fans sitting on top of the tanks).	740-TW-001	Continuous	Water splash noise abatement and includes Temperature-based operations – 5dB(A)	**BAT 23** **b.** Operational measures	High	Yes	No further action required	-
					BAT 23 **d.** Noise and vibration control equipment				
					BAT 23 **e.** Noise abatement				

Table 8.2 BAT Assessment

9 Conclusions

RSK Acoustics (RSKA) has been instructed by Heidelberg Materials UK to undertake a noise impact assessment in support of an Environmental Permit Variation Application for the proposed CCS Project on the existing Padeswood site.

Baseline unattended noise measurements were undertaken at four locations, covering the closest noise sensitive receptors to the facility.

A noise assessment has been undertaken which compares the predicted rating noise levels of the proposed development against the derived background noise level at the considered noise sensitive receptors.

With consideration to the application of rating corrections, the application of tonality, intermittency or impulsivity corrections is not deemed necessary. For general industry, the location for the proposed development is already influenced by the existing industrial facility at a number of receptor locations, therefore, the proposed development is not introducing a new noise character at locations where existing industry is audible.

During the baseline noise survey, observations were made at locations MP1 and MP2, which noted that the existing site was audible. As a result, it is not deemed necessary to apply a character correction at receptors associated with MP1 and MP2 monitoring locations.

During observations at MP3 and MP4 activities associated with the existing facility were not noted, and therefore a +3 dB(A) has been applied to all relevant receptors where the specified noise level is less than 10 dB(A) below background.

This correction has been applied in line with both British Standards ‘BS 4142:2014+A1:2019’ and NRW Guidance ‘Noise and Vibration Management: Environmental Permit’ requirements.

When compared to the derived background noise levels, the predicted rating levels during normal conditions are +4 dB(A) above background noise levels at Dyke Farm and Well House Farm receptors. In accordance with BS 4142: 2014+A1: 2019, this is an indication of the development having a low impact on the existing (and nearest) sensitive receptors with consideration to context.

The context considers that the proposed development is in keeping with the character of noise within the current soundscape. Additionally, the increase in ambient noise levels as a result of the proposed development is expected to less than +2 dB(A) increase, which would be experienced as a barely perceptible change.

Based on the computer noise modelling and influence of plant at the receptor locations, an assessment has been made of the Best Available Techniques (BAT) on site to determine where improvement measures can be implemented. The BAT assessment shows that no further noise control measures are considered appropriate for the proposed plant, with the design already embedding various mitigation measures (BAT).

Glossary

Term	Definition
Ambient sound	The total sound at a given place, usually a composite of sounds from many sources near and far.
Background sound, $L_{A90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval.
dB	Decibel. Scale for expressing sound pressure level. It is defined as 20 times the logarithm of the ratio between the root mean square pressure of the sound field and a reference pressure i.e. $2x10^{-5}$ Pascal.
dB(A)	A-weighted decibel. This provides a measure of the overall level of sound across the audible spectrum with a frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies. Example sound levels include: 140 dB(A) Threshold of pain 120 dB(A) Threshold of feeling 100 dB(A) Loud nightclub 80 dB(A) Traffic at busy roadside 60 dB(A) Normal speech level at 1m 40 dB(A) Quiet office 20 dB(A) Broadcasting studio 0 dB(A) Median hearing threshold (1000 Hz)
Frequency	The repetition rate 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 thousand hertz is often denoted as kHz, e.g. 2 kHz = 2000 Hz. Human hearing ranges approximately from 20 Hz to 20kHz.
$L_{Aeq,T}$	This is defined as the notional steady sound level over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
Rating level	Specific sound level of a source plus any adjustment for the characteristic features of the sound.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Sound absorption	Process whereby sound energy is converted in to heat. Sound absorption properties is expressed as the sound absorption coefficient α or the sound absorption class (A-E).
Sound insulation	The reduction or attenuation of airborne sound by a solid element between source and receiver.
Specific sound	Sound pressure level produced by the source being assessed at the assessment location.

