Hindlow Works

Combined Heat and Power Plant

Appendix B - Noise Assessment

Lhoist UK Ltd

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1.0 INTRODUCTION

Lhoist UK Limited has appointed SLR Consulting Limited to undertake a noise assessment for a combined heat and power (CHP) plant at Hindlow Lime Works, Derbyshire. This noise assessment forms a technical appendix to the Planning Statement that supports a planning application for the proposed CHP plant.

The noise assessment of the CHP plant has been carried out in accordance with the guidance contained in British Standard 4142:2014 *Methods for rating industrial and commercial sound.*

The noise predictions in this assessment have been undertaken using a proprietary software-based noise model, CadnaA, which implements the full range of UK calculation methods.

Whilst reasonable effort has been made to ensure that this report is easy to understand, it is technical in nature; to assist the reader, a glossary of terminology is included in Annex A.

2.0 SITE DESCRIPTION

2.1 Existing Site Conditions

The Hindlow Lime Works produces the 'Sorbacal' hydrated lime product which is used in flue gas treatment. The CHP plant would be positioned in the eastern part of the works site behind the Sorbacal plant.

2.2 Proposed Development

The proposal would involve the installation and operation of a CHP plant for on-site electricity generation via a gas fired turbine. In addition, heat produced by the CHP plant would be used within the lime works

The CHP plant would be packaged into a weatherproof acoustically lined container, complete with forced draught ventilation system designed to provide the required cooling and combustion air for the generator set. The containerised plant would be designed to achieve an overall noise level of 65dBA @ 10m.

A plan showing the design and the location of the proposed CHP Plant can be seen in Annex B.

3.0 SCOPE

3.1 Consultation with Derbyshire County Council

Derbyshire County Council was consulted and it was confirmed that the application would require planning permission[1] as opposed to having deemed planning permission under the Town and Country Planning (General Permitted Development) Order 2015.

As the application is the installation of a CHP plant within an active mineral working, and thus anciallry to the mineral operation, the planning authority that would consider the application is Derbyshire County Council (as mineral planning authority, MPA). Notwithstanding this, the Environmental Health Officer (EHO) at the High Peak District Council will be consulted as part of the planning process. At this stage SLR has not consulted with the either the MPA or EHO but it is anticipated that the MPA would request that the proposals are assessed in accordance with British Standard 4142:2014 *Methods for rating and assessing industrial and commercial sound.*

3.2 British Standard 4142:2014

British Standard 4142:2014 is intended to be used to assess the potential adverse impact of sound, of an industrial and/or commercial nature, at nearby sensitive receptor locations within the context of the existing sound environment.

Where the specific sound contains tonality, impulsivity and/or other sound characteristics penalties should be applied depending on the perceptibility. For tonality a correction of either 0, 2, 4 or 6dB should be added; for impulsivity a correction of either 0, 3, 6 or 9dB should be added and if the sound contains specific sound features which are neither tonal nor impulsive a penalty of 3dB should be added.

In addition, if the sound contains identifiable operational and non-operational periods, that are readily distinguishable against the existing sound environment, a further penalty of 3dB may be applied.

The assessment of impacts contained in BS4142:2014 is undertaken by comparing the sound rating level, i.e. the specific sound level of the source plus any penalties, to the measured representative background sound level immediately outside the sensitive receptor location. Consideration is then given to the context of the existing sound environment at the sensitive receptor location to assess the potential impact.

Once an initial estimate of the impact is determined, by subtracting the measured background sound level from the rating sound level, BS4142:2014 states that the following should be considered:

- typically, the greater the difference, the greater the magnitude of the impact;
- a difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- a difference of around +5dB 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. It is an indication that the specific sound source has a low impact

[1] Letter from Derbyshire County Council to Lhoist UK Ltd Letter reference EM1/0716/29

when the rating level does not exceed the background sound level, depending on the context.

BS4142:2014 notes that:

> "*Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.*"

BS4142:2014 outlines guidance for the consideration of the context of the potential impact including consideration of the existing residual sound levels, location and/or absolute sound levels.

