NOISE IMPACT ASSESSMENT FOR ENVIRONMENTAL PERMITTING

For Tenmat, Permali, Gloucester

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Noise Impact Assessment for Enviromental Permitting
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1 Introduction

1.1.1 The Acoustics Team of RPS Planning and Environmental (RPS) has been appointed by Permali Gloucester Ltd to provide a noise impact assessment of the operational noise levels from the Permali facility at 270 Bristol Road, Gloucester, GL1 5TT. The site is located within the local authorities of Gloucestershire County Council (GSCC) and Gloucester City Council (GCC).

1.1.2 This noise impact assessment has been prepared to support the application for the Environmental Permit (EP) for the existing Permali manufacturing facility of composite and PU material solutions.

1.1.3 An environmental sound survey was undertaken on site, at locations representative of the nearest noise sensitive receptors (NSRs) to establish the baseline sound conditions.

1.1.4 Details of the type of new plant proposed to operate at the facility with associated noise emissions were provided by the client.

1.1.5 A 3D sound model of the facility was built, considering the provided plant noise levels, to predict specific sound levels from the facility at the NSRs. An assessment of the impact of the predicted specific sound levels was undertaken based on the methodology detailed in British Standard (BS) 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'[1].

1.1.6 The assessment is based upon appropriate information regarding the proposed development provided by the design team and the client. RPS is a member of the Association of Noise Consultants (ANC), the representative body for acoustics consultancies, having demonstrated the necessary professional and technical competence. The assessment has been undertaken with integrity, objectivity and honesty in accordance with the Code of Conduct of the Institute of Acoustics (IOA) and ethically, professionally and lawfully in accordance with the Code of Ethics of the ANC.

1.1.7 The technical content of this assessment has been provided by RPS personnel, all of whom are members of the IOA (the UK's professional body for those working in acoustics, noise and vibration). This report has been peer reviewed within the RPS team to ensure that it is technically robust and meets the requirements of our Integrated Management System. Our Personnel and Individual Qualifications are given in Appendix A.

[1] British Standards Institution (BSI). British Standard 4142:2014+A1:2019. Methods for rating and assessing industrial and commercial sound. 2019.

2 REGULATIONS, STANDARDS AND GUIDANCE

Environmental Permitting Regulations

2.1.1 The Environmental Permitting (England and Wales) Regulations 2010 (EPR) designate the Environment Agency (EA) as the 'Regulator' responsible for enforcing the regime. As part of its role as regulator, the Environment Agency is responsible for producing guidance for use in enforcing the EPR. However, such guidance has not yet been produced and, in the interim period, it is understood that the existing guidance documents for the old IPPC regime may continue to be used.

2.1.2 The Regulations require that installations should be operated in such a way that all appropriate preventative measures are taken against pollution, in particular with the application BAT. BAT includes both the technology used and the way in which the installation is designed, built, operated and decommissioned.

Noise and vibration management: environmental permits

2.1.3 The Environment Agency, Scottish Environment Protection Agency (SEPA), Natural Resources Wales and Northern Ireland Environment Agency have produced a guidance[2] on environmental permits to help holders and potential holders of permits apply for, vary, and comply with their permits. The guidance was published on 23 July 2021, and it replaces the H3 guidance.

2.1.4 For each particular case, the environment agencies have to decide whether or not a proposed facility is causing (or are likely to cause) unacceptable noise pollution, even if appropriate measures are used. It is the applicant's responsibility to avoid significant pollution and to demonstrate that BAT or appropriate measures are used to prevent, or where that is not practicable, to minimise noise impact.

Standards

British Standard 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

2.1.5 BS 4142:2014+A1:2019 primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific sound'[3] from the proposed development) at residential noise sensitive receptors. The specific sound level may then be corrected for the character of the sound (e.g. perceptibility of tones and/or impulses), if appropriate, and it is then termed the 'rating level', whether or not a rating penalty is applied. The 'residual sound' is defined as the 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.

2.1.6 The specific sound levels should be determined separately in terms of the $L_{Aeq,T}$ index over a period of 1-hour during the daytime and 15-minutes during the night-time. For the purposes of the Standard, daytime is typically between 07:00 and 23:00 hours, and night-time is typically

[2] A website link to the guidance is given here: https://www.gov.uk/government/publications/noise-and-vibration-management-environmental-permits/noise-and-vibration-management-environmental-permits

[3] equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr.

between 23:00 and 07:00 hours although these time periods can be varied based on local circumstances.

2.1.7 With regards to the character correction, paragraph 9.2 of BS 4142:2014+A1:2019 states:

"Tonality

For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a rating penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. … If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Other sound characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

2.1.8 The standard requires that the background sound levels[4] adopted for the assessment be representative for the period being assessed. The Standard recommends that the background sound level should be derived from continuous measurements of normally not less than 15-minute intervals, which can be contiguous or disaggregated. However, the Standard states that there are no 'single' background sound levels that can be derived from such measurements.

2.1.9 It is particularly difficult to determine what is 'representative' of the night-time period is because it can be subject to a wide variation in background sound level between the middle of the night and the shoulder periods. The accompanying note to paragraph 8.1.4 of the standard states that:

"A representative level should account for the range of background sounds levels and should not automatically be assumed to be either the minimum or modal value."

2.1.10 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level of the specific sound. In the context of the Standard, adverse impacts include, but are not limited to, annoyance and sleep disturbance. Typically, the greater this difference, the greater is the magnitude of the impact:

[4] A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

- 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.

2.1.11 The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. As set out in the standard, 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.

2.1.12 The significance of the effect of the noise in should be determined on the basis of the initial estimate of impact significance with reference to the context of the sound.

2.1.13 Whilst there is a relationship between the significance of impacts determined by the method contained within the standard and the significance of effects described in the PPG-N (Ministry of Housing, Communities and Local Government, 2019b), there is not a direct link. It is not appropriate to ascribe numerical rating / background level differences to LOAEL and SOAEL because this fails to consider the context of the sound, which is a key requirement of the Standard.

2.1.14 The significance of the effect of the noise in question (i.e. whether above or below SOAEL and LOAEL) should be determined on the basis of the initial estimate of impact significance from the standard assessment with reference to the examples of outcomes described within the PPG-N, and after having considered the context of the sound. It is necessary to consider all pertinent factors, including:

- the absolute level of sound;
- the character and level of the residual sound compared to the character and level of the specific sound; and
- the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:
  - facade insulation treatment;
  - ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
  - acoustic screening.

Guidance

Guidelines for Community Noise

2.1.15 The World Health Organisation (WHO) published guidance on the desirable levels of environmental noise in 2000. In this document, Guidelines for Community Noise (GCN) (WHO, 2000), the authors consider that sleep disturbance criteria should be taken as an internal noise level of 30 dB L_{Aeq} or an external level of 45 dB $L_{Aeq,8hr}$, measured at 1 m from the façade (equivalent to a free-field level of 42 dB L_{Aeq}). It is also suggested that internal instantaneous levels of 45 dB L_{Amax} and external instantaneous levels of 60 dB L_{Amax}, should not be exceeded.

2.1.16 The criteria for speech intelligibility and moderate annoyance during the daytime and evening should be taken as an internal noise level of 35 dB L_{Aeq}. For external daytime levels, it is considered that:

"To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55 dB L_{Aeq} on balconies, terraces, and outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50 dB L_{Aeq}. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development."

2.1.17 The major concern in Europe is with respect to noise from transportation systems, and most of the studies on which these guidelines are based relate to this type of noise source. There can be no certainty that the same effects will be observed from noise of an industrial nature, but in the absence of any more detailed information some weight should be attached to the WHO guidance when assessing industrial noise as well.

2.1.18 The WHO published more recent guidance in the Environmental Noise Guidelines for the European Region in 2018 (WHO, 2018). It provides guidance, primarily for policymakers, on protecting human health from harmful exposure to environmental noise and sets health-based recommendations on the average environmental noise exposure of five relevant sources of environmental noise. Industrial noise was not one of the categories included and, therefore, this guidance is not considered to be directly applicable to this assessment notwithstanding the fact that it is primarily for policymakers and does not apply to general assessments.

Night Noise Guidelines for Europe

2.1.19 In 2009 a report was published presenting the conclusions of a World Health Organisation (WHO) working group responsible for preparing guidelines for exposure to noise during sleep entitled "Night Noise Guidelines for Europe" (NNG) (European Centre for Environment and Health, 2009). The document can be seen as an extension to the original WHO GCN. Various effects are described including biological effects, sleep quality, and well-being. The document gives threshold levels for observed effects expressed as L_{max}, inside and L_{night}, outside. The L_{night} is a year-long average night-time noise level, not taking into account the façade effect of a building. In an exposed population a noise exposure of 40 dB $L_{night, outside}$ is stated as equivalent to the "lowest observed adverse effect level" for night noise. Above this level adverse health effects observed are self-reported sleep disturbance, environmental insomnia and increased use of somnifacient drugs and sedatives. Above 55 dB $L_{night, outside}$, cardiovascular effects become the major public health concern. Threshold levels for waking in the night, and/or too early in the morning are given as 42 dB $L_{Amax, inside}$. Lower thresholds are given that may change sleep structure.

Table 2.1: Summary of Observed Health Effects in the Population (WHO NNG)

Noise Level, $L_{night,outside}$	Observed Effect
up to 30 dBA	No substantial biological effects are observed.
30 to 40 dBA	A number of effects are observed to increase: body movements, awakening, self-reported sleep disturbance, arousals. The intensity of the effect depends on the nature of the source and on the number of events, even in the worst cases the effects seem modest.
40 to 55 dBA	Adverse health effects are observed among the exposed population. Many people have to adapt their lives to cope with the noise at night. Vulnerable groups are now severely affected.
Above 55 dBA	The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a high percentage of the population is highly annoyed and there is limited evidence that the cardiovascular system is coming under stress.

2.1.20 It is relevant to note that, taking into account the typical night to night variation in noise levels that will often occur due to meteorological effects and the effects of a façade, the night noise guidelines are similar to those previously given in the WHO GCN (i.e. an external façade noise level of 45 dB L_{Aeq}), although defined in a different way.

2.1.21 The WHO guidelines have not been formally adopted into UK legislation or guidance; hence it remains a source of information reflecting a high level of health care with respect to noise, rather than a standard to be rigidly applied. The guideline values give the lowest threshold noise levels below which the occurrence rates of particular effects can be assumed to be negligible. Exceedances of the WHO guideline values do not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher degrees of noise exposure are reached.

3 BASELINE CONDITIONS

Site Location and Noise Sensitive Receptors

3.1.1 The site is located at 270 Bristol Road, Gloucester, GL1 5TT within a mixed-use industrial area as seen in Figure 3.1.

3.1.2 Light industrial/manufacturing facilities are located to the north and south of the site. Residential uses are located to the east and a supermarket is located immediately to the south. The Gloucester and Sharpness Canal is located to the west of the site with further residential uses beyond it.