Table A 1 Glossary

Appendix A – Site Layout Plan

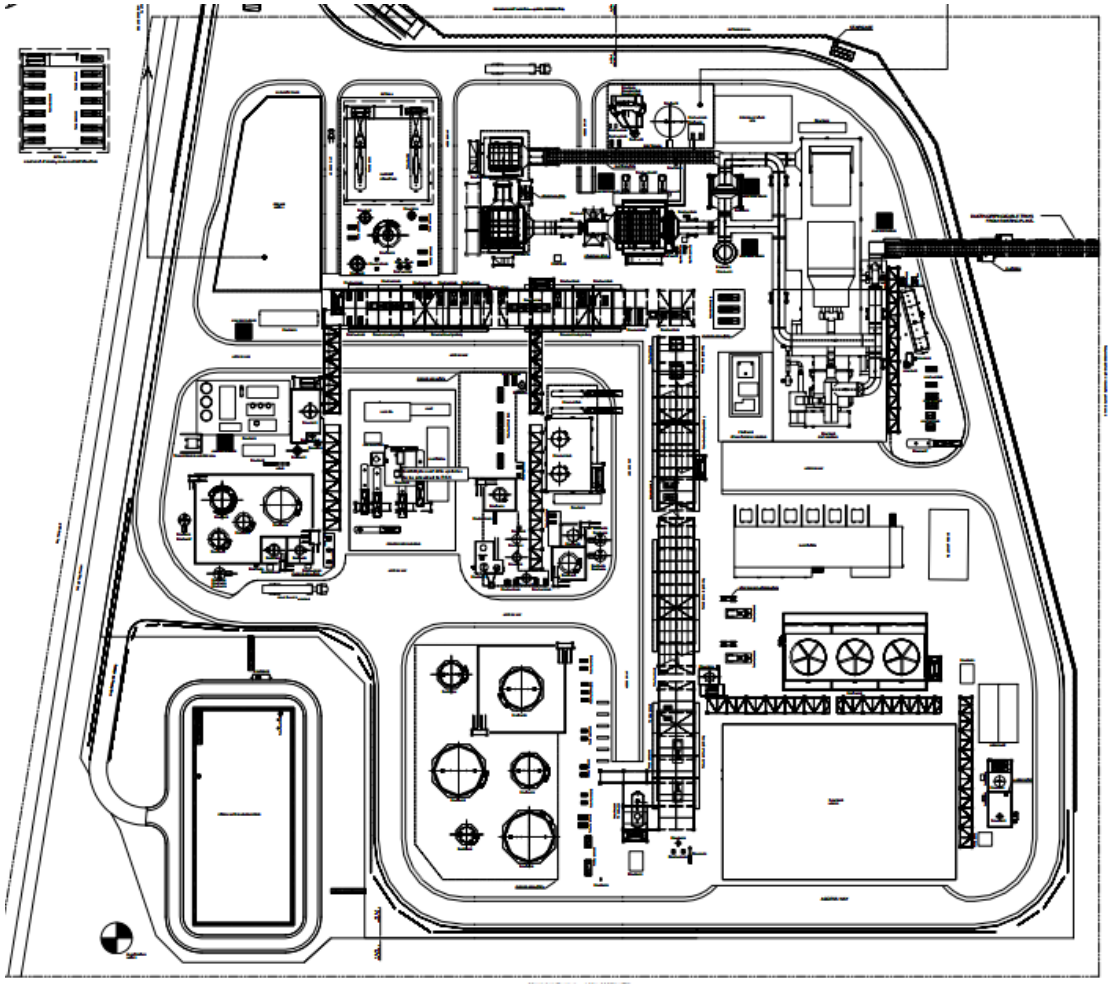


Figure A 1 Site Location

Appendix B – Noise Monitoring Installation Photographs

Figure B 1 Noise Monitoring Location MP1

Figure B 2 Noise Monitoring Location MP2