4.0 ENVIRONMENTAL SOUND SURVEY

SLR completed a daytime baseline sound survey at No.2 Fiveways in July 2012 as part of an application for the determination of new planning conditions under the Environment Act 1995. This data will be referred to in this assessment. At this stage no baseline sound data has been obtained at Harley Grange. In addition, the noise monitoring data only covers the day time period; no data has been obtained for the night time.

4.1 Survey Date

An attended environmental sound survey was undertaken by SLR on Tuesday 17th July. Measurements were taken over eight consecutive 15-minute periods during the daytime period 07:00 to 19:00 hours to give a total of two hours of data at the location.

4.2 Weather

The weather conditions during the survey periods were acceptable for noise monitoring, being dry with little or no wind.

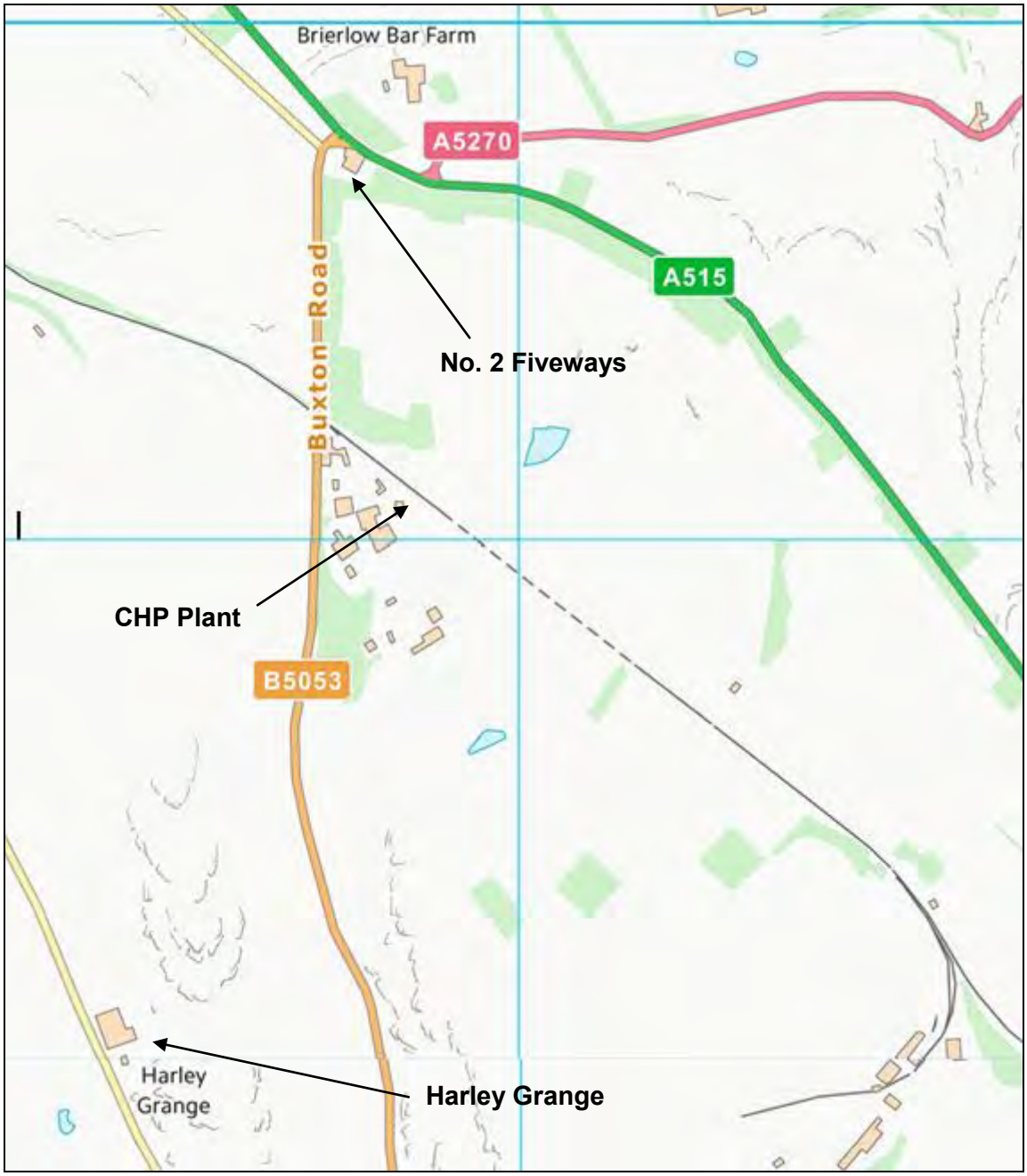
4.3 Equipment

The sound monitoring equipment used during the assessment is detailed in Appendix D. All measurement instrumentation was calibrated before and after the measurements. The calibration chain is traceable via the United Kingdom Accreditation Service to National Standards held at the National Physical Laboratory. No significant drift was observed.

4.4 Monitoring Locations

The two receptor locations, the survey location, and the proposed location of CHP plant can be seen in Figure 4-1. The survey location was selected as it was considered representative of No. 2 Fiveways and permission had been obtained from the landowners.

Figure 4-1
Noise Monitoring Locations



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At the monitoring location the microphone was placed 1.5m above the ground in free-field conditions, i.e. at least 3.5m from the nearest vertical, reflecting surface, with the following sound level indices being logged every 5-minutes:

- $L_{Aeq,T}$.
- L_{A90}.
- L_{A10}.
- L_{Amax}.

4.5 Results

The measured baseline sound levels, and the representative L_{A90} at No.2 Fiveways, are shown in Table 4-1. The full survey results can be seen in Appendix E of this Report.

Table 4-1
Summary of Measured Sound Levels, free-field, dB

Location	Period	$L_{Aeq,T}$	Median L_{A90}	L_{Amax}
No.2 Fiveways	Daytime	53.4	47.5	69.5

4.6 Sound Climate