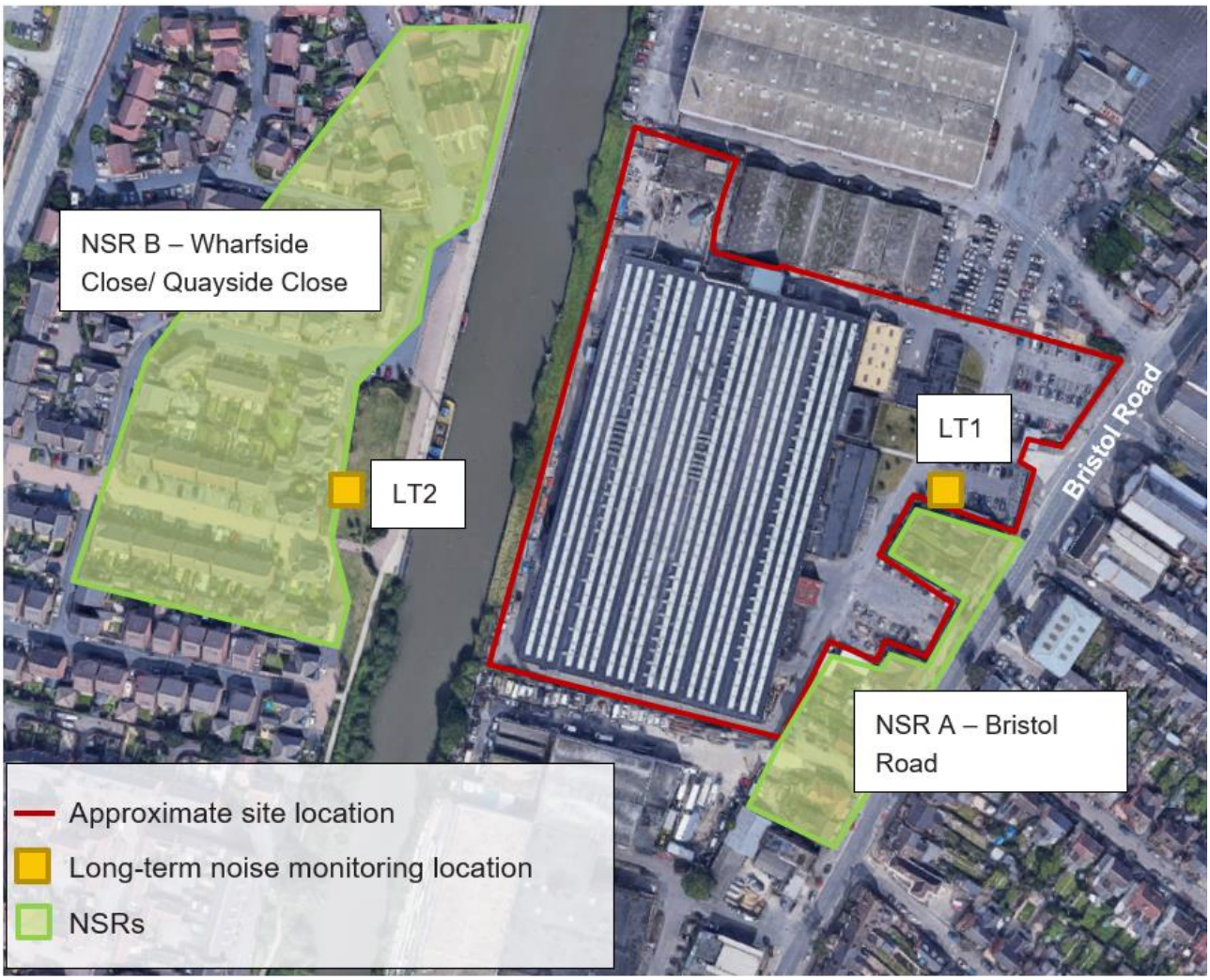


Figure 3.1 Site Location

3.1.3 The nearest NSRs are identified in Figure 3.1 and listed below:

- NSR A: residential properties along Bristol Road, directly to the east of the site, and
- NSR B: residential properties across the Canal, along Wharfside Close and Quaydise Close, approx. 73 m to the west of the site.

Site Description

3.1.4 It is understood that the site currently operates as a manufacturing facility of composite and PU material solutions. The current Permali process locations as well as current/proposed emission points are given in Figure 3.2.

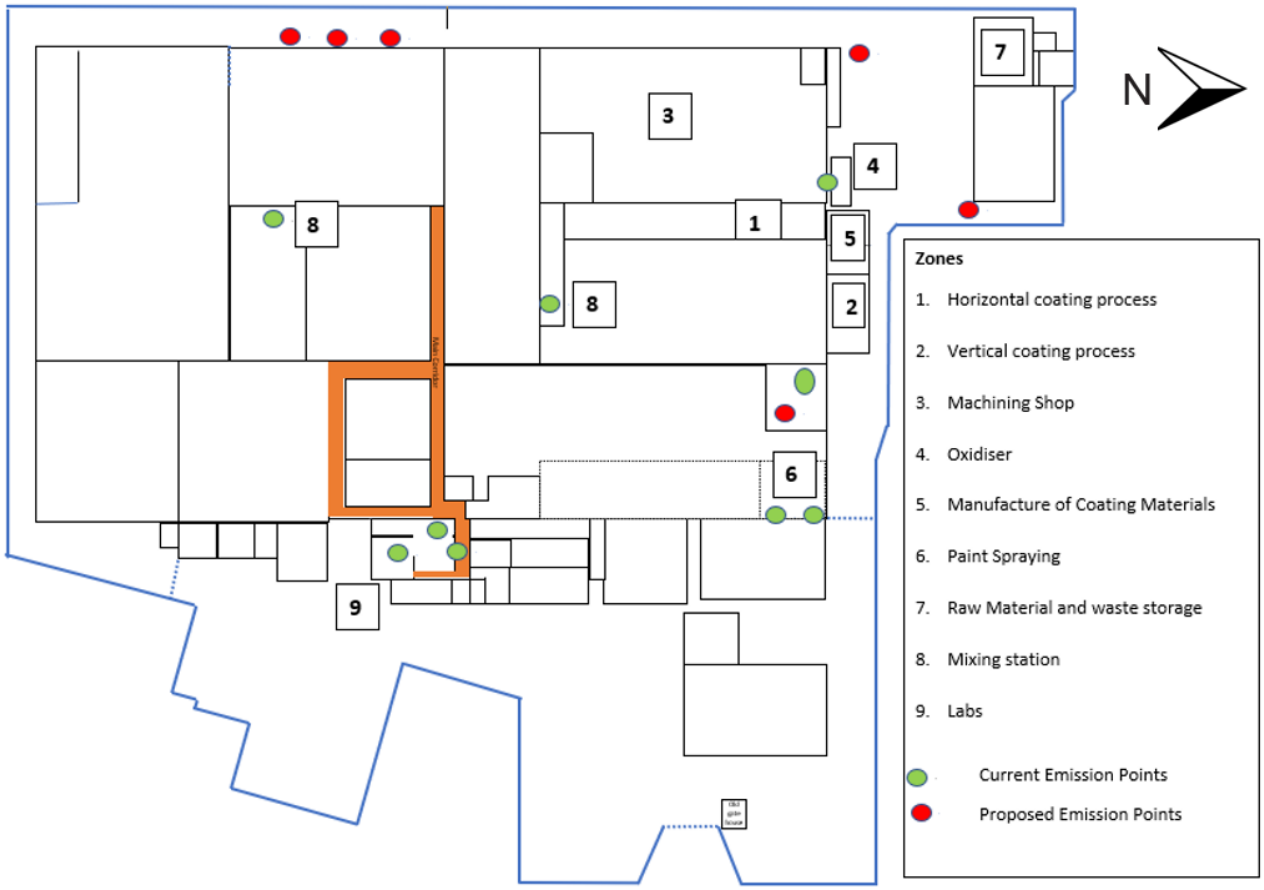


Figure 3.2 Permali Process Locations and Emission Points

3.1.5 Currently the following new external plant is being considered for the facility:

- 1 thermal oxidiser
- 1 scrubber
- 2 boilers
- 1 Nederman dust plant
- 1 dust plant “3”
- 1 Cyclofilter

3.1.6 With regards to operational time, the site would initially be operational on a 24/7 basis, 5 days a week with a view to increase to a full 24/7 basis, 7 days a week.

Baseline Survey Methodology

3.1.7 Representative baseline sound levels at the nearest NSRs have been determined through long-term sound monitoring at locations close to the nearest residential properties. The baseline sound monitoring locations can be seen in Figure 3.1.

3.1.8 One long term monitor (LT1) was installed next to the carpark outside the front of the Permali building, next to the wall just south of the carpark at a location that is considered representative of NSR A. Measurements were made between 13:15 hrs on 25 March 2022 and 12:00 hrs on 31 March 2022.

3.1.9 It should be noted that sound monitoring locations LT1 and LT2 were chosen to be located as far away as practically possible from any current noise sources on the Permali site, while still being representative of the relevant NSRs.

3.1.10 The main sound source at LT1 was road traffic on the local roads, in particular on Bristol Road. Other noise sources included vehicles entering and leaving the site, construction noise coming from the north and east of the site (including crashing noise and reverse alarms), operational noise from surrounding industrial uses and some pedestrian noise.

3.1.11 A second long term monitor (LT2) was installed across the Canal, in front of the houses on Quayside Way at a location that is considered representative of NSR B. Measurements were made between 14:30 hrs on 25 March 2022 and 12:30 hrs on 31 March 2022.

3.1.12 The main sound source at LT2 was a plant from the Permali site across the Canal. Other noise sources included residual traffic noise to the east on Bristol Road, occasional cars on Quayside way, bird song, occasional distant engine sounds.

Instrumentation

3.1.13 Measurements were carried out using a ‘Class 1’ Rion NL-52 sound level meter (SLM) in accordance with BS 7445-2:1991(BS, 1991), with the microphone mounted on a pole at around 1.5 m above local ground level.

3.1.14 Details of the instrumentation used during the survey are provided in Table 3.1 below. Calibration certificates of the equipment are available upon request. Calibration of the equipment was carried out before and after measurements with no significant drift (< ± 0.5 dB) observed. Data were logged of the broadband, A weighted sound pressure level in 100 ms samples.

Table 3.1: Baseline Sound Survey Instrumentation

Measurement Location	Make/Model	Serial Number	Calibration Ref/ Calibration Start /Calibration End	Last Calibration Date
LT1	Rion NL52	#165 / 998563	94.0 / 93.9 / 124.0 (int cali) dB	02/03/2022
LT2	Rion NL52	#167 / 998567	94.0 / 93.9 / 124.2 (int cali) dB	02/03/2022
Calibrator	Rion NC72	#015 / 110090 / Internal Calibration	n/a	19/04/202113

Weather Conditions

3.1.15 A wind monitor and rain gauge were also set up alongside the noise monitor at location LT1 to properly quantify the weather conditions throughout the survey. Overall, there were no periods

of wind speeds high enough to affect the results. There were some periods of rain, data recorded during these has been discounted so as not to interfere with the validity of results.

3.1.16 At LT1 on deployment it was 18°C, 34% relative humidity, 0.9ms^{-1} wind from the west, 2 oktas of cloud.

3.1.17 At LT2 on deployment it was 20°C, 35% relative humidity, 1.9ms^{-1} wind from the west, 4 oktas of cloud.

Results

3.1.18 An analysis has been carried out of the measured baseline sound levels at the long-term sound monitoring locations. The data has been extracted and post-processed in 15-minute periods for the daytime (07:00 to 23:00 hrs) and night-time (23:00 to 07:00 hrs) periods. This analysis is provided in Table 3.2. Data are rounded to the nearest whole number. Further survey details and graphical plots of the survey data are provided in Appendix B and Appendix C.