Figure B 3 Noise Monitoring Location MP3

Figure B 1 Noise Monitoring Location MP4

Appendix C – Weather Data

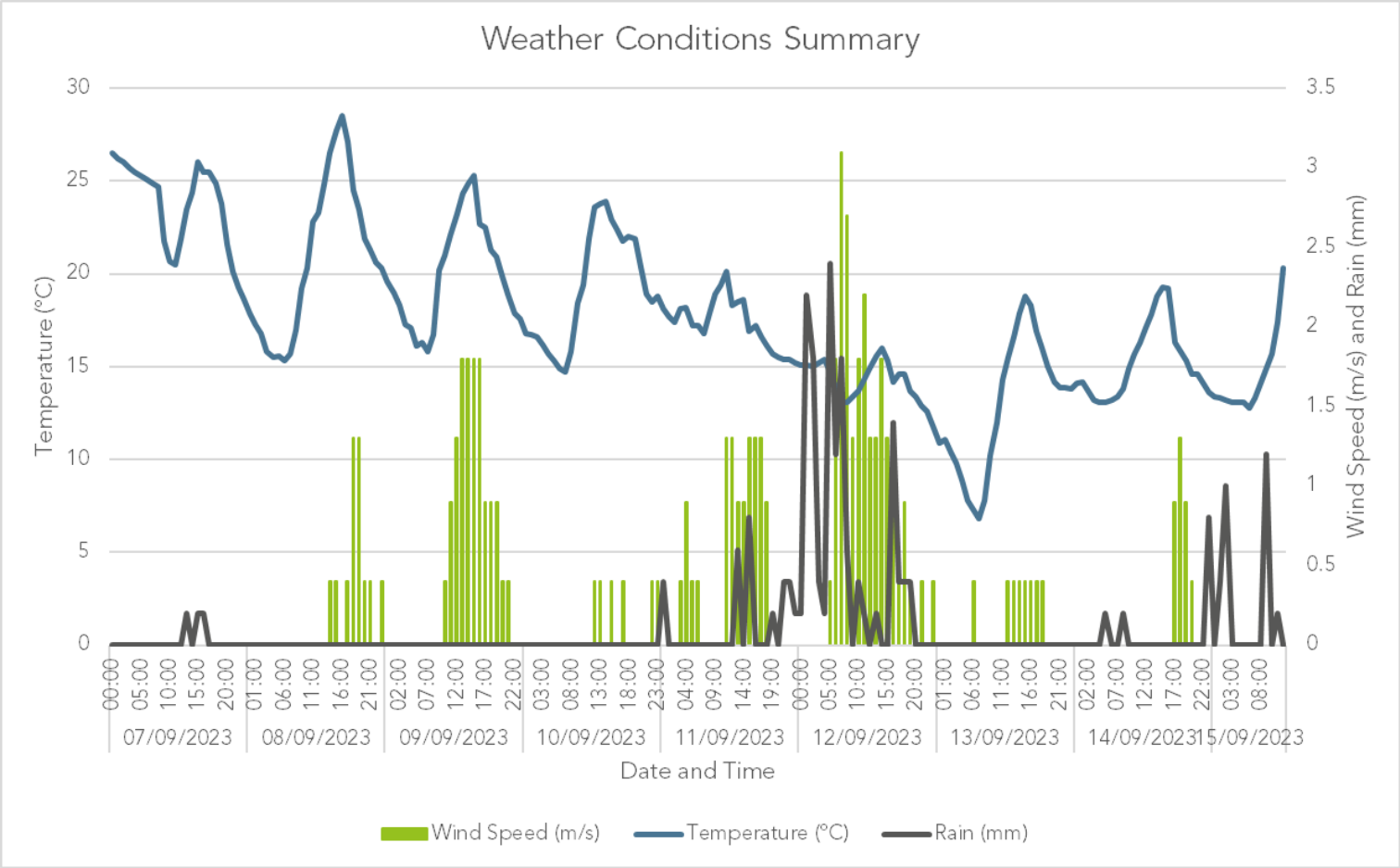


Figure C 1 Weather conditions summary

Appendix D – Measured Noise Levels