During meter set-up and collection the sound climate consisted of road traffic noise and natural sounds such as birdsong and leaf rustle.

5.0 ON-SITE ASSESSMENT

The noise predictions in this on-site assessment have been undertaken using a proprietary software-based noise model, CadnaA, which implements the full range of UK calculation methods. The calculation algorithms set out in ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2 General method of calculation* have been used and the model assumes:

- A ground absorption factor of 1.
- A reflection factor of 2.
- A daytime receiver height of 1.5m and a night-time receiver height of 4.0m.

5.1 Noise Sources

Table 5-1 details the plant that will be in operation at the CHP Plant.

Table 5-1
Plant Details

Plant	Sound Power Level dB(A)	Data Source
GE Jenbacher JMS612GS-NL(F11) Containerised Gas-Engine Generating-Set	93.0	Clarke Energy Limited Document Reference Number C3447LC04
Exhaust (10m high)		
Exhaust pipework		
Table Cooler		
Cooling Air Intake		
Cooling Air Discharge		

5.2 Container Construction

Information with regard to the sound reduction index value (R_W) of the container has not been provided but based on the information that at 10m from the container the average sound pressure level is 65dB(A) an R_W of 22dB has been used for the roof and the walls of the container.

Based on each container having a surface area of 206.6m^2 and an absorption coefficient of 0.1, the total reverberant noise level produced by the gas engine is 98dB(A).

A noise model of a container housing the gas engine and the associated plant listed in Table 5-1 can be seen in Annex E. It can be seen from this model that SLR has accurately modelled the container, as at 10m the average sound pressure level is 67.3dB(A).

5.3 Assessment Results

Free-field sound predictions have been made at the worst affected façade of the two receptor locations assessed.

As the predicted specific sound levels at each receptor are low, SLR does not consider that any penalties need to be applied to the specific sound level, as the plant would not be

audible at the receptors assessed. The rating level is therefore the same as the specific sound level.

The results of the BS4142 assessment are shown in Table 5-2. It must be noted that the rating levels and the representative background sound levels have been rounded to the nearest decibel. .