Table 3.2: 15-minute Baseline Sound Level Data (whole period) at LT1

Measurement Location	Daytime (07:00-23:00)		Night-time (23:00-07:00)	
	Average $L_{Aeq,16hr}$ (dB)*	50th percentile $L_{A90,15min}$ (dB)**	Average $L_{Aeq,8hr}$ (dB)*	50th percentile $L_{A90,15min}$ (dB)**
LT1***	54	47	50	41
LT2***	49	43	45	39

Notes:
All values have been rounded to the nearest whole number, where 0.5 is rounded up.
* Logarithmic average of each 16-hour period, then arithmetic average of the various $L_{Aeq,16hour}$ periods.
** 50th percentile $L_{A90,15min}$ (dB): A-weighted L_{90} sound pressure level which is exceeded for 25 % of the measurement time .
*** Due to the distance of 1 m of this monitoring location from the wall, a correction of 3 dB was applied to the baseline sound levels

Representative Baseline Sound Levels at Receptors

3.1.19 The sound levels at individual receptors have been based on professional judgement, a review of the sound levels at the long-term and the closest short-term sound monitoring location, where applicable.

3.1.20 LT1 has been considered representative of the residential properties along Bristol Road, i.e., NSR A, and LT2 has been considered representative of the residential properties to the west of the site, i.e., NSR B.

3.1.21 A summary of the representative baseline sound levels at each of the sensitive receptor groups identified is provided in Table 4.2 below.

Table 3.3: Representative Baseline Sound Levels for Assessment

NSRs	Representative Baseline Sound Levels			
	Daytime (07:00 to 23:00 hours)		Night-time (23:00 to 07:00 hours)	
	Residual Sound Level, $L_{Aeq,T}$ dB	Background Sound Level, $L_{A90,T}$ dB	Residual Sound Level, $L_{Aeq,T}$ dB	Background Sound Level, $L_{A90,T}$ dB

NSR A – Bristol Rd	54	47	50	41
NSR B - Wharfside Close/ Quayside Close	49	43	45	39

4 3D Sound Model

4.1.1 In order to calculate specific sound levels associated with operation of the facility at NSRs a 3D model has been built using SoundPLAN v8.2 proprietary noise modelling software.

4.1.2 The model predicts sound levels under light down-wind conditions based on hemispherical sound propagation with corrections for atmospheric absorption, ground effects, screening and directivity based on the procedure detailed in ISO 9613-2:1996 'Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation'[5].

4.1.3 Terrain contour data have been entered into the model based on OS land contours. The site buildings and local buildings have been included, and these provide some degree of screening as well as reflecting surfaces.

4.1.4 Specific sound levels have been calculated at ground and first floor levels for houses, 1.5 m and 4.0 m above ground level respectively. The maximum predicted specific sound level per receptor has been used in the assessment. The same noise modelling techniques have been used by RPS on numerous sites in the UK and worldwide and there is a high degree of confidence in the model.

Description of Noise Sources

4.1.5 The new noise sources, as listed in paragraph 3.1.5 and Table 4.1, were implemented in the new model at the approximate locations shown in Figure 4.1 .

4.1.6 The noise emissions for the new noise sources, that were included in the 3D noise model, were based on measurement data of the plant from other Permali sites, as provided by the client and shown in Table 4.1. Further details on the new plant, such as the number of plant items, the height above local ground level and the on-time are also given in Table 4.1.

4.1.7 All noise sources were modelled as point sources.

4.1.8 The spectral information given in Table 4.1 was provided by the client unless stated otherwise. The spectral information for the Nederman dust plant, dust plant 3 and the thermal oxidiser was provided in sound pressure levels and was converted to sound power levels based on the information provided by the client on the plant dimensions. The provided technical datasheets can be seen in Appendix D.

4.1.9 Based on experience from similar plant items, the plant listed in Table 4.1 is not expected to present tonal characteristics[6] or have an impulsive character.

[5] ISO. International Standard ISO 9613-2:1996. Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation.

[6] It should be noted that the provided plant noise emissions data was in octave bands and not in one-third octave bands. Therefore, it was not possible to check the presence of tones in accordance with the methodology described within Annex C of BS 4142:2014+A1:2019.

Table 4.1: Modelled Plant

Modelled Plant	Quantity	Sound Power Level (dB L_{wA})	Height AGL (m)	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz	On-time
Boiler*	2	85	1.5	96	108	105	104	95	92	89	87	87	n/a	100%
Nederman dust plant	1	88	2.3	90	90	89	88	78	85	78	78	72	65	100%
Dust plant 3	1	90	2.3	97	90	90	89	88	85	79	78	79	76	100%
Cyclofilter V9 - free inlet/outlet**	1	109	2.3	n/a	111	111	111	106	102	99	97	94	n/a	100%
Cyclofilter V9 - casing	1	87	1.5	n/a	99	95	89	84	80	77	75	70	n/a	100%
Scrubber*	1	85	1.5	77	82	87	87	91	101	99	88	79	n/a	100%
Thermal Oxidiser	1	93	1.5	84	88	86	89	93	89	82	79	73	79	100%

* The spectral values for this plant were based on similar plant types from the RPS source term library

** It is assumed that the inlet is located internally within the building and the outlet is located externally. As a result, only the Cyclofilter outlet has been considered as part of the external plant.

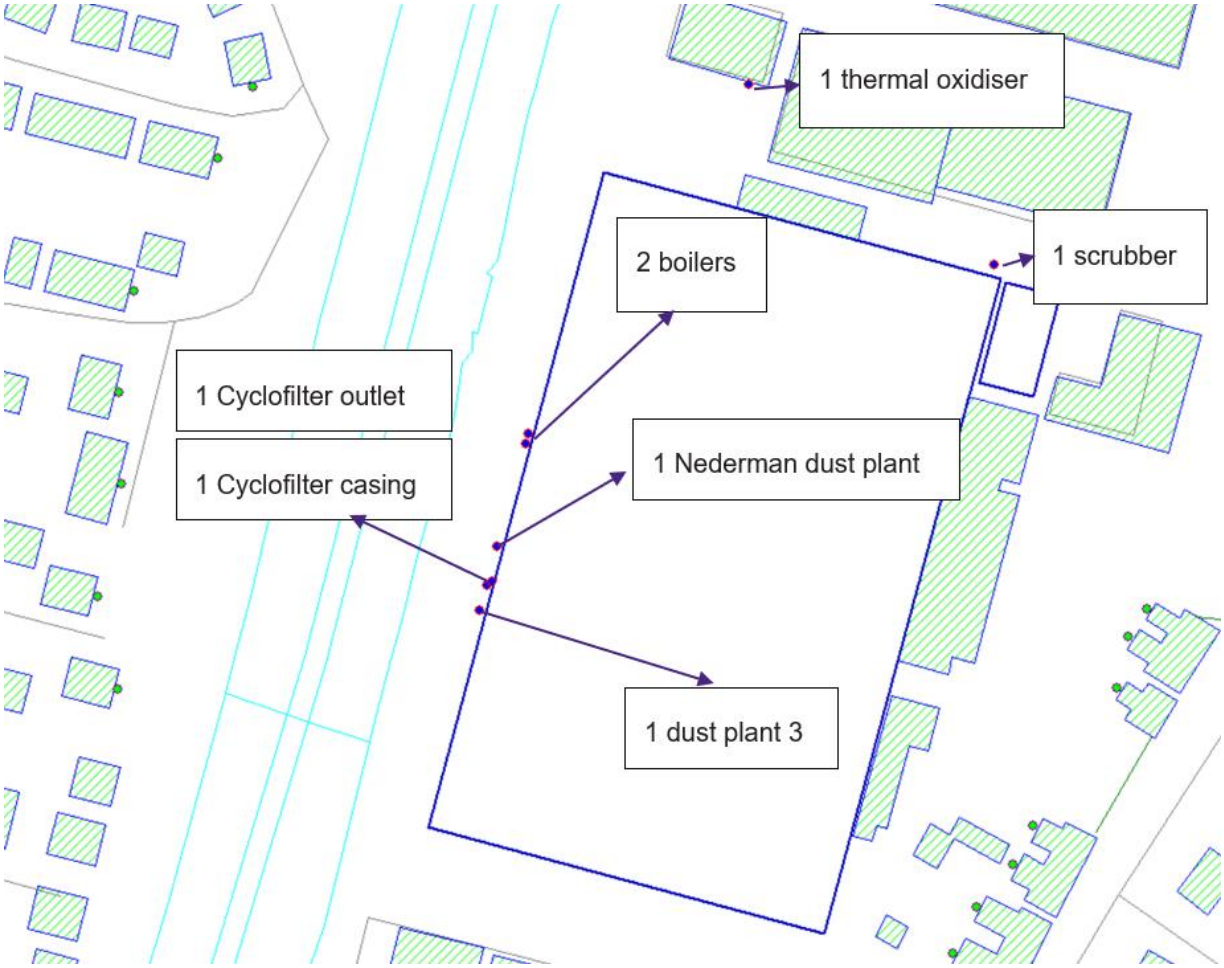


Figure 4.1 Location of plant on site

4.1.10 It should be noted that the calculation uncertainty of the sound power levels of the noise sources on site has been reduced by peer review of the measurement data provided by the client and calculations.

5 Sound Modelling Results

5.1.1 The 3D sound model was used to predict the specific sound levels at the nearest NSRs, i.e., NSR A and NSR B.

5.1.2 As the facility is expected to operate on a 24/7 basis, both daytime and night-time assessment scenarios are considered for this noise assessment.

5.1.3 A summary of the predicted specific sound levels during daytime and night-time from the operational site are shown in Table 5.1. It should be noted that as 100% on-time is assumed for all plant during both daytime and night-time, the predicted specific sound levels are the same during daytime and night-time.

Table 5.1: Specific Sound Levels at NSRs

Location / NSR	Specific Sound Level (dB $L_{Aeq,Tr}$)	
	Daytime	Night-time
NSR A - Bristol Rd	42	42
NSR B - Wharfside Close/ Quayside Close	64	64

5.1.4 The NSR closest to the majority of the plant is NSR B, which is predicted to experience the highest levels of sound from the site. A breakdown of the partial specific sound levels from the plant at NSR B is provided in Table 5.2 below. It should be noted that as 100% on-time is assumed for the plant during both daytime and night-time, the partial specific sound levels are the same during daytime and night-time.

Table 5.2: Daytime/Night-time Partial Specific Sound Levels at NSR B

Plant Item	Partial Specific Sound Level (dB $L_{Aeq,Tr}$)
Boiler	41
Cyclofilter V9 - free outlet	64
Cyclofilter V9 - outside casing	42
Dust Plant 3	46
Nederman dust plant	43
RTO (thermal oxidiser)	27
Scrubber	10

6 BS 4142:2014+A1:2019 Assessment

6.1.1 An initial estimate of impact undertaken in accordance with BS 4142:2014+A1:2019 is provided in Table 6.1 and Table 6.2 for the daytime and night-time periods respectively.

6.1.2 As mentioned in Section 4, the proposed new plant is not considered to contain tones or be impulsive. Therefore, no penalty for tonality or impulsivity has been applied.

6.1.3 The proposed plant is assumed to operate with a 100% on-time. Therefore, no penalty for intermittency has been applied.

6.1.4 The predicted specific sound levels at NSR A are between 5 dB and 9 dB below the residual sound levels at NSR A. At NSR A the representative residual sound level is not expected to be 'readily distinctive' above road traffic movements and other activity in the area affecting the residual sound level. That is not to say the noise from the facility would not be audible, rather that it would not be readily distinctive against the residual acoustic environment, and thus warrant a correction.

