



Bio Dynamic UK Limited

Noise Impact Assessment of Anaerobic Digestion Facility

dBx Acoustics Ltd
Beehive Mill, Jersey Street
Manchester M4 6JG

20036 Bio Dynamic UK Limited AD Facility R01B

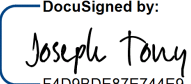
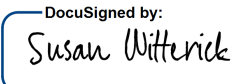
Client: Bio Dynamic UK Limited

Date: 17 January 2022

Contents

Contents	1
Introduction.....	2
Proposed Development Details.....	3
Road Traffic Noise Impact	6
Assessment Criteria.....	7
Environmental Noise Survey and Noise Emission Limits	9
Noise Impact Assessment.....	10
Conclusions.....	15
Appendix A – Glossary of Acoustic Terminology.....	16
Appendix B – Manufacturer’s Datasheets.....	17

Revision History

Revision	Date	Revision Details	Author	Checked
R01	23/09/2021	Original Issue	Joseph Tony BTech MIOA	Susan Witterick BSc MIOA
R01A	27/09/2021	Updated to address Consultant Comments	Joseph Tony BTech MIOA	Susan Witterick BSc MIOA
R01B	17/01/2022	Updated to include revised layout	DocuSigned by:  F4D9BDE87E744E9... Joseph Tony BTech MIOA	DocuSigned by:  3E69257DCFC14C6... Susan Witterick BSc MIOA

Introduction

dBx Acoustics Ltd has been appointed by Bio Dynamic UK Limited to undertake a noise impact assessment for the proposed Anaerobic Digestion (AD) facility refurbishment at the Colwick Industrial Estate, Nottingham, NG2 2JT. The assessment is prepared to support a variation to the Bio Dynamic UK Limited AD plant permitted facility to allow for a site refurbishment which includes the addition of two new CHPs, a diesel-powered boiler, and an increase in tonnages processed at the site which will result in an increase in vehicle movements.

dBx Acoustics Ltd. has previously undertaken a noise survey and BS4142 noise impact assessment for the adjacent Biogas Upgrading Unit site (Report Ref: *20083 BD Permits Biogas Upgrading Facility R01 dated 11th November 2020*). Noise limits for this assessment were set on the basis that the BS4142 rating limit for the new plant should not exceed the existing background sound level.

This report considers the potential impact of noise generated by the development on existing noise sensitive receptors (NSRs). As part of this examination the following works have been undertaken:

- Assessment of development related road traffic noise;
- Prediction of cumulative plant noise levels at the nearest noise sensitive premises to the Site.