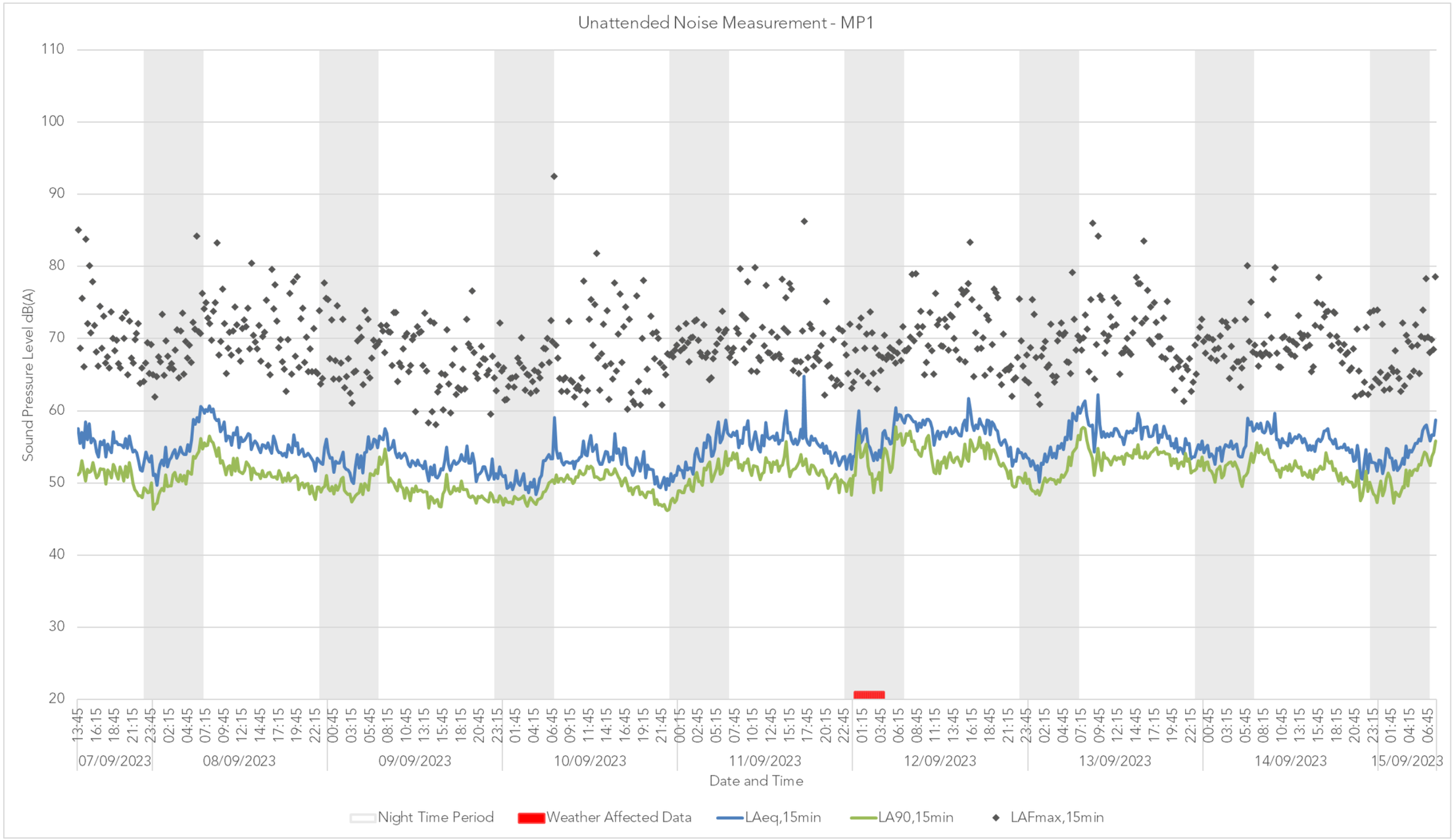


Figure D 1 Unattended noise monitoring summary MP1

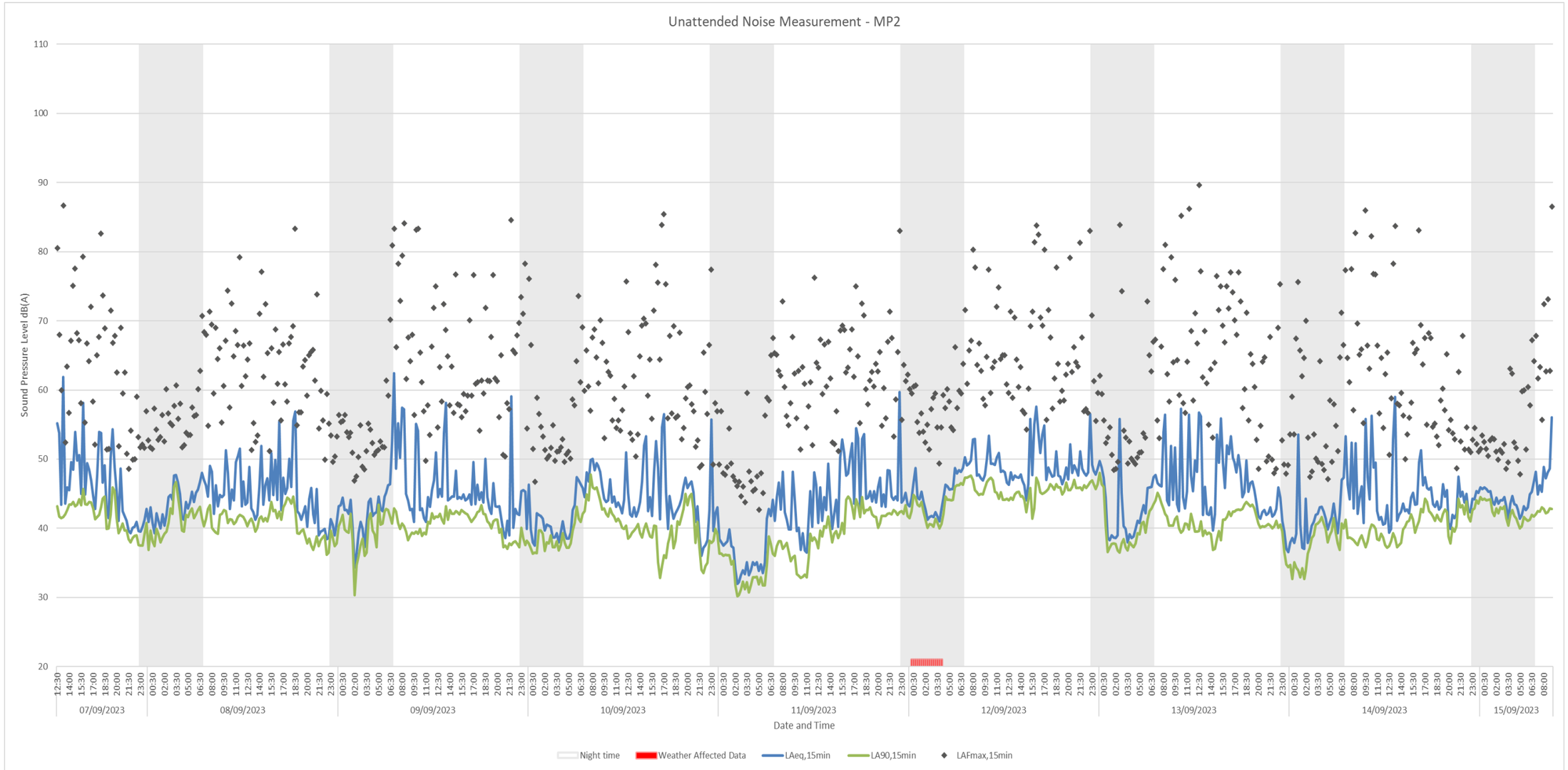


Figure D 2 Unattended noise monitoring summary MP2

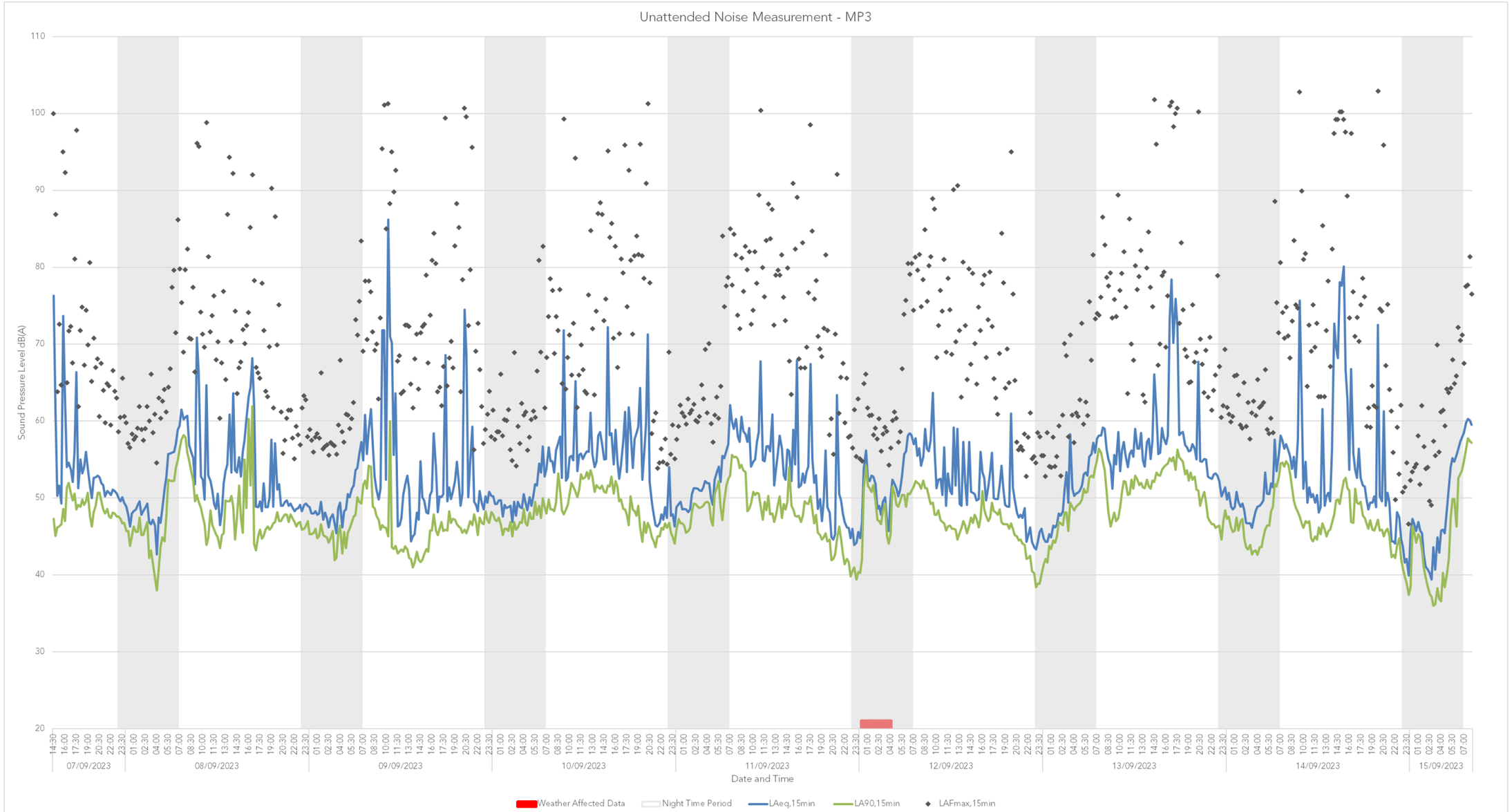