6.1.5 The predicted specific sound levels at NSR B are between 15 dB and 19 dB above the residual sound levels at NSR B. Therefore, it is expected that the character of the acoustic environment at NSR B, which is closest to the facility plant, would be considered 'readily distinctive'. Therefore, a penalty for the specific character of sound has only been applied for NSR B.

Table 6.1: BS 4142:2014+A1:2019 Assessment - Daytime

NSRs Location	Representative Baseline Sound Levels		Specific Sound Level, dB L_S	Rating Penalty, dB	Rating Level, dB $L_{Ar,Tr}$	Rating - Background Level Difference, dB
	Background, dB $L_{A90,T}$	Residual, dB $L_{Aeq,T}$				
NSR A - Bristol Rd	44	51	42	0	42	**-2**
NSR B - Wharfside Close/ Quayside Close	43	49	64	3	67	**+24**

Table 6.2: BS 4142:2014+A1:2019 Assessment – Night-time

NSRs Location	Representative Baseline Sound Levels		Specific Sound Level, dB L_S	Rating Penalty, dB	Rating Level, dB $L_{Ar,Tr}$	Rating - Background Level Difference, dB
	Background, dB $L_{A90,T}$	Residual, dB $L_{Aeq,T}$				
NSR A - Bristol Rd	38	47	42	0	42	**+4**
NSR B - Wharfside Close/ Quayside Close	39	45	64	3	67	**+28**

6.1.6 With regards to the rating/background level difference, BS 4142:2014+A1:2019 states:

- 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 impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

6.1.7 On the basis of the above, and with reference to Table 6.1, as rating levels are 2 dB below the representative background sound level during daytime at NSR A, it is considered that there is a negligible risk for an adverse impact at this receptor due to the facility operation, depending on the context. At NSR B the rating levels are up to 24 dB above the representative background sound level during daytime. Therefore, there is a risk that operation of the facility would result in significant adverse impacts at this receptor, depending on the context.

6.1.8 With reference to Table 6.2, as rating levels are 4 dB above the representative background sound level during night-time at NSR A, it is considered that there is a low risk for an adverse impact at this receptor due to the facility operation, depending on the context. At NSR B are up to 28 dB above the representative background sound level during night-time. Therefore, there is a risk that operation of the facility would result in significant adverse impacts at this receptor, depending on the context.

6.1.9 With regards to the daytime and night-time period, consideration of the context does reduce the likelihood for adverse impacts at NSR A, but the likelihood of significant adverse impacts at NSR B is still significant, even following the consideration of the context. This is detailed below in terms of an assessment of the change in ambient sound level due to the specific sound as well as the character of the existing noise environment at the receptors.

Noise Change Assessment

Ambient sound levels with and without the facility in operation are shown in Table 6.3 and

6.1.10 Table 6.4 during daytime and night-time. The results show that sound from the plant is predicted to result in an increase in the ambient sound level during the daytime/night-time period by up to +1 dB at NSR A and up to +19 dB at NSR B.

Table 6.3: Ambient Noise Level Change Assessment (daytime)

Location	Baseline residual noise level, dB $L_{Aeq,T}$	Specific sound level, dB $L_{Aeq,T}$	Ambient noise level with site, dB $LA_{eq,T}$	Noise change, dB
NSR A - Bristol Rd	51	42	52	**+1**
NSR B - Wharfside Close/ Quayside Close	49	64	64	**+15**

Table 6.4: Ambient Noise Level Change Assessment (night-time)

Location	Baseline residual noise level, dB $L_{Aeq,T}$	Specific sound level, dB $L_{Aeq,T}$	Ambient noise level with site, dB $LA_{eq,T}$	Noise change, dB
NSR A - Bristol Rd	47	42	48	**+1**
NSR B - Wharfside Close/ Quayside Close	45	64	64	**+19**

6.1.11 On the basis that a + 3 dB change is generally taken as the minimum change which is perceptible to most people for steady sources of a similar character, and that the dominant noise source affecting the specific sound level is continuous and steady (i.e. the Cyclofilter outlet), it is considered that the change in ambient sound level would not be particularly noticeable at NSR A. As such, the likelihood for the noise to result in adverse impact is reduced.

6.1.12 At NSR B, the predicted +19 dB noise level change is going to be noticeable.

Assessment Summary

6.1.13 On the basis of the above, when considering noise from the facility at NSR A, this would likely not be audible, noticeable or intrusive/incongruous when compared to the baseline acoustic environment. Therefore, a negligible adverse impact is predicted during daytime and a low risk for adverse impact is predicted during night-time at NSR A.

6.1.14 At NSR B, noise is highly likely to be clearly perceptible when compared to the baseline acoustic environment. As a result, noise from the facility is expected to lead to significant adverse impacts at NSR B which should be mitigated.

Mitigation at Source

6.1.15 In order to reduce the predicted specific sound levels from the site operation at the nearest noise sensitive receptors, the following reduction in the plant noise emissions should be considered:

- 30 dB mitigation will be required for the noise emissions of the Cyclofilter outlet;
- 15 dB mitigation for the noise emissions of the thermal oxidiser;
- 12 dB mitigation will be required for the noise emissions of each boiler, and
- 10 dB mitigation will be required for the noise emissions of the Cyclofilter casing, the Nederman dust plant and dust plant 3.

6.1.16 It should be noted that the above mitigation refers only to mitigation of noise emission levels at source. The exact type of noise mitigation required will depend on the nature of the noise generating equipment and practical considerations, but could include for example:

- Attenuators to ducted noise sources (e.g. outlets, inlets etc.);
- Enclosures to non-ducted equipment, e.g. the Cyclofilter casing, and
- other noise control measures at source.

BS 4142:2014+A1:2019 Assessment with Mitigation

6.1.17 An initial estimate of impact undertaken in accordance with BS 4142:2014+A1:2019 when noise reduction at source, as listed above is considered, is provided in Table 6.5 and Table 6.6 for the daytime and night-time periods respectively.

Table 6.5: BS 4142:2014+A1:2019 Assessment - Daytime with Mitigation

NSRs Location	Representative Baseline Sound Levels		Specific Sound Level, dB L_S	Rating Penalty, dB	Rating Level, dB $L_{Ar,Tr}$	Rating - Background Level Difference, dB
	Background, dB $L_{A90,T}$	Residual, dB $L_{Aeq,T}$				
NSR A - Bristol Rd	44	51	41	0	41	**-3**
NSR B - Wharfside Close/ Quayside Close	43	49	40	3	43	**0**

Table 6.6: BS 4142:2014+A1:2019 Assessment – Night-time with Mitigation

NSRs Location	Representative Baseline Sound Levels		Specific Sound Level, dB L_S	Rating Penalty, dB	Rating Level, dB $L_{Ar,Tr}$	Rating - Background Level Difference, dB
	Background, dB $L_{A90,T}$	Residual, dB $L_{Aeq,T}$				
NSR A - Bristol Rd	38	47	41	0	41	**+3**
NSR B - Wharfside Close/ Quayside Close	39	45	40	3	43	**+4**

6.1.18 On the basis of the above, and with reference to Table 6.5, as rating levels are 3 dB below the representative background sound level during daytime at NSR A and equal to the representative background sound level during daytime at NSR B, it is considered that there is a negligible risk for an adverse impact at the receptors due to the facility operation, depending on the context.

6.1.19 With reference to Table 6.6, as rating levels are up to 4 dB above the representative background sound level during night-time at NSR A and NSR B, it is considered that there is a low risk for an adverse impact at these receptors due to the facility operation, depending on the context.

6.1.20 With regards to the daytime and night-time period, consideration of the context does reduce the likelihood for adverse impacts at NSR A and NSR B. This is detailed below in terms of an assessment of the change in ambient sound level due to the specific sound as well as the character of the existing noise environment at the receptors.

Noise Change Assessment with Mitigation

6.1.21 Ambient sound levels with and without the facility in operation, when mitigation is being considered, are shown in Table 6.7 and Table 6.8 during daytime and night-time. The results show that sound from the plant is predicted to result in an increase in the ambient sound level during the daytime/night-time period by up to +1 dB at both NSR A and NSR B.

Table 6.7: Ambient Noise Level Change Assessment (daytime) – With Mitigation

Location	Baseline residual noise level, dB $L_{Aeq,T}$	Specific sound level, dB $L_{Aeq,T}$	Ambient noise level with site, dB $LA_{eq,T}$	Noise change, dB
NSR A - Bristol Rd	51	41	51	**+0**
NSR B - Wharfside Close/ Quayside Close	49	40	50	**+1**

Table 6.8: Ambient Noise Level Change Assessment (night-time) – With Mitigation

Location	Baseline residual noise level, dB $L_{Aeq,T}$	Specific sound level, dB $L_{Aeq,T}$	Ambient noise level with site, dB $LA_{eq,T}$	Noise change, dB
NSR A - Bristol Rd	47	41	48	**+1**
NSR B - Wharfside Close/ Quayside Close	45	40	46	**+1**

6.1.22 On the basis that a + 3 dB change is generally taken as the minimum change which is perceptible to most people for steady sources of a similar character, and that the dominant noise source affecting the specific sound level is continuous and steady, it is considered that the change in ambient sound level would not be particularly noticeable at any of the NSRs. As such, the likelihood for the noise to result in adverse impact is reduced.

Absolute Noise Level Assessment

6.1.23 With reference to Table 6.7 and Table 6.8, the total ambient sound level of the specific sound and residual ambient sound is predicted to be up to 41 dB $L_{Aeq,T}$, 9 dB and 14 dB below the GCN guideline levels for the onset of moderate (50 dB $L_{Aeq,T}$) and serious annoyance (55 dB $L_{Aeq,T}$) for external levels respectively. On this basis, noise emissions from the facility would not be of a magnitude sufficient to give reasonable cause for annoyance at the NSRs.

6.1.24 In addition (on the basis that a partially open window provides 12 dB of attenuation), internal sound levels would be 29 dB $L_{Aeq,T}$ during the night-time period, 1 dB below the level above which adverse effects are noted for the night-time periods (30 dB $L_{Aeq,T}$).

6.1.25 On the basis the above the total ambient sound level at NSR locations would not be of a magnitude likely to result in moderate annoyance or result in other adverse effects.

Assessment Summary with Mitigation

6.1.26 On the basis of the above, when considering the mitigated noise emissions from the facility at both NSRs, this would:

- likely not be audible or noticeable or intrusive/incongruous when compared to the baseline acoustic environment; and
- not result in overall ambient noise levels exceeding the level above which adverse effects would occur either in external amenity areas or internally within dwellings with windows partially open.

6.1.27 Consequently, it is considered that operational sound levels during the daytime and night-time would be of a magnitude below the LOAEL, i.e. that whilst noise may just be heard during otherwise quiet periods, it would not cause any change in behaviour, attitude or other physiological response and would not cause a change in the quality of life. There would also be no need to close windows at any time because of the noise. Significant adverse noise impacts on health and the quality of life is unlikely to occur.

6.1.28 Noise emissions from the facility, when mitigated as described, would not be of a magnitude sufficient to give reasonable cause for annoyance, and a high general level of protection of the environment is provided.

6.1.29 It should be noted that the mitigation described above is for reducing the noise at source. Mitigation could also be applied as a combination of reducing noise at source and implementing an acoustic absorptive barrier to the west of the site. At this stage it is understood that the priority is initially to mitigate the noise at source, and then consider any additional mitigation measures, as required.