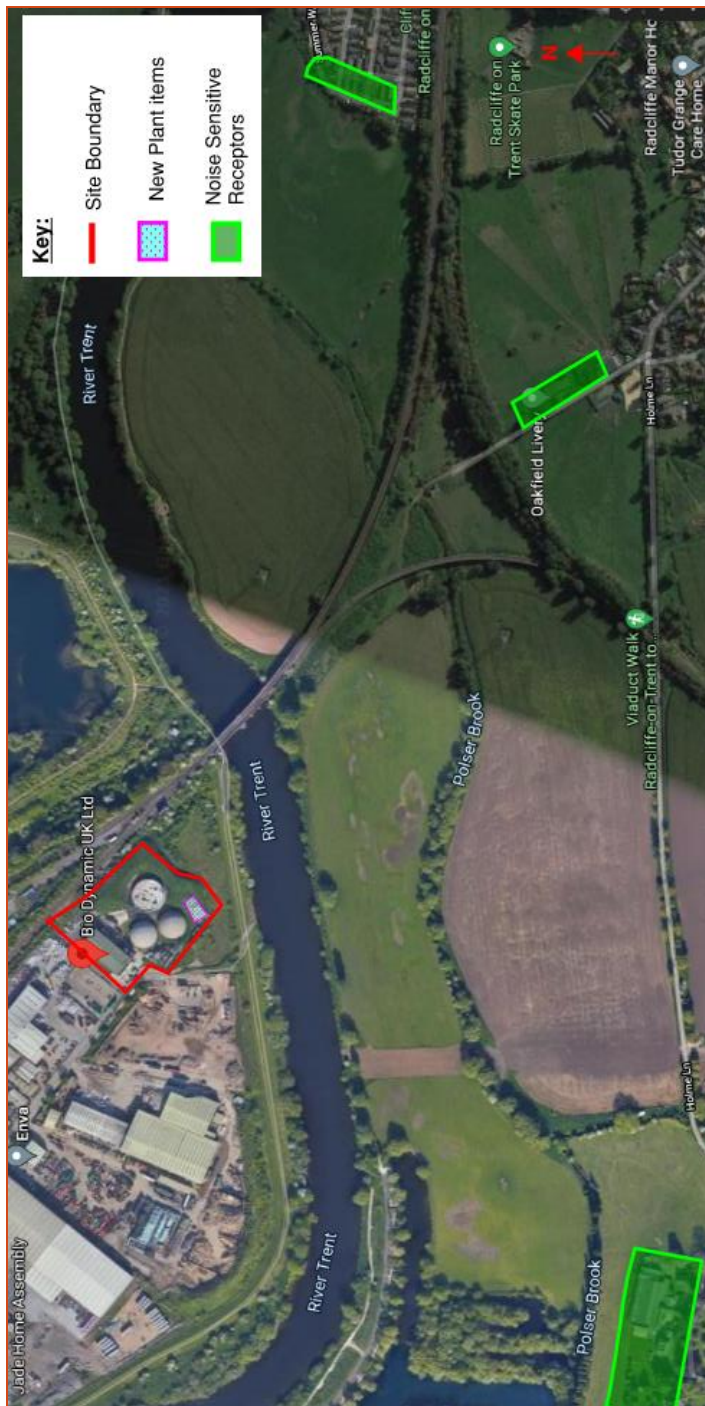
A glossary of acoustic terminology has been supplied in Appendix A in order to assist the reader.

Proposed Development Details

Site Description

The proposed development comprises of refurbishment of the existing biogas AD facility to include two new CHP engines and a diesel-powered boiler at the Colwick Industrial Estate, Nottingham. The approximate location of the new external plant items is presented on Figure 1, below.

Figure 1: Site, Noise Sensitive Receptors and Proposed New Plant Location



Noise Sensitive Receptors

The surrounding area comprises a mixed residential and industrial area. The nearest noise sensitive receptors (NSRs) have been identified as the residential properties overlooking Holme Lane and Oak Avenue Road. Where a number of NSRs are located close to each other, the nearest NSR to the Site has been chosen to represent the immediate area.

The closest noise sensitive receptors (NSRs) in relation to the Site are listed in Table 1 and illustrated on the general layout at Figure 1, above.

Table 1: Noise Sensitive Receptors

Noise Sensitive Receptors	Description	Approximate Distance from the Site Boundary(m)
Residential dwelling overlooking Holme Lane	South-west of the Site boundary	730m to the South-west
Horse-riding school (Oakfield Livery) overlooking Island Lane	South-east of the Site boundary	670m to the South-east
Residential dwelling overlooking Oak Avenue	South-east of the Site boundary	860m to the South-east

Proposed Plant

Proposed new noise-generating plant items are presented in Table 2, and their locations are identified in Figure 2. It is anticipated that the plant will operate continuously (24 hours a day, 7 days a week).