Table 5-2
BS4142 Assessment, dB

Receptor	Assessment	Predicted Specific Sound Level, $L_{Aeq,T}$	Predicted Rating Level, $L_{Ar,T}$	Representative Background Sound Level L_{A90}	Difference
No.2 Fiveways	Daytime	7.4	7.0	48.0	-41.0
	Night-Time	7.8	8.0	-	-
Property to south	Daytime	0.9	1.0	-	-
	Night-Time	1.3	1.0	-	-

5.3.1 Daytime

The daytime assessment results indicate that:

- The rating level at the No.2 Fiveways is 41dB(A) below the background sound level.
- Whilst SLR does not have any baseline sound data at Harley Grange the rating level of 1dB(A) is likely to be significantly below the background sound level at the receptor.

With reference to BS4142:14, the low rating levels relative to the measured / likely representative background sound levels indicate that the specific sound source will not have an adverse noise impact at the two receptors assessed.

5.3.2 Night-Time

The night-time assessment results indicate that:

- Whilst SLR does not have any night-time baseline sound data at No.2 Fiveways the predicted rating level of 8dB(A) is likely to be significantly below the background sound level at the receptor.
- Whilst SLR does not have any night-time baseline sound data at Harley Grange the predicted rating level of 1dB(A) is likely to be significantly below the background sound level at the receptor.

With reference to BS4142:14, the low rating levels relative to the measured / likely representative background sound levels indicate that the specific sound source will not have an adverse noise impact at the two receptors assessed.

6.0 CONCLUSION

Lhoist UK Ltd has appointed SLR Consulting Limited to undertake a noise assessment for a CHP Plant at Hindlow Lime Works, Derbyshire.

The noise assessment of the CHP Plant has been carried out in accordance with the guidance contained in British Standard 4142:2014 *Methods for rating industrial and commercial sound.*

The assessment has concluded that with reference to BS4142:14, the low rating levels relative to the measured / likely representative background sound levels indicate that the specific sound source will not have an adverse noise impact at the two receptors assessed.

7.0 CLOSURE

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of Lhoist UK Ltd; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

APPENDIX A

APPENDIX A – GLOSSARY OF TERMINOLOGY

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0dB (the threshold of hearing) to over 120dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A-1
Sound Levels Commonly Found in the Environment

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

Acoustic Terminology

dB (decibel) — The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2x10^{-5}$Pa).

dB(A) — A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.

L_{Aeq} — L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.

L_{10} & L_{90} — If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.