7 Summary & Conclusions

7.1.1 The Acoustics Team of RPS Planning and Environmental (RPS) has been appointed by Permali Gloucester Ltd to provide a noise impact assessment of the operational noise levels from the Permali facility at 270 Bristol Road, Gloucester, GL1 5TT. The site is located within the local authorities of Gloucestershire County Council (GSCC) and Gloucester City Council (GCC).

7.1.2 This noise impact assessment has been prepared to support the application for the Environmental Permit (EP) for the existing Permali manufacturing facility of composite and PU material solutions.

7.1.3 An environmental sound survey was undertaken on site, at locations representative of the nearest noise sensitive receptors (NSRs) to establish the baseline sound conditions.

7.1.4 Details on the type and noise emissions of the new plant proposed to operate at the facility were provided by the client.

7.1.5 A 3D sound model of the facility was built, considering the provided plant noise levels, to predict specific sound levels from the facility at the NSRs.

7.1.6 An assessment of the noise from the facility has been carried out in accordance with BS 4142:2014+A1:2019, which is the cited standard to use in the Environmental Permitting Regulations.

7.1.7 The results of the noise assessment show that with the consideration of the following noise reduction:

- 30 dB mitigation will be required for the noise emissions of the Cyclofilter outlet;
- 15 dB mitigation for the noise emissions of the thermal oxidiser;
- 12 dB mitigation will be required for the noise emissions of each boiler, and
- 10 dB mitigation will be required for the noise emissions of the Cyclofilter casing, the Nederman dust plant and dust plant 3.

the operation of the facility would likely result in adverse effects below the LOAEL and that residential amenity would not be adversely affected. Significant adverse impacts/effects would be avoided.

7.1.8 On the basis of the above and in conclusion, sound from the facility is considered to be mitigated through the application of appropriate noise reduction at source, such that it does not cause an adverse impact.

7.1.9 Noise emissions from the facility would not be of a magnitude sufficient to give reasonable cause for annoyance and a high general level of protection of the environment as a whole is provided.

APPENDICES

Appendix A

Personnel and Individual Qualifications

Lise W. Tjellesen – Technical Director – Acoustics

MEngSc Acoustics; Member of the Institute of Acoustics; Member Acoustical Society of America; Member of Danish Acoustic Society; Member of Audio Engineering Society

A.1 Lise is Technical Director of the RPS Acoustics Team with more than 20 years of experience in acoustics. She is a specialist acoustic consultant with a wide range of experience gained in the UK, Denmark and worldwide. She has worked with electroacoustics, psychoacoustics, architectural acoustics, vibrations and environmental acoustics. She has gained particular experience in the fields of architectural acoustics (building and room) working with the construction industry on a variety of projects, including residential, commercial, education, health and entertainment.

A.2 Lise is an expert on the subject of room acoustics and room acoustic computer simulations, as well as a leading expert on the emerging field of archaeoacoustics. She has published several papers on the above subjects and on acoustics of offices.

A.3 Lise has been involved in many BS 4142 noise assessments for both the previous and current 2014 version of BS 4142. She has given evidence at public inquiries where BS 4142 has been the primary assessment methodology. On the basis of Lise's overall experience in acoustics (particularly in relation to environmental noise) combined with particular focus on BS 4142, she is deemed competent for BS 4142 assessments.

A.4 For this project Lise has taken on the role of:

- Project Director responsible for overseeing and delivering the project.

A.5 Lise was also responsible for

- reviewing and authorising the report, figures and appendices.

Christina Ioannidou – Principal Consultant – Acoustics

MSc Engineering Acoustics; Member of the Institute of Acoustics; MSc Telecommunications; Electrical and Computer Engineering;

A.6 Christina is an Acoustic Consultant and environmental acoustics specialist with more than seven years' experience. She has an Electrical and Computer Engineering Degree Bachelor and Master's Degree and has also a Master's Degree in Engineering Acoustics. She has been a member of the Institute of Acoustics since 2015.

A.7 Christina has project managed and undertaken noise assessments for a variety of developments, including: large scale mixed-use developments, incorporating commercial, retail, leisure and residential elements; energy from waste facilities; manufacturing facilities; distribution centres; retail units and minerals extraction and exploration. She has provided input into Environmental Impact Assessments (EIAs) since the start of her career in 2015 for residential, industrial, educational and mixed-use developments (including residential, hotel, commercial uses). She has also undertaken noise assessments to support planning applications and discharge planning conditions. She has a Continuous Professional Development (CPD) Record to support this competency and experience.

A.8 Within the past years Christina has been involved BS 4142 noise assessments for both the previous and current 2014 version of BS 4142. She is familiar with the Standard and has attended relevant talks organised by the Institute of Acoustics. On the basis of Christina's overall experience in acoustics, combined with particular focus on BS 4142 and with the assistance of more experienced colleagues, she is deemed competent for BS 4142 assessments.

A.9 For this project Christina has supported the Project Manager in the assessment and noise modelling. She was also responsible for reviewing the modelling and the report, figures and appendices.

A.10 For this project Christina has taken on the role of

- Project Manager and has been responsible for overseeing the project.
- Consultant responsible for carrying out the acoustic modelling.

A.11 Christina was also responsible for

- undertaking the assessment;
- undertaking the modelling;
- preparing the report, figures and appendices; and

Ben Gray – Consultant – Acoustics

BSc (Hons) Mathematics;

A.12 Ben is an Acoustic Consultant and joined RPS in 2019 and has been an associate member of the Institute of Acoustics since 2019 also.

A.13 Since joining RPS he has undertaken acoustic surveying and assessments for a number of commercial, residential, and industrial developments - both small and large scale - in addition to assisting more senior members of staff with the undertaking of their responsibilities.

A.14 He has carried out acoustic survey, data processing and noise modelling experience, including, but not limited to: BS4142 Assessments, Vibration Surveys, Insulation testing and Environmental Impact Assessments, as well as contributing to reports on Building Acoustics and Noise Impact Assessments. Additionally, he has a Continuous Professional Development Record to support this competency and experience.

A.15 For this project Ben has taken on the role of: … (delete as appropriate) …

- Consultant responsible for carrying out the acoustic surveying.

A.16 Ben was also responsible for … (delete as appropriate) …

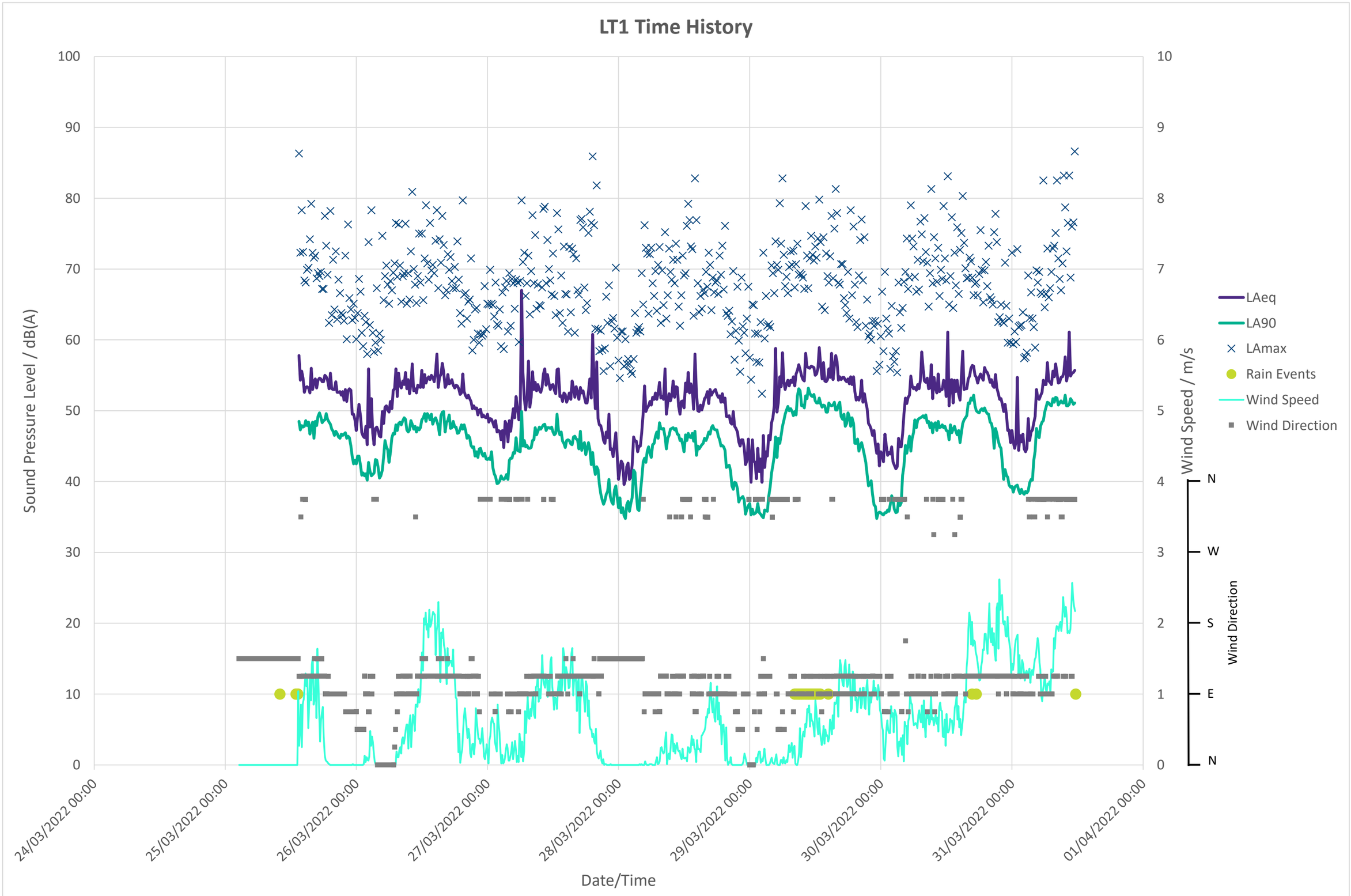
- undertaking the site visit;
- carrying out sound monitoring;

- downloading and processing the survey data;
- reviewing the modelling;