Figure D 3 Unattended noise monitoring summary MP3

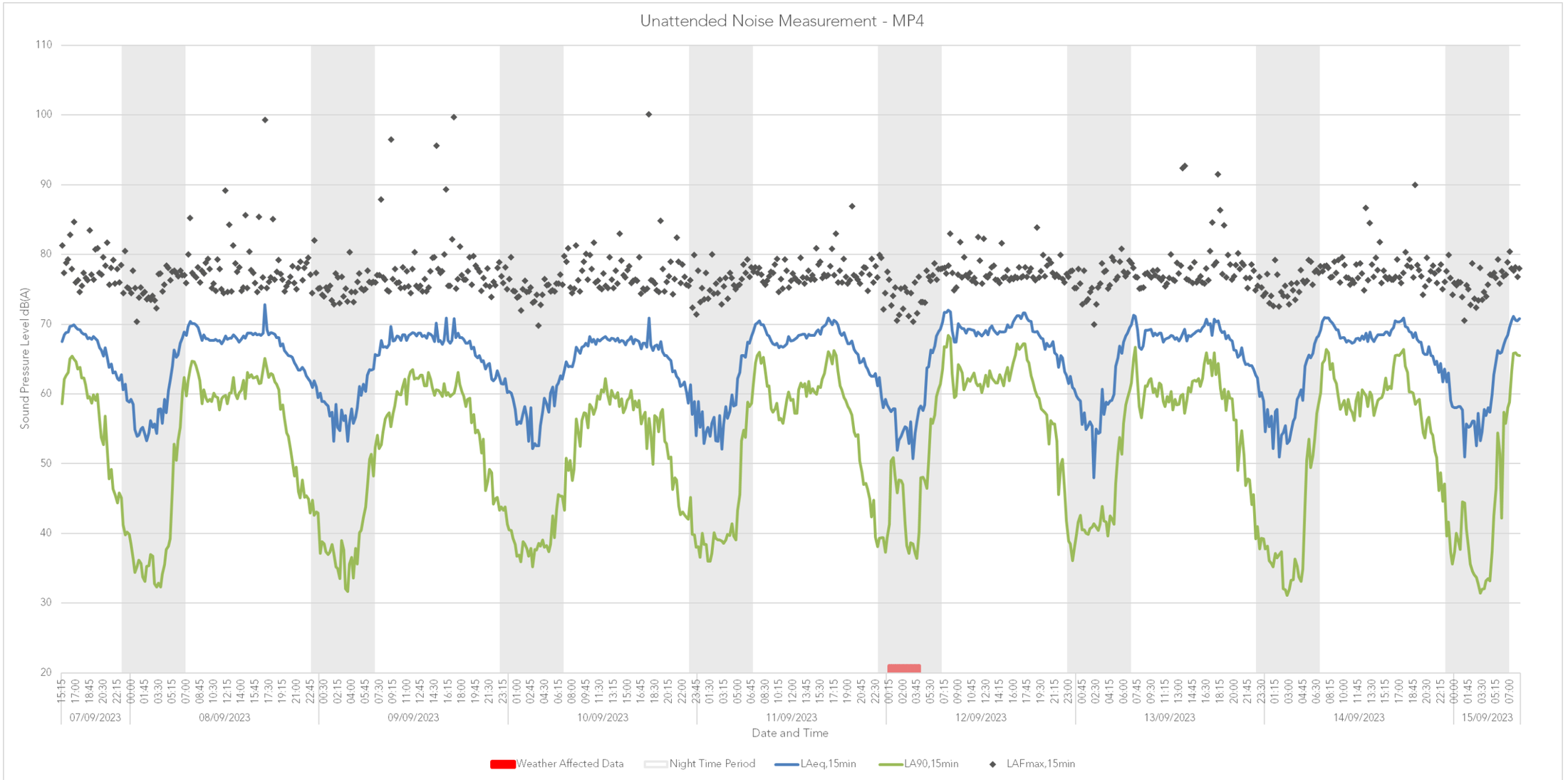


Figure D 4 Unattended noise monitoring summary MP4

Appendix E - Statistical Analysis

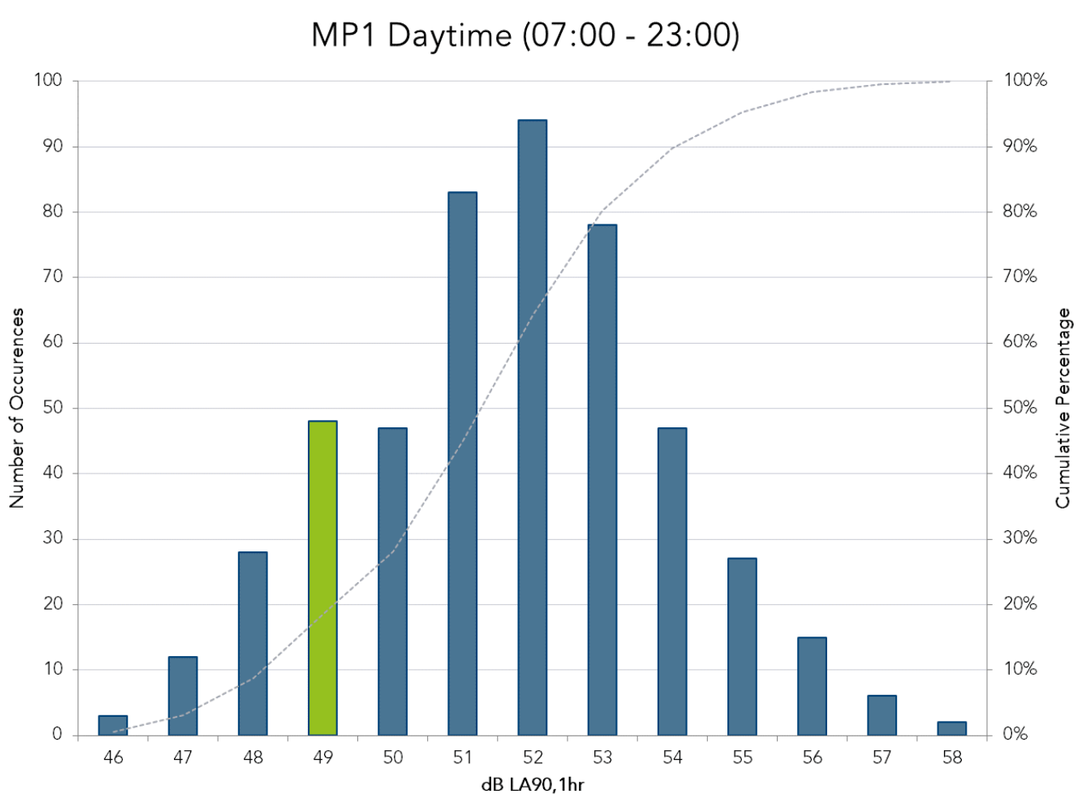
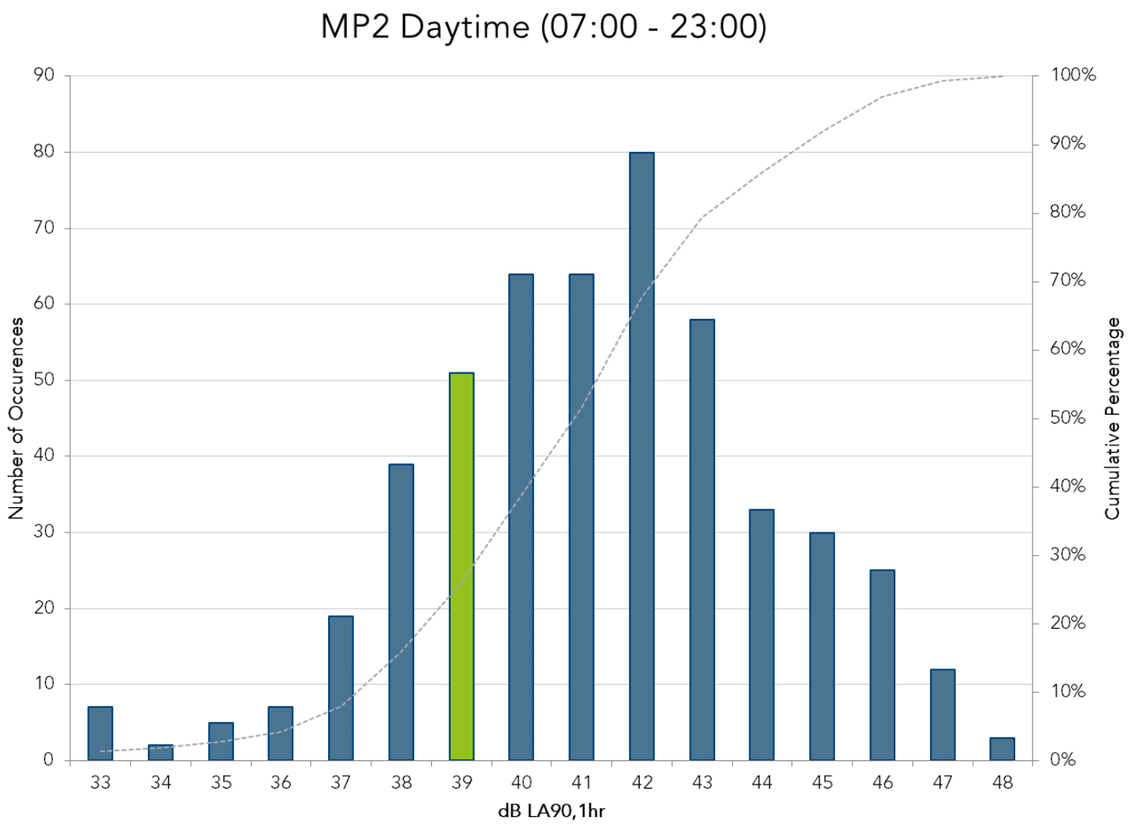