L_{Amax} — L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise

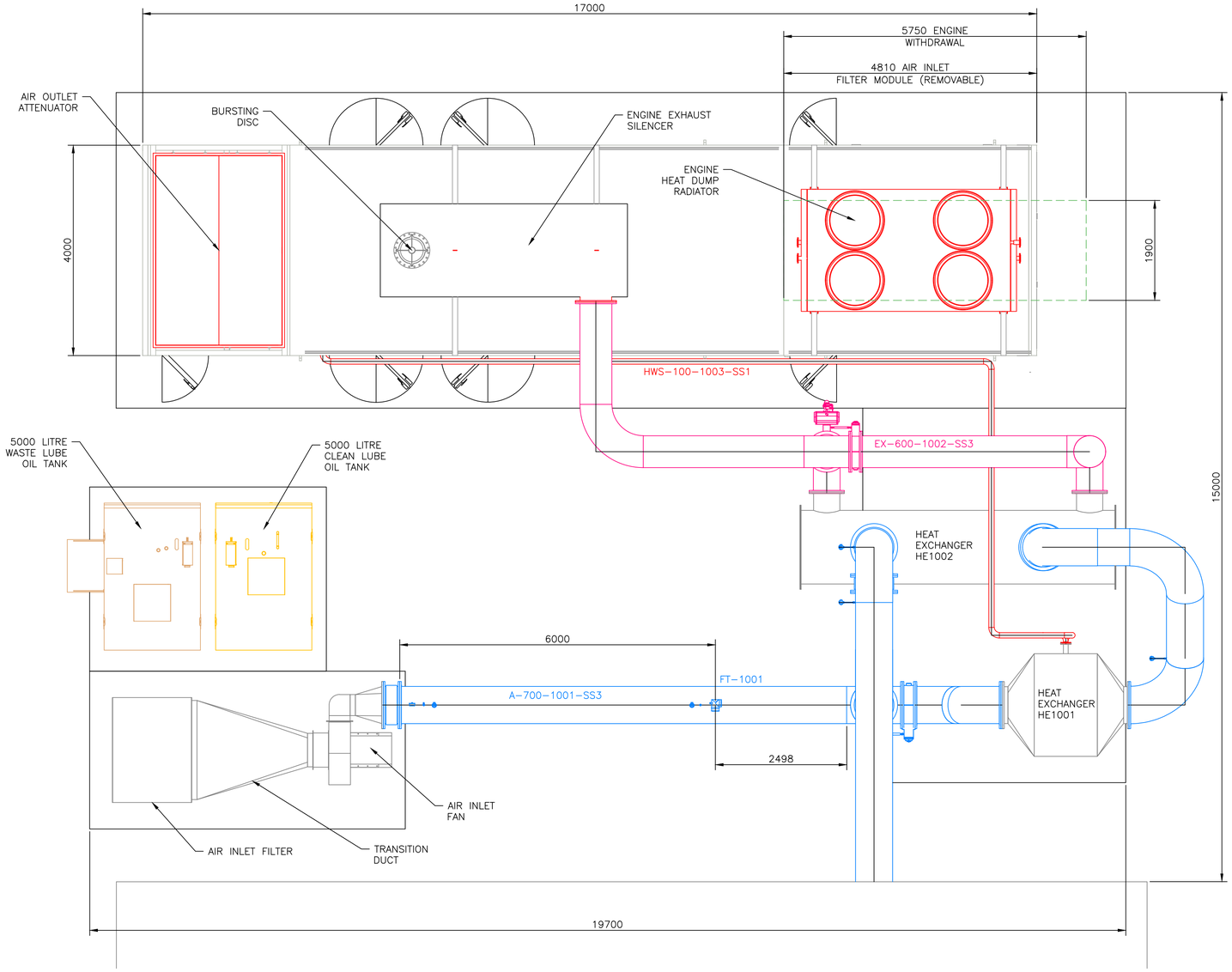
APPENDIX A

where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.