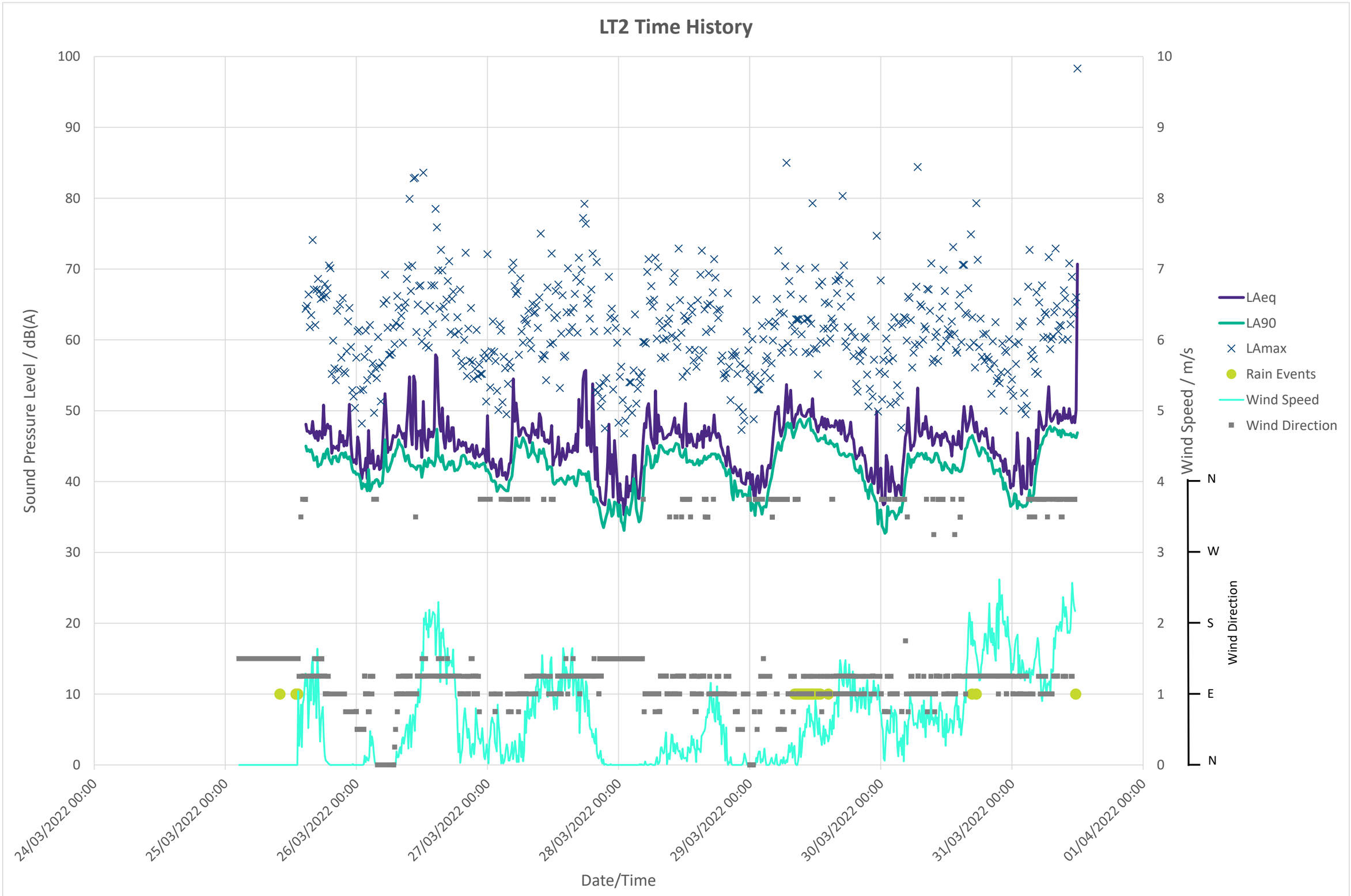
Appendix B

Time History Graphs

LT1 Time History



LT2 Time History



Appendix C

Environmental Sound Survey Sheets

Location			LT1, Permali site, Bristol Road, Gloucester			
Purpose of Monitoring			Permali / Tenmat, Bristol Road			
Relevant Guidance / Standard						
Sound Measurement System						
RPS ID	Manufacturer / Model		Serial Number	Last Lab Verification	Filename	Memory Card ID
165	Rion-NL-52		998563	02/03/2022		
Mic Height	Measurement Interval	Dynamic Range (dB)	Time Weighting	Frequency Weighting	Façade / Freefield	Photo?
1.5	15min / 100ms		Fast	A	Façade	

			START				**END**		
Personnel			BG				SDH		
Date / time			25/03/2022 13:15				31/03/2022 1200		
Calibrator	RPS ID		15				internal		
	Manufacturer / Model		RION-NC-74						
	Serial Number		110090						
	Date last verification		19/04/2021						
	Reference level (dB)		94.0				124.0		
	Meter reading (dB)		93.9				124.0		
	Wind speed (m/s) & dir'n Av.		0.9	Eastwards			2.8	-	
	Cloud cover (100%= 8 oktas)		2				5-6 oktas		
	Temperature (degrees Celsius)		18				10.6		
	Relative Humidity (%)		34				47%		
	Likely temp. inversion / Precipitation / Fog / Wet ground / Frozen ground / Snow cover? (tick boxes)		TI	P	F	S	TI	P	F	S
							×	×	×	×
	Subjective description / additional details								

Description of site (location of equipment, general surroundings, nature of ground between NSR and sound source(s) (hard/ soft ground, topography, intervening features, reflecting surfaces))

Survey location LT1 was located next to the carpark outside the front of the Permali building, next to the wall just south of the carpark. 15m south of the entrance road, 1m north of wall, 8.2m east of western corner of wall, 2.5m south of southernmost carpark white line. The microphone was set up 1.5 m above ground level (AGL), with an environmental windshield.

Description of sound environment at start of survey (principal environmental and natural sound sources, which sources are dominant, character of the sound environment cf. to the character of the new source)

At location LT1, at the time of deploying the survey, the main noise source on site was road traffic from Bristol Road, shielded by the site wall but still present, broadband hum from residual traffic sound from the north and south and individual pass bys, not overly loud but clearly audible. Also have noise from traffic entering and leaving the site, slower moving but closer so probably a touch louder, but less frequent on the traffic on Bristol Road. Have construction sounds to the north and east, assorted crashes and bashes as well as a high pitch beeping alarm. Distant so not too loud. Sound of what appears to be spray painting coming from the garage across the road from the Permali site. Broadband sound, and irregular. Some noise from pedestrians / workers moving into and out of site, talking, laughing etc. not overly loud but close. Crane to the northwest, making occasional whirring sound from winch, fairly loud.

Description of sound environment at end of survey (principal environmental and natural sound sources, which sources are dominant, character of the sound environment cf. to the character of the new source)

On collection the sounds were the same, again dominated by road traffic, more wind noise though.

Location	LT1, Permali site, Bristol Road, Gloucester

Photographs of measurement location





Location			LT2, off Quayside Way, Gloucester						
Purpose of Monitoring			Permali / Tenmat, Bristol Road						
Relevant Guidance / Standard									
Sound Measurement System									
RPS ID	Manufacturer / Model		Serial Number	Last Lab Verification		Filename		Memory Card ID	
167	Rion-NL-52		998567	02/03/2022					
Mic Height	Measurement Interval	Dynamic Range (dB)	Time Weighting	Frequency Weighting		Façade / Freefield		Photo?	
1.5	15min / 100ms		Fast	A		Freefield			
			START			**END**			
Personnel			BG			SDH			
Date / time			25/03/2022 14:30			31/03/2022 1200			
Calibrator	RPS ID		15			internal			
	Manufacturer / Model		RION-NC-74						
	Serial Number		110090						
	Date last verification		19/04/2021						
	Reference level (dB)		94.0			124.0			
	Meter reading (dB)		93.9			124.2			
	Wind speed (m/s) & dir'n Av.		1.9	Eastward		2.8	-		
	Cloud cover (100%= 8 oktas)		4			5-6 oktas			
	Temperature (degrees Celsius)		20			10.6			
	Relative Humidity (%)		35			47%			
	Likely temp. inversion / Precipitation / Fog / Wet ground / Frozen ground / Snow cover? (tick boxes)		TI	P	F	S	TI	P	F	S
							×	×	×	×
	Subjective description / additional details									

Description of site (location of equipment, general surroundings, nature of ground between NSR and sound source(s) (hard/ soft ground, topography, intervening features, reflecting surfaces))

Survey location LT2 was located on the other side of the river to the Permali site and LT1. On portion of grass between the river and houses on Quayside Way, attached to fence line. 21m west of western edge of pavement on riverbank, 4.5m north of southern extent of fence. The microphone was set up 1.5 m above ground level (AGL), with an environmental windshield.

Description of sound environment at start of survey (principal environmental and natural sound sources, which sources are dominant, character of the sound environment cf. to the character of the new source)

At location LT2, at the time of deploying the survey, the noise environment was quieter than LT1. Main sound is some plant at Permali site across the river, broadband hum / whirr, not sure what. Very faint broadband hum from residual traffic noise to the east on Bristol Road. Some other miscellaneous site sounds from there too, high pitch alarm, quiet though. Fishers on the bank, some sounds from talking and using their equipment but relatively quiet, however, it echoes of the walls of the Permali site across the river. Occasional car on Quayside way, not too close and slow moving so quiet. Bird song from all directions, reasonably loud. Wind noise, not so loud but ever present. Occasional distant engine sound, only the loudest ones and even then, pretty loud.

Description of sound environment at end of survey (principal environmental and natural sound sources, which sources are dominant, character of the sound environment cf. to the character of the new source)

On collection the sounds were similar, dominated by distant traffic noise and construction sounds. Again, more wind noise than before

Location	LT2, off Quayside Way, Gloucester

Photographs of measurement location

Appendix D

Technical Datasheets/ Measurement Data

Babcock Wanson

Client
Permali

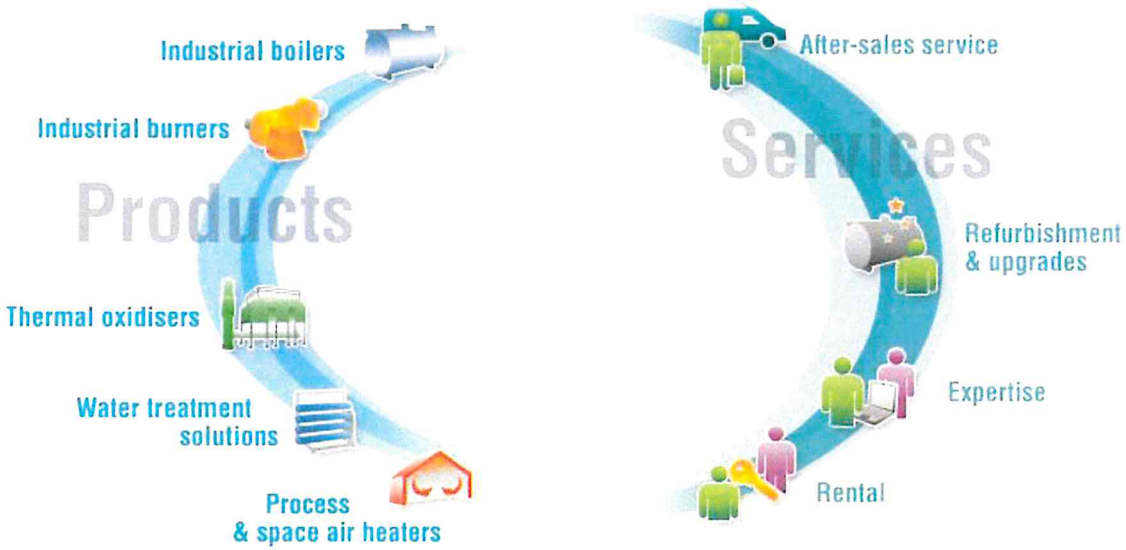
Offer No.
VT15984

Rev.
B

2 x NBWB 100 Premium Firetube Steam Boilers

Sales Contact: **Tim Marchant**
Date: **28/02/2022**
Prepared: **DS**
Approved: **EF**

BABCOCK WANSON Provides a complete range of products and services to supply your process heat requirements. From Steam Boilers, Thermal Fluid Heaters, Rapid Steam Generators and Hot Water Boilers to VOC abatement and odour treatment by Thermal Oxidation, Water Treatment or Air Heating Solutions; we help you to optimise your energy use and production with high quality products and services.



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www.babcock-wanson.co.uk

Permali
270 Bristol Rd
Gloucestershire
GL1 5TT

For the attention of Ms. Ellie Taylor:

Dear Madam,

Re: Steam Generating Equipment

In response to your recent discussions with our Mr Tim Marchant, we have much pleasure in enclosing our quotation for the supply of TWO Model NBWB 100 Premium Steam Boilers complete with ancillary equipment. We will arrange for Amultra to attend site to look at the installation costs.