Figure E 1 Statistical Analysis MP1



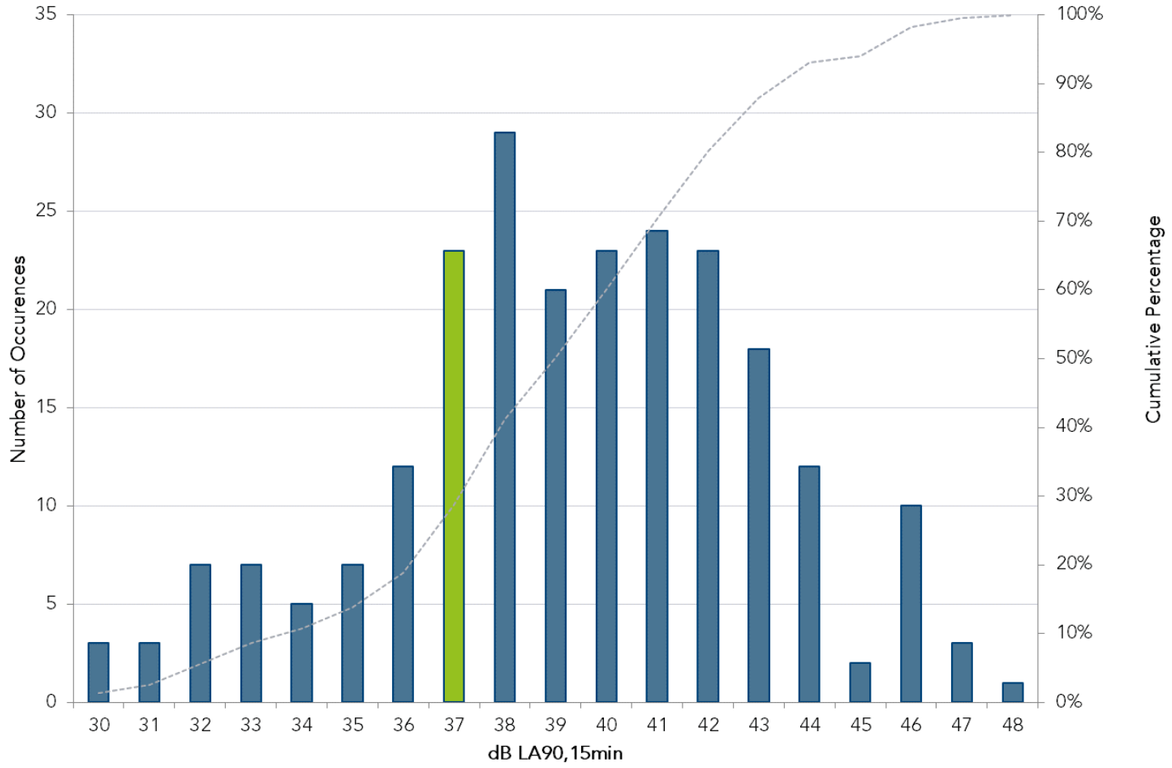


Figure E 2 Statistical Analysis MP2

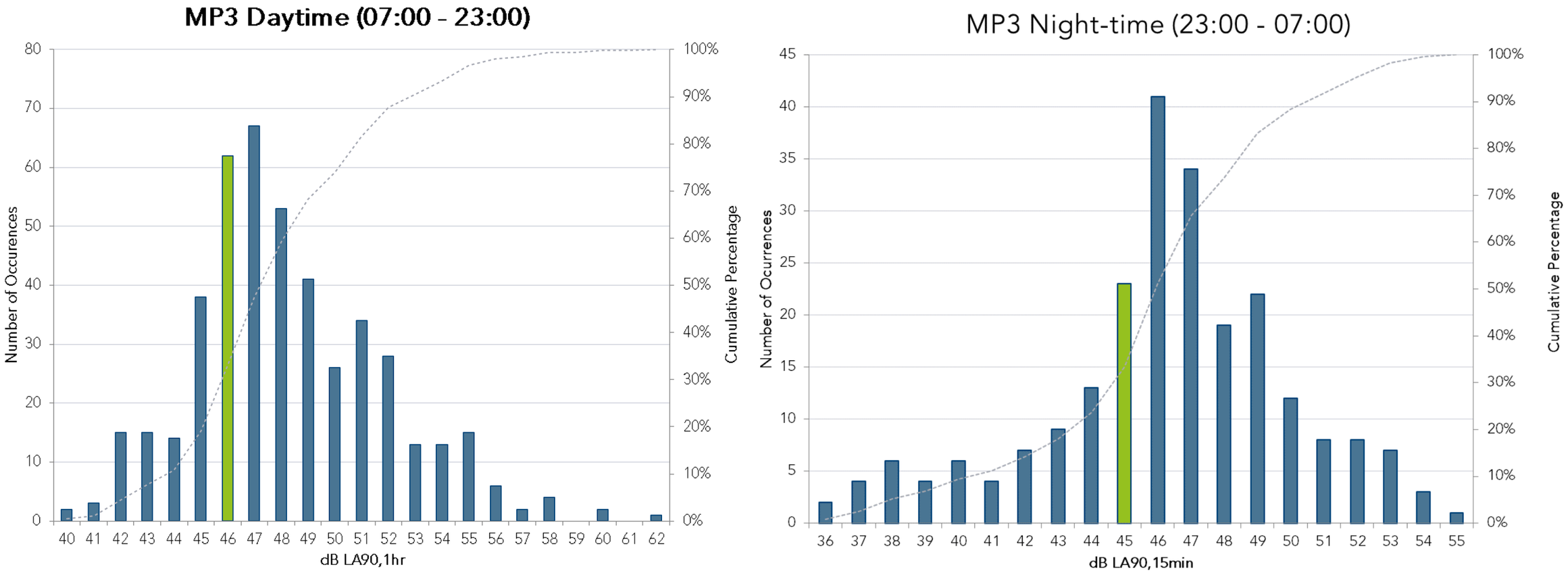


Figure E 3 Statistical Analysis MP3

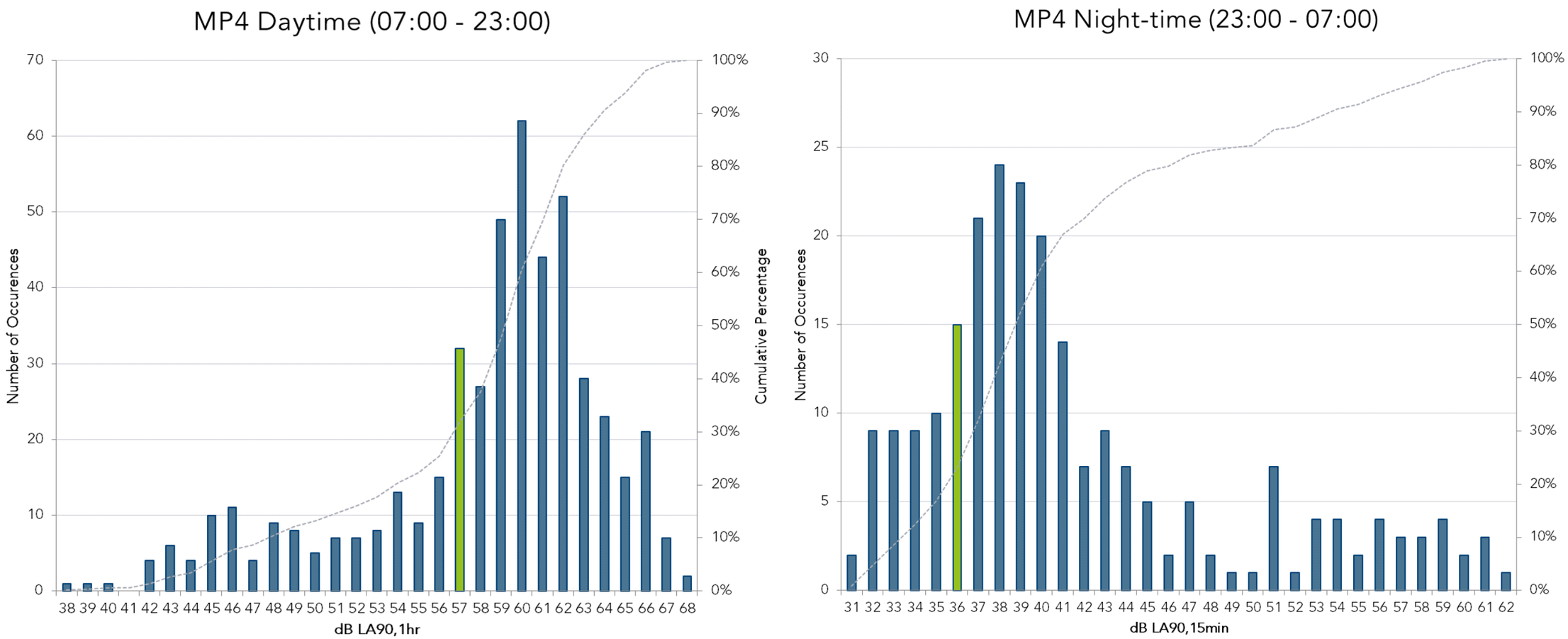


Figure E 4 Statistical Analysis MP4

Appendix F – Recommended Building Specifications

Plant Item	Element	Rw	C	Ctr	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Compressor Building	Walls	47	-4	-10	18	24	37	48	53	55	63
	Roof	47	-4	-10	18	24	37	48	53	55	63
CHP Package	Walls	45	-3	-9	18	23	35	44	49	50	61
	Roof	44	-5	-11	11	19	36	48	54	61	73
Turbine Building	Walls	47	-4	-10	18	24	37	48	53	55	63
	Roof	44	-5	-11	11	19	36	48	54	61	73