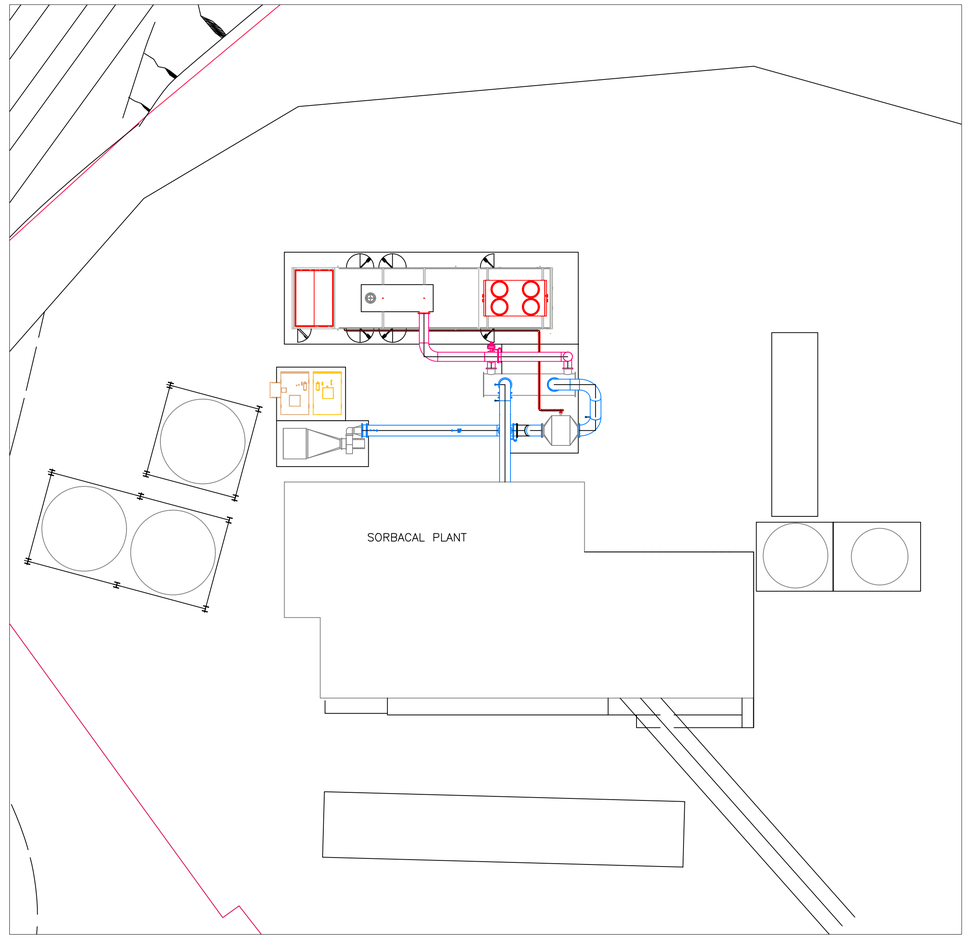
APPENDIX B

APPENDIX B – DRAWING

DRAWING No.	C3447-GA-001	DO NOT SCALE		IF IN DOUBT ASK		REMOVE ALL SHARP EDGES		ALL DIMENSIONS IN mm UNLESS OTHERWISE STATED



PLAN VIEW



LOCATION PLAN (1:200)

ISSUED FOR TENDER
ALL EQUIPMENT & DIMENSIONS SHOWN ARE INDICATIVE ONLY

REV	AMENDMENT	BY.	CHK.	APP.	DATE.
TB	UPDATED TENDER ISSUE	PHW	NA	LG	01.03.16
TA	TENDER ISSUE	RJG	NA	NA	16.10.15

KEY TO FIRST LETTER OF DRAWING ISSUE.
'B' = AS-BUILT ISSUE
'A' = CONSTRUCTION ISSUE
'P' = PRELIMINARY ISSUE
'T' = TENDER ISSUE

FABRICATION/BUILD ONLY TO BE UNDERTAKEN AT CONSTRUCTION ISSUE

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TITLE	GENERAL ARRANGEMENT OF GE JENBACHER 612 CONTAINERISED ENGINE & AIR DRYER
CLIENT	LHOIST
SITE	HINDLOW, BUXTON

PAPER SIZE.	A1	SCALE.	1:50		
DRAWN BY.	P.H.Watson		DATE DRAWN.	16.10.15	ISSUE.
DRAWING NO.	C3447-GA-001				TB

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APPENDIX C

APPENDIX C – SURVEY EQUIPMENT

Table C-1
Survey Equipment

Location	Equipment	Serial Number
1 – No.2 Fiveways	Norsonic Nor140 Type 1 Sound Level Meter	1403009
	Norsonic Nor1251 Acoustic Calibrator	31875