NBWB

The NBWB Firetube boiler is fully packaged and includes a fully matched burner, suitably equipped electrical control panel and a complete set of mountings. This boiler range comes with the longest continuous pedigree of any packaged Firetube Boiler, whilst incorporating all the latest design and performance features to comply with current legislation and expectations of industry. It also incorporates the benefit of over 50 years of continuous development ensuring long and reliable product life.

BOILER UNATTENDED OPERATION – BG01 Guidance on Safe Operation of Boilers

The boiler as offered is fitted with the Babcock Wanson **BW3DAY** control system and as such exceeds the operational requirements of **BG01 Typical Arrangement 2 for unattended operation**.

BW3DAY UNATTENDED OPERATION

In conjunction with the boiler house risk assessment mentioned below, the provision of any automatic water monitoring equipment required and planned maintenance, the Babcock Wanson **BW3DAY** control system permits uninterrupted operation for a period of up to 6 months and unattended boiler operation for up to 3 days.

Babcock Wanson BW3DAY controls offer the following key benefits:

1) Lower boiler operation cost,
   - Daily boiler water level control checks are replaced by a simple 15-minute test every 3 days.
   - The 3-day test can be undertaken without stopping the boiler thereby avoiding interference with normal production requirements.
   - The mandatory daily/weekly boiler water level control evaporation test is replaced with a 6 monthly test, thereby reducing overall manning and operational costs.

2) **Easy boiler operation** with self-checking burner controls enabling uninterrupted, unattended burner operation.

BG01 Guidance on Safe Operation of Boilers

When specified with additional boiler mountings for automatic Total Dissolved Solids Control and Timed Bottom Blowdown plus remote monitoring of the feed tank and fault conditions, the NBWB 100 Premium boiler also meets the operational requirements of **BG01 Typical Arrangement 3 for unattended operation**.

Please note that compliance with BG01 Typical Arrangement 3 will require a boiler house risk assessment to be completed on both the boiler feed water and returning condensate conditions and may require further water analysis equipment to be fitted. Unless already available further boiler house protection systems such as fire detection may also be required to meet this high level of unattended operation. Our Engineers would be pleased to discuss these requirements further if required.

LOW NOx BURNERS – THE MEDIUM COMBUSTION PLANT DIRECTIVE (MCPD)

Directive (EU) 2015/2193 relates to the limitation of pollutants into the air from medium combustion plants i.e. combustion of fuels in plants with a rated thermal input equal to or greater than 1 megawatt (MWth) and less than 50 MWth.

The emission limit values set in the MCPD has applied since 20/12/18 for new plants and will be applied by 2025 or 2030 for existing plants, depending on their size.

Babcock Wanson Low NOx Natural Gas burners guarantee NOx emissions of <100 mg/Nm^3, this ensures compliance with the MCPD well into the future. This figure is based on dry flue gas and 3% O_2 as defined in the MCPD.

Babcock Wanson Low NOx burners offer the following advantages:

- Variable Speed Drive (VSD) Combustion Air Fan
- Improved burner control
- Lower electrical consumption
- Improved acoustic performance at low load
- Reduced maintenance of mechanical components

ECONOMISER

The design of the NBWB 100 Premium boiler allows for the straightforward installation of a Flue Gas Economiser which can be selected at the time of order or ordered later as an upgrade. The economiser raises the efficiency of the boiler from 90% to 95% providing a significant fuel cost saving. We understand that you are considering the economiser as a standard feature future addition and have therefore provided a suitable spool piece transition piece within the cost for the twin wall flues which

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would allow the future installation of the economiser. In addition to the economiser, a flue transition piece would be required to affect the installation; we have not provided a cost for this item at this time.

REGULATORY FRAMEWORK

Firetube Boiler "Assemblies" fall within the scope of the European Pressure Equipment Directive 20141/68/EU, Category IV.

A CE declaration of conformity is provided certifying design and manufacture according to European requirements, under the control of the notified organization.

With regard to design codes for the boiler pressure containing parts, our boilers are built in accordance with French Standard NFE 32-100. With regard to design codes for the control equipment, we follow the instructions of European Standard EN 12953-8 (2002) – EN 12953-6(2012)* - EN 12953-10 (2004).
*: Except for operating mode NFE32020: Attended Mode

All our boilers are manufactured in line with these assessment procedures carried out by two notified bodies.

Lloyd's Register for the boiler pressure vessels; CE0038

Apave Group for the boiler equipment assembly; CE0060

AFTER SALES SERVICE

Babcock Wanson is represented in both Sales and Service throughout Europe. We have an experienced and comprehensive team of Service Engineers whose responsibilities are to assist all Babcock Wanson clients with commissioning and ongoing service, plus staff instruction for safe operation of our products both at home and abroad.

With over 100 years as a successful boiler manufacturing group, Babcock Wanson has grown into a major, internationally recognised, and respected boiler producer. Babcock Wanson can offer a total steam-raising package tailor-made to the customer's specific requirements ensuring a Single-Source of Responsibility.

EXTENDED WARRANTY

We offer an extension of our standard warranty on the boiler plant to up to 5 years from commissioning when a Babcock Wanson Service Agreement is entered into and maintained for the duration of the warranty period. This can provide our customers with peace of mind for operation of the plant without extensive cost or additional servicing needs.

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We are also pleased to offer a 5-year Corrosion Warranty for Babcock Wanson Firetube Steam boilers which are covered continuously from new by a Babcock Wanson Water Treatment Contract. All steam raising equipment requires suitably treated water to ensure safe and reliable operation, our high quality, cost effective and comprehensive service is tailor made for our boilers.

We feel that these services combined provide our clients with a single source solution and the peace of mind which comes along with this.

We trust that your requirements have been interpreted correctly, our proposal will be of interest to you and that it contains sufficient information for your project requirements, if not please call us.

Our team of Engineers and Specialists is available to provide answers to any questions that you may have and your local Babcock Wanson Engineer will make contact shortly to offer any assistance you may need.

There may be other products from our Company portfolio in which you may be interested and an introduction to them is enclosed for your information.

Yours faithfully,

For and on behalf of Babcock Wanson UK Limited,

Dami Solaru
Applications Engineer
PROCESS ENGINEERING DIVISION
DSolaru@babcock-wanson.com

Your sales engineer is:

Tim Marchant
Sales Engineer
PROCESS ENGINEERING DIVISION
+44 (0) 796 7340 224
TMarchant@babcock-wanson.com

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PROJECT COST SUMMARY

NBWB 100 Premium Fire tube Steam Boiler

2 x NBWB 100 Premium Fire-tube Steam Boilers including Modulating Burner and Sample Cooler

2 x Timed Bottom Blow Down (TBB)
2 x Auto Total Dissolved Solids (TDS) Controls
2 x Self-Checking Level and Burner Controls for Unattended Operation – BW3 Days
2 x Economisers

Ancillary Equipment

1 x 2000 L Feedwater Tank (Stainless)
1 x BGW 75 Duplex Water Softener
1 x Chemical Dosing Set (3 x Single On/Off Pumps)
1 x Blowdown Vessel and Cooling System
2 x 300mm Wall Mounted Chimneys At A Height Of 6.6m From FFL
1 x TDS Controller – Probes & Controller Only

Commissioning

1 x System Commissioning – *SIX working days (TOTAL) on site*

Training

1 x Training For The Maintenance Team – *TWO working days on site*

Transport

1 x Delivery to site, including Offloading & Positioning

TOTAL PROJECT COST £123,000

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TECHNICAL DETAILS

NBWB 100 Premium STEAM BOILER

TWO – NBWB 100 Premium Firetube Steam Boilers, with control panel, Babcock Wanson burner, burner management system, each mounted as a single unit, fully wired and tested. Process controllers are used to control the boiler.

Technical Specification for a Single Unit

Model	NBWB 100 Premium	
Maximum Steam Output at MCR	kg/h	1,000
Maximum steam output F/A 100°C	kg/h	1,121
Design Pressure	barg	12
Max Operating Pressure	barg	10
Fuel Type	Natural Gas (10.17 kWh/Nm³)	
Nominal Gas Consumption at MCR	Nm³/h	76.5 approx.
Minimum Gas Supply Pressure	mbarg	42 – 300
Efficiency at MCR (on NCV of Natural Gas EN12953)	%	90
LNTG1.16/RS M Burner	Modulating	
NOx	<150 mg/Nm³	
Burner Turn Down	4 : 1	
Ignition	Spark	
Main Electrical supply (three phase)	400 V 50 Hz	
Control supply (single phase)	220 V 50 Hz	
Feedwater Control	Modulating	
Boiler water sample cooler mounted on the boiler shell	Included	
Weight, Flooded	5,065 kg	
Weight, Dry	3,700 kg	
Cladding	Aluzinc.	

*Maximum Continuous Rating (MCR) is based on producing steam at 10 barg from water at 60 °C for NBWB 25-250 Units

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A full description of the above equipment is given in our General NBWB Firetube Boiler Technical Specification, a copy of which is enclosed.

STEAM BOILER MOUNTED EQUIPMENT

Sample Cooler

TWO – Boiler Water Sample Coolers supplied mounted on the boiler shell.

Auto TDS Controls

TWO – Sets of automatic Total Dissolved Solids (TDS) control systems complete with digital controller, conductivity probe, and electrically actuated valves mounted on the boiler shell.

Timed Bottom Blowdown

TWO – Sets of Automatic Timed Bottom Blowdown (TBB) including the Control Panel, mounted electronic controller and pneumatically actuated bottom blowdown valve supplied loose (with associated connecting piece) for fitting to the boiler shell.

ANCILLARY EQUIPMENT

Feedwater Tank

ONE – Stainless Steel feedwater Tank, complete with all necessary connections for condensate return, steam injection, soft water make-up, feed outlet(s), drain and chemical dosing (where appropriate).

Tank supplied with water preheating steam injector including steam solenoid valve as appropriate and instrument controlling the supply of steam for heating and opening the soft water make up valve to provide cooling, sight gauge and level control.

Insulation has not been included because it could get damaged during transportation and/or during the installation into a container.

Blowdown Vessel

ONE - Blowdown Vessel suitable for use with offered Firetube Boiler(s). Vessel designed constructed and CE marked in accordance with the PED or ASME equivalent. Please note that if containerization is accepted then the header will be manufactured and installed. If the items are bought separately it is supplied without headers required to allow for multiple boiler installations as these would form part of the site pipework installation works.

The following equipment has been included:

- Automatic cooling control valve.
- Isolating and Non-return Valves and Drain Valves required in accordance with the requirements of PM60

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Water Softener

Base Exchange Water Softener with control head and brine system. The softener size is based on the following operating conditions and is fitted with 24 V controls:

50% condensate returned
300 mg/l total water hardness
24 hours per day operation
2 to 8.5 barg mains water supply pressure
12.3 hours capacity between regeneration at 1,090 kg/h service flow
3,000 kg/h maximum service flow

Chemical Dosing Set(s)

ONE – Chemical Dosing Set comprising an on / off output injection pump mounted on a chemical storage tank (excluding chemicals) for Oxygen Removal.

ONE – Chemical Dosing Set comprising on / off output injection pump mounted on a chemical storage tank (excluding chemicals) for Acidity Correction.