Table F 1 Recommended minimum building specifications

Appendix G – Equipment Contribution at Receptors

Address	Equipment Component	Predicted Noise Level Contribution, dB(A)
2 Padeswood Drive	710-BL-001	25
	740-TW-001	24
	720-PU-005A	23
	720-zz-011	23
	720-PU-014AB	22
3 Padeswood Drive	710-BL-001	24
	720-PU-005A	23
	720-ZZ-011	22
	720-PU-014A/B	22
	720-PU-003B	20
6 Padeswood Drive	720-PU-005A	23
	710-BL-001	22
	720-PU-014A/B	22
	720-ZZ-011	22
	720-PU-003B	20
7 Padeswood Drive	720-PU-014AB	22
	720-ZZ-011	22
	710-BL-001	21
	720-PU-005A	20
	720-HE-215B	20
10 Padeswood Drive	740-TW-001	24
	800-PU-002AB	24
	710-BL-001	22
	720-PU-014AB	22
	720-ZZ-011	21
11 Padeswood Drive	740-TW-001	24
	710-BL-001	24
	720-ZZ-011	24
	800-PU-002AB	23
	720-PU-014AB	21
14 Ffordd Derwyn, Penyffordd	740-TW-001	26
	740-ZZ-004	19
	Water Treatment Building	17
	740-PU-004B	17
	740-ZZ-002	15
33 Ffordd Derwyn, Penyffordd	740-TW-001	26
	740-ZZ-004	20
	Water Treatment Building	17
	740-ZZ-002	16
	710-HE-008A	15

Address	Equipment Component	Predicted Noise Level Contribution, dB(A)
34 Plas Yn Rhos, Penyffordd	740-TW-001	25
	740-ZZ-004	19
	Water Treatment Building	16
	740-PU-004B	16
	740-ZZ-002	15
38 Plas Yn Rhos, Penyffordd	740-TW-001	25
	740-ZZ-004	19
	Water Treatment Building	17
	740-PU-004B	17
	740-ZZ-002	15
40 Plas Yn Rhos, Penyffordd	740-TW-001	25
	740-ZZ-004	19
	740-PU-004B	18
	Water Treatment Building	17
	740-ZZ-002	15
44 Plas Yn Rhos, Penyffordd	740-TW-001	26
	740-ZZ-004	19
	740-PU-004B	17
	Water Treatment Building	17
	740-ZZ-002	15
Bannel Farm	740-TW-001 - Wet Air Inlet 2	20
	740-TW-001 - Wet Air Inlet 1	18
	710-BL-001	18
	Water Treatment Building	18
	710-BL-001	17
Beudy Coch	740-PU-004B	24
	720-ZZ-011	21
	720-PU-003B	20
	Water Treatment Building	20
	720-PU-013A/B	20
Camfa Rheinallt Farm	720-ZZ-011	21
	720-PU-003B	20
	Water Treatment Building	20
	720-PU-013A/B	19
	740-ZZ-004	19
Dyke Farm	720-PU-006	27
	720-PU-027	27
	740-PU-004B	25
	720-HE-211	25
	720-PU-013AB	24
Hendy Cottage	720-ZZ-011	23
	740-TW-001	23
	720-ZZ-001	21

Address	Equipment Component	Predicted Noise Level Contribution, dB(A)
	Pipework - Intercoolers	20
	720-PU-033	20
Homelea	800-PU-002AB	28
	800-PU-001AB	27
	720-PU-014AB	27
	720-ZZ-011	25
	720-PU-017A	22
Laburnam Cottage	720-PU-014AB	29
	740-TW-001	29
	720-PU-005A	27
	720-PU-003B	26
	720-PU-007A	26
Brook Meadow Housing Estate	710-BL-001	18
	740-TW-001	17
	Water Treatment Building	17
	710-BL-001	17
	710-HE-008A	14
Oak Drive	740-TW-001	23
	740-ZZ-004	19
	740-ZZ-002	15
	Water Treatment Building	15
	Pipework - Intercoolers	14
Oak Tree Farm, A5118	720-PU-014AB	31
	740-TW-001	30
	720-PU-003B	28
	720-PU-007A	27
	720-HE-215B	26
Oak Tree Farm, Bannel Lane	740-TW-001 - Wet Air Inlet 2	20
	740-TW-001 - Wet Air Inlet 1	18
	710-BL-001	18
	Water Treatment Building	18
	710-BL-001	17
Pen-Yr-Allt Farm	740-PU-004B	22
	710-PU-002B	19
	720-ZZ-001	19
	720-PU-014AB	19
	Water Treatment Building	19
The Gables	800-PU-001AB	25
	740-PU-004B	21
	Water Treatment Building	20
	Pipework - Intercoolers	19
	720-HE-215B	18

Address	Equipment Component	Predicted Noise Level Contribution, dB(A)
The Old Barn	740-PU-004B	22
	710-PU-002B	19
	720-ZZ-001	19
	720-PU-014AB	19
	Water Treatment Building	19
Toll Bar Cottage	720-PU-003B	20
	Water Treatment Building	20
	720-PU-013AB	19
	740-ZZ-004	19
	800-BL-001	18
Ty Gwyn Farm	720-PU-014AB	28
	740-TW-001	27
	720-PU-005A	24
	720-PU-003B	22
	720-PU-006	22
Well House Farm	740-PU-004B	29
	720-ZZ-011	27
	720-PU-013A/B	25
	710-PU-002B	24
	Water Treatment Building	24
Springfield	800-PU-002AB	18
	740-TW-001	16
	Ductwork	15
	Water Treatment Building	14
	710-HE-008A	14