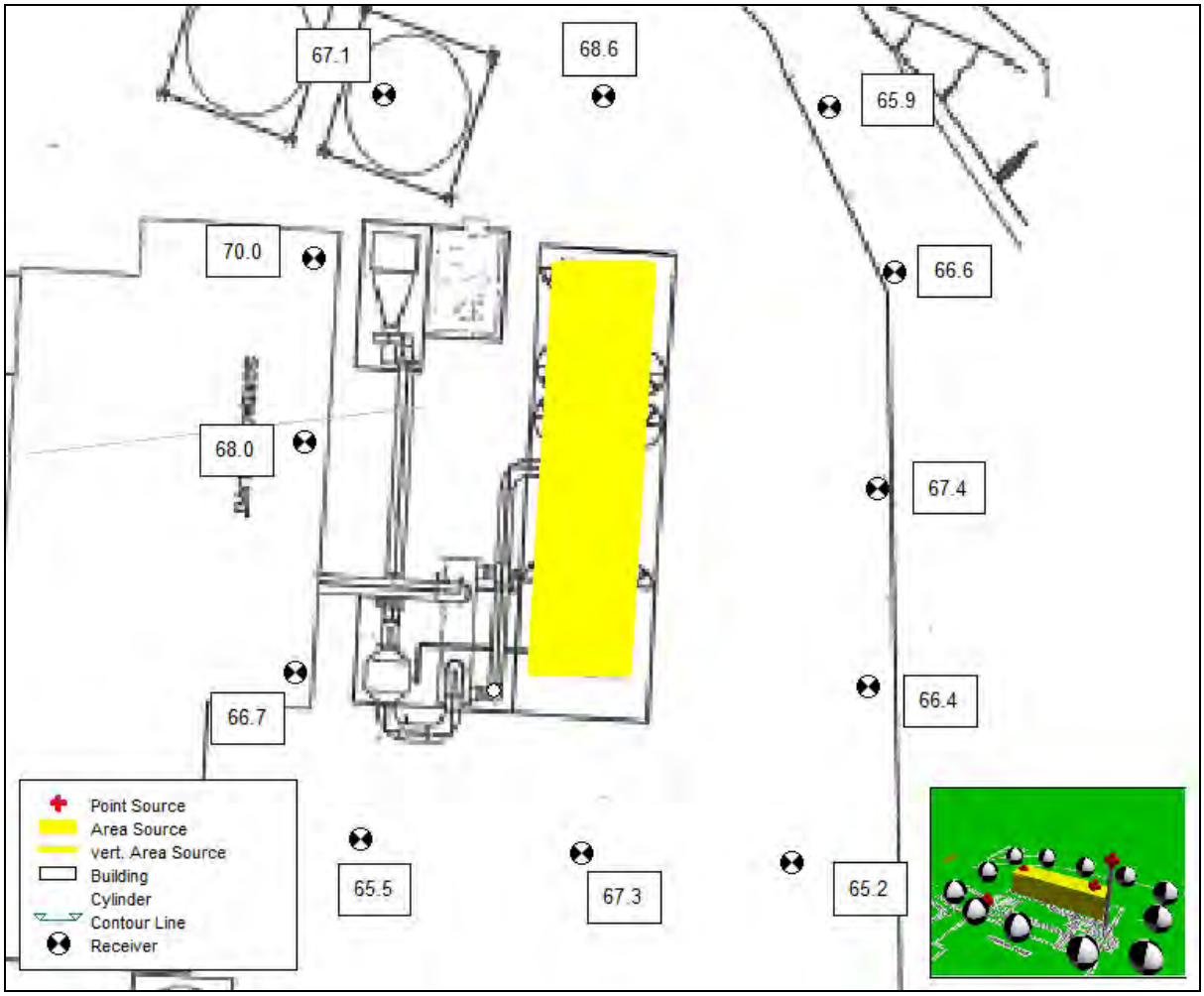
APPENDIX D – SURVEY RESULTS

Table E-1
Measured Noise Levels at No.2 Fiveways, free-field, dB

Date	Start Time	$L_{Aeq,T}$	L_{A90}	L_{A10}	L_{Amax}
17/07/12	14:45	53.7	47.9	56.5	64.1
	15:00	51.8	43.7	55.2	62.2
	15:15	54.2	47.0	57.1	69.5
	15:30	53.4	47.7	56.4	68.3
	15:45	53.8	47.6	56.7	65.8
	16:00	53.3	47.3	56.0	63.0
	16:15	52.8	45.6	56.2	63.6
	16:30	54.1	48.1	56.9	66.5

APPENDIX E – CHP PLANT NOISE MODEL

Figure E-1
Noise Model of a Containerised JGC Generator



APPENDIX F – REPORT LIMITATIONS

This entails a physical investigation of the site with a sufficient number of sample measurements to provide quantitative information concerning the type and degree of noise affecting the site. The objectives of the investigation have been limited to establishing sources of noise material to carrying out an appropriate assessment.

The number and duration of noise measurements have been chosen to give reasonably representative information on the environment within the agreed time, and the locations of measurements have been restricted to the areas unoccupied by building(s) that are easily accessible without undue risk to our staff.

As with any sampling, the number of sampling points and the methods of sampling and testing cannot preclude the existence of “hotspots” where noise levels may be significantly higher than those actually measured due to previously unknown or unrecognised noise emitters. Furthermore, noise sources may be intermittent or fluctuate in intensity and consequently may not be present or may not be present in full intensity for some or all of the survey duration.

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