ONE – Chemical Dosing Set comprising on / off output injection pump mounted on a chemical storage tank (excluding chemicals) for Sludge Conditioning.

CHIMNEY

Chimney – Wall Mounted

TWO – 300mm bore stainless steel twin-wall wall-mounted CHIMNEY complete with a branch to the rear of the unit, drain plate, weather apron and wall brackets. Please note we have allowed a typical chimney height of 6.64 m from Finished Floor Level; the chimney would be supplied in sections 1.2 m long.

The above offer and attached technical detail is for a twin-wall type chimney of a nominal height. The offered equipment does not need a specific height of chimney to operate correctly and therefore the final design must be confirmed to suit site requirements. This may mean the final height needs to be adjusted and we would be happy to discuss this aspect with you further. The chimney type offered requires it to be supported from your building or local steelwork with no more than 3M of free-standing section.

Please note that depending on the final height additional brackets and / or guy wires may be required to support / steady the chimney.

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COMMISSIONING AND DELIVERY

Commissioning

The above price includes for commissioning and the instruction of site personnel in operation and maintenance techniques. This work should take up to SIX workings days (for both boilers) on site which is assumed to be uninterrupted and in normal hours. Should our engineer be delayed through causes beyond our control, we reserve the right to charge for additional hours at the rates shown on the attached sheet.

Commissioning Assumptions

Unless stated otherwise, our quotation is based on work being carried out during normal working hours and that free and unrestricted access to the working area will be made available at all times.

The commissioning visit can be undertaken as a continuous operation with all necessary fuel, power, and heat consumption services being available as required.

A lockable storage facility for tools and materials will be required and we assume that temporary lighting, first aid and sanitary facilities will be made freely available to our operatives during the course of the contract.

No asbestos-bearing material or other substance hazardous to health is likely to be encountered by our operatives during the course of the works and if discovered, will be safely removed by the client.

Delivery

Approximately 10 working weeks from an order being placed before 4th March 2022.

Transportation

Delivery to site as a single consignment is included, along with offloading and positioning.

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TERMS AND CONDITIONS

Terms and Conditions

This offer is made in accordance with our Terms and Conditions of Sale and would note that all prices quoted in this tender are exclusive of VAT and the addition of any customs tariffs that may be applied following the UK's departure from the EU.

Tender Validity

Unless previously withdrawn, this tender is open for acceptance for 30 days from the date thereof and is subject to confirmation at the time of acceptance.

Terms of Payment

30% with order.
60% on notification that the equipment is ready for and prior to despatch.
10% after commissioning or 60 days from delivery, whichever is the sooner.

Customer Responsibilities

The extent of our supply is strictly limited to the equipment described above. Your attention is drawn to the following specific exclusions.

- Mechanical and electrical installation work.
- Fused mains isolator or any interconnecting wiring or local isolation required on site.
- Electrical power connections to skid (as appropriate) and boiler control panel.
- Ducting or chimney **NB** we have offered a typical flue arrangement only.
- Additional ducting to chimney **NB** we have offered a typical flue arrangement only.
- Ladder and access platforms including any temporary access facilities required for commissioning purposes to access high-level equipment and valves etc.
- Fuel supply to the heater including any valves, strainers or fire valves. LPG supply where required for Liquid Fuel Pilot Ignition. It is assumed that there is a suitable gas meter local to the unit which can be used to facilitate commissioning.
- Interconnecting pipe work or additional valves (beyond skid where appropriate).
- Insurance Company and/or Independent Inspection Authority tests and expenses. **NB** attendance by our commissioning engineer to facilitate these tests, if required, would be chargeable.
- Water Treatment Chemicals and or Consumables.
- Fuel, Water and Water Treatment Chemicals for Commissioning and Testing

Documentation

TWO copies of our Operation and Maintenance Manuals in the English Language are included in our proposed scope of supply. These are provided in electronic format on CD-ROM.

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After Sales Services

Babcock Wanson UK Ltd. has a team of Service Engineers providing after sales service for all Babcock Wanson products both in the United Kingdom and Overseas. Spare parts are available from our Works at Borehamwood and from the Babcock Wanson Organisation and its licensees in most major countries.

Enclosures

For your general guidance and information, we enclose the following documents:

Terms and Conditions of Sale – BW/COB/9724
NBWB Technical Specification
Product Guide
Service and Commissioning charge rates.

For and on behalf of Babcock Wanson UK Limited

Dami Solaru
Applications Engineer
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Your sales engineer is:

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Measurement Summary Report

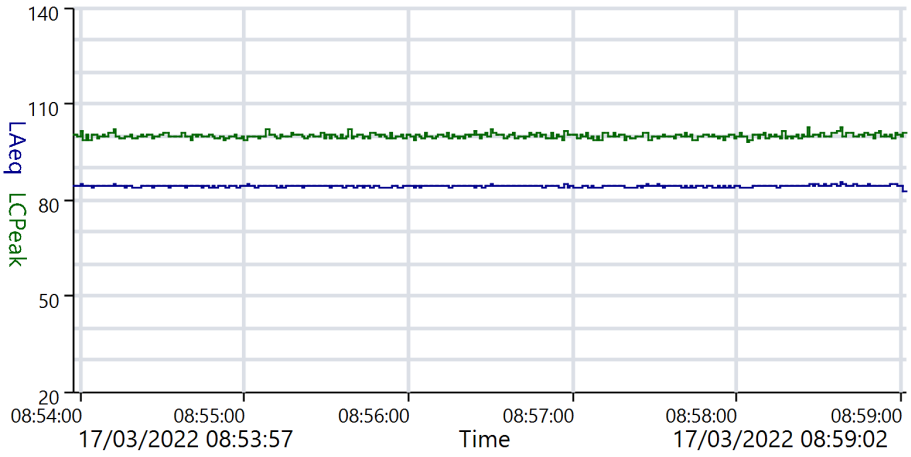
Name	Thermal Oxidiser at 1m from fan			
Time	17/03/2022 08:53:57	**Person**	**Place**	**Project**
Duration	00:05:05	Stephen Crewe	Tenmat Ltd	Site Move Project
Instrument	PN1218, Model 45	HSSE		

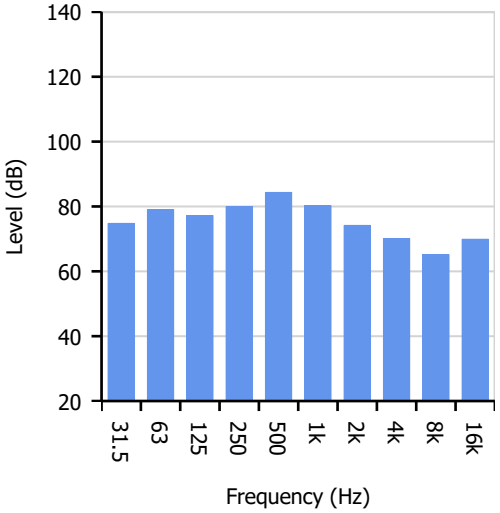
Calibration

Before	17/03/2022 08:53	Offset	0.29 dB	**After**	17/03/2022 10:53	Offset	0.46 dB

Basic Values	
LAeq	84.2 dB
LCPeak	102.5 dB
C-A	3.7 dB
LEPd	64.5 dB
LAFMax	86.0 dB

Projected Exposure	
30 Minutes	72.2 dB
1 Hour	75.2 dB
2 Hours	78.2 dB
4 Hours	81.2 dB
6 Hours	83.0 dB
8 Hours	84.2 dB
10 Hours	85.2 dB
12 Hours	86.0 dB





Measurement Summary Report

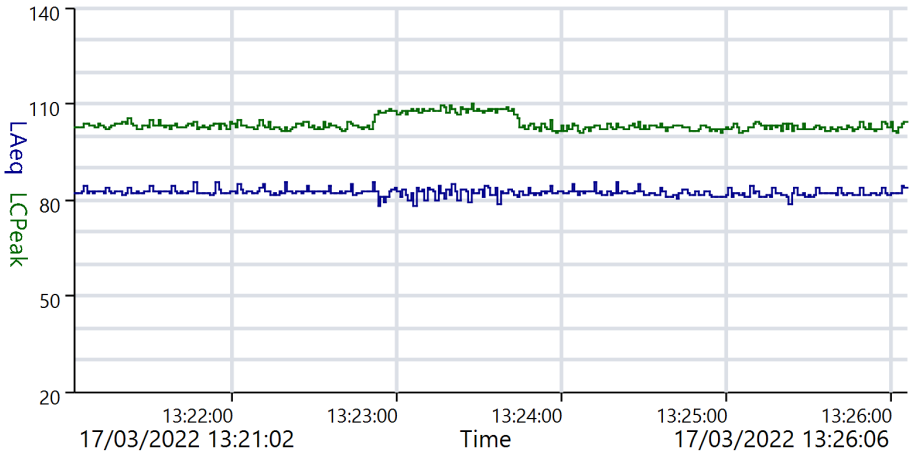
Name	Dust plant 3 1m from fan			
Time	17/03/2022 13:21:02	**Person**	**Place**	**Project**
Duration	00:05:04	Stephen Crewe	Tenmat Ltd	Site Move Project
Instrument	PN1218, Model 45	HSSE		

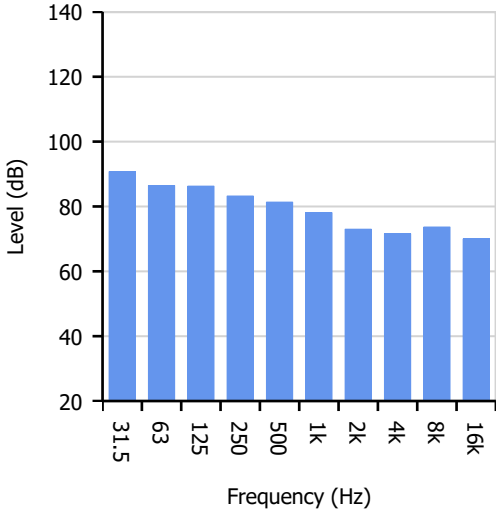
Calibration

Before	17/03/2022 13:20	Offset	0.42 dB	**After**	17/03/2022 13:43	Offset	0.28 dB

Basic Values	
LAeq	82.4 dB
LCPeak	110.0 dB
C-A	10.4 dB
LEPd	62.6 dB
LAFMax	88.8 dB

Projected Exposure	
30 Minutes	70.4 dB
1 Hour	73.4 dB
2 Hours	76.4 dB
4 Hours	79.4 dB
6 Hours	81.2 dB
8 Hours	82.4 dB
10 Hours	83.4 dB
12 Hours	84.2 dB





Measurement Summary Report

Name	Nederman dust plant 1m from fan			
Time	17/03/2022 12:52:15	**Person**	**Place**	**Project**
Duration	00:05:10	Stephen Crewe	Tenmat Ltd	Site Move Project
Instrument	PN1218, Model 45	HSSE		

Calibration

Before	17/03/2022 12:51	Offset	0.42 dB	**After**	17/03/2022 13:20	Offset	0.42 dB

Basic Values	
LAeq	79.6 dB
LCPeak	111.6 dB
C-A	9.7 dB
LEPd	59.9 dB
LAFMax	84.2 dB

Projected Exposure	
30 Minutes	67.6 dB
1 Hour	70.6 dB
2 Hours	73.6 dB
4 Hours	76.6 dB
6 Hours	78.4 dB
8 Hours	79.6 dB
10 Hours	80.6 dB
12 Hours	81.4 dB