Table G 1 Equipment contributions at receptors - daytime

Appendix H – Noise Contour Maps

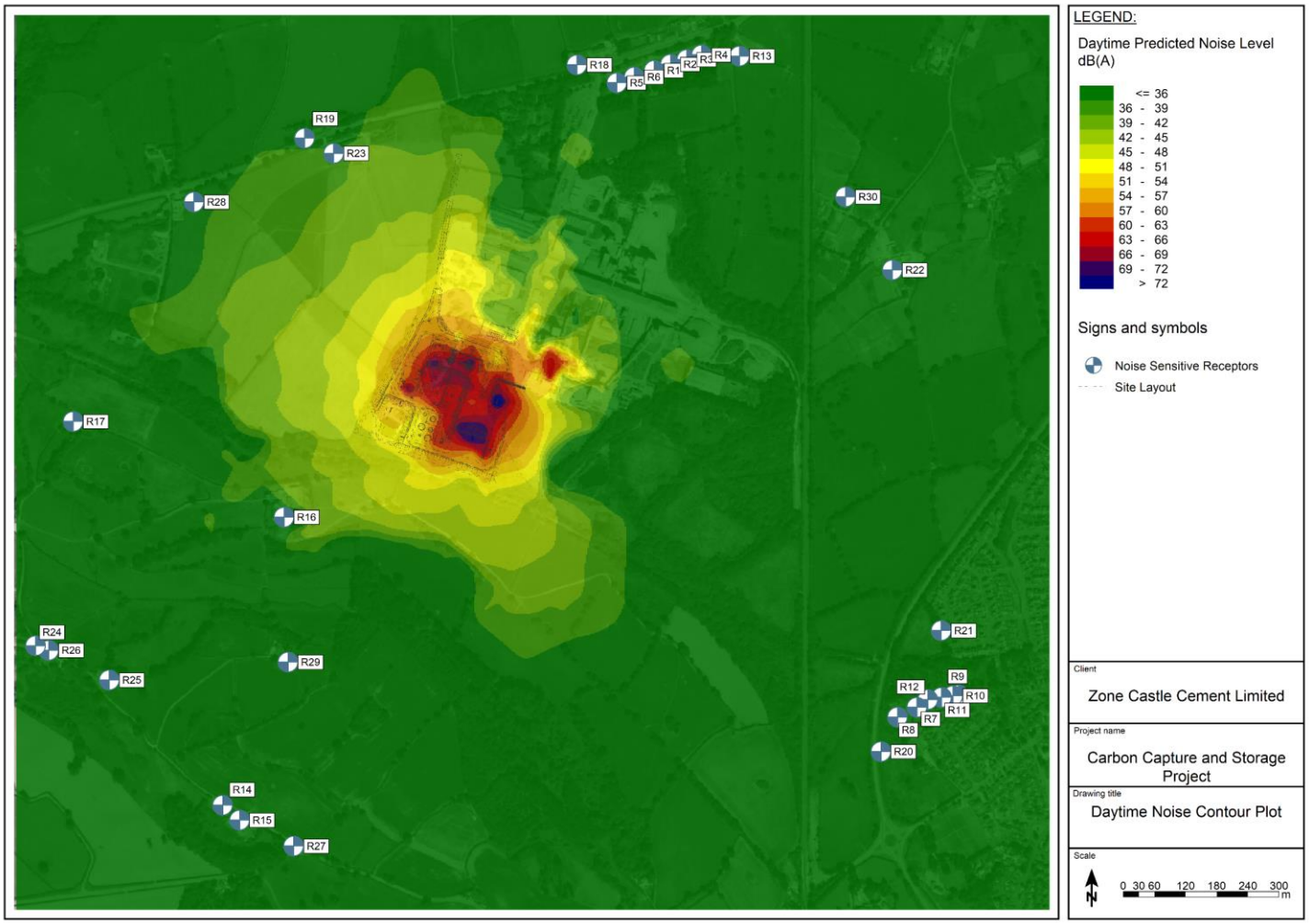


Figure H 1 Daytime Noise Contour Map

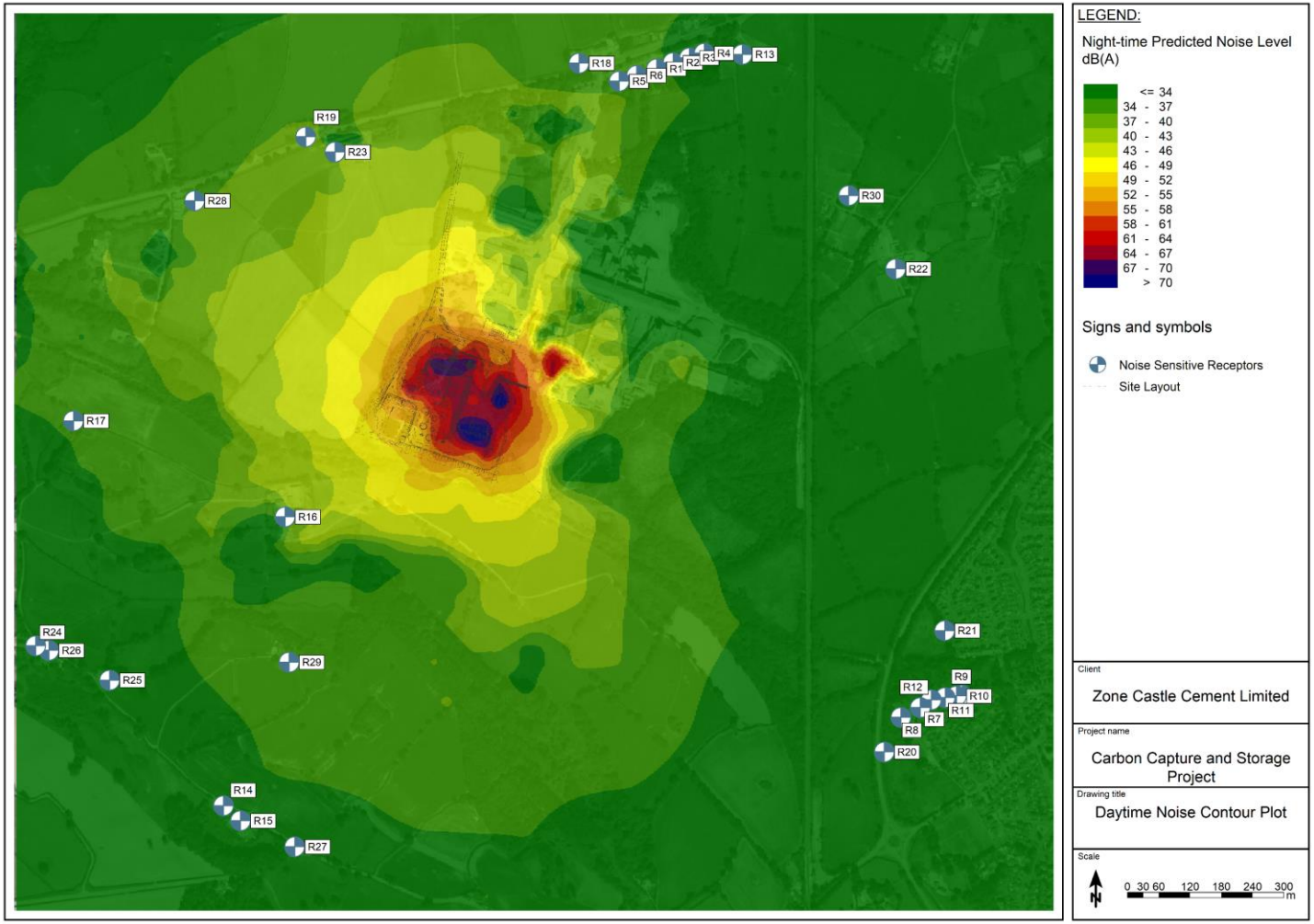


Figure H 2 Night-time Contour Map

RSK acoustics

Institute of Acoustics 50 Sponsoring Organisation

bsi. ISO 9001 Quality Management

bsi. ISO 14001 Environmental Management

bsi. ISO 45001 Occupational Health and Safety Management

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BUILDER'S PROFILE