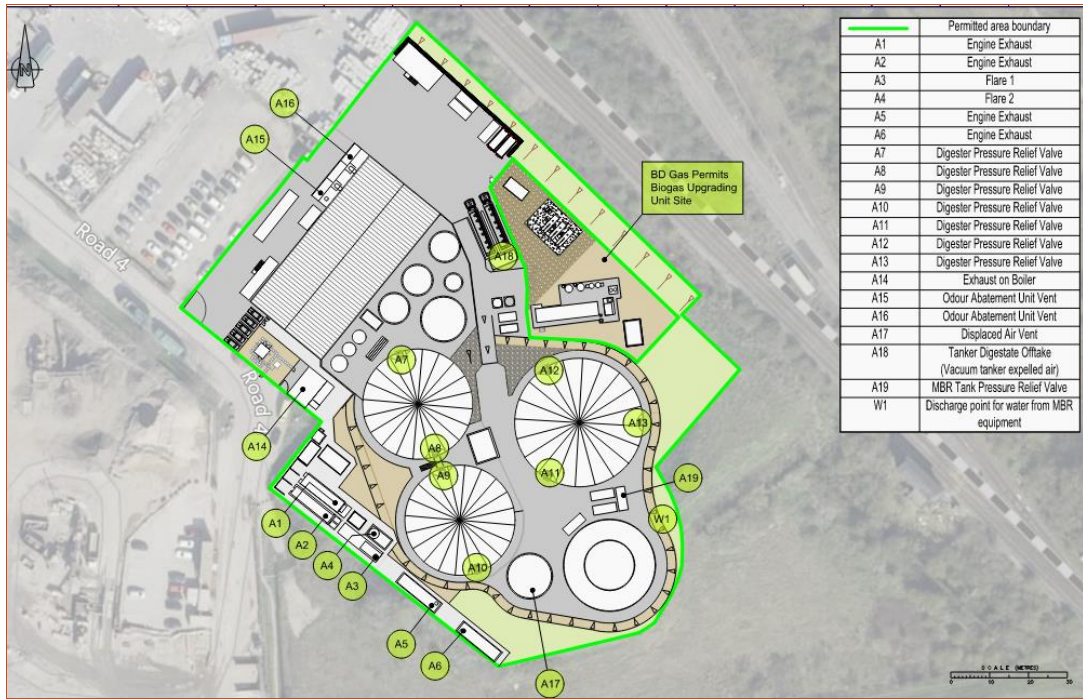
Noise levels of the proposed plant are presented in Appendix B of this document.

Table 2: Proposed Biogas Upgrading Plant Items Exposed to NSR

Plant Item (Unit Reference)	Number of Units	Sound Pressure Level
A5 and A6 (Caterpillar, 1250kWe CHPS) ¹	2	65 dBA at 10m (Engine Average + Exhaust)
A14 (Boiler Exhaust)	1	79 dBA at 1m

Note ¹ : It is understood from the manufacturer that CHP enclosures are designed to meet 65dBA at 10m, this noise data includes the noise from engine exhaust and engine sides.

Figure 2: General Layout of the Proposed Plant Items



Road Traffic Noise Impact

The document *Calculation of Road Traffic Noise (CRTN)*¹ (Department of Transport, 1988) provides a methodology for the calculation of road traffic noise levels, taking into account factors such as distance between the road and receptor, road configuration, ground cover, screening, angle of view, reflection from façades and traffic flow, speed and composition. The noise parameter calculated is the $L_{A10,18 \text{ hour}}$ and is based on the 18hour Annual Average Weekday Traffic (18hr-AAWT).

The Institute of Environmental Management and Assessment's (IEMA) Guidance Note No.1 '*Guidelines for the Environmental Assessment of Road Traffic*'² recommends assessment of noise where traffic flows will increase by more than 30% (or the number of Heavy Goods Vehicles (HGVs) will increase by more than 30%), and where specifically sensitive areas experience traffic flow increases of 10% or more. The guidance indicates that projected changes in traffic of less than 10% create no discernible environmental impacts.

The Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7, '*Noise and Vibration*'³ accords with IEMA guidance stating in paragraph A 1.8 that an increase of 25% or a decrease of 20% in traffic volumes (assuming no change in speed or other factors affecting the generation and propagation of noise as in this instance) is equivalent to an increase in noise level of 1 dB(A), which is the minimum change that can be detected by human hearing. Therefore, only changes in traffic volumes of 25% or greater are considered significant.

dBx Acoustics has received information from Bio Dynamic, regarding existing traffic flows in the vicinity of the site and the anticipated trip generation associated with the proposed development.

Based on traffic flow data provided by Bio Dynamic and having regard to IEMA and DMRB guidance, the potential noise impact of road traffic noise generated by the Development is anticipated to be of negligible significance and has not been considered further in this report.

¹ Department of Transport / Welsh Office (DoT / WO) (1988); '*Calculation of Road Traffic Noise*', HMSO, London.

² Institute of Environmental Management and Assessment (IEMA) (1993); '*Guidance Notes No.1 – Guidelines for the Environmental Assessment of Road Traffic*', IEMA.

³ Department for Transport (2011); '*Design Manual for Roads and Bridges: Volume 11, Section 3, Part 7 Traffic Noise and Vibration*'

Assessment Criteria

Environment Agency

It has been assumed that this site should generally be assessed in line with guidance from the Environment Agency, as follows;

Figure 3: Environment Agency Requirements for Noise Impact Assessment

Noise impact assessment /risk assessment

Where the proposal has a potential to impact nearby sensitive receptors, a noise impact assessment (NIA) should be provided. This will normally be based on BS 4142. Noise modelling requirements can be found at the following link: <https://www.gov.uk/government/publications/noise-impact-assessment-information-requirements>

The noise assessment needs to consider all on site noise sources including on-site vehicle movements but not off-site vehicle movements.

Link to noise guidance:

<https://www.gov.uk/government/publications/environmental-permitting-h3-part-2-noise-assessment-and-control>

<https://www.gov.uk/guidance/control-and-monitor-emissions-for-your-environmental-permit#emissions-that-do-not-have-set-limits>

Where the risk and impact assessment shows that there is a potential for the facility to have noise impacts on nearby sensitive receptors, a Noise Management Plan (NMP) should be provided.

Environment Agency Guidance on Noise Impact Assessments Involving Calculations or Modelling

The document referenced in the link in Figure 3: Environment Agency Requirements above, has been superseded by a new document published in October 2018. This can be accessed at <https://www.gov.uk/guidance/noise-impact-assessments-involving-calculations-or-modelling>.

The following required information is presented within this report;

- Site location and Layout;
- Proposed activities and noise sources;
- Local receptors and reasons for selection;
- Noise remediation approach.

This report provides the following receptor information;

- Measured background sound level, dB L_{A90};
- Specific and rating noise levels for site activities;
- Rationale for applying or not applying acoustic penalties;
- Numerical impacts.

BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound'

BS 4142:2014 sets out a procedure for assessing noise impact whereby a Noise Rating is determined and compared with the existing local Background Sound Level.

The Rating Level ($dB_{A,r,T,r}$) is evaluated from the Specific Noise Level by including several, cumulative corrections to account for factors such as distinguishable tone, impulse, intermittency or other readily distinguishable sound characteristics.

The assessment of the impact depends upon the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level. An initial estimate of the impact of the specific sound is made by subtracting the Background Sound Level from the Rating Level, while considering the following points:

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

Environmental Noise Survey and Noise Emission Limits

Environmental Noise Survey

dBx Acoustics Ltd. has previously undertaken a noise survey and BS4142 noise impact assessment for the adjacent Biogas Upgrading Unit site. Full results of the survey and the assessment undertaken is available on dBx Acoustics Ltd Report Ref: *20083 BD Permits Biogas Upgrading Facility R01 dated 11th November 2020*.

Noise Emission Limits

Noise limits for this assessment were established on the basis that the BS4142 rating limit for the new plant should not exceed the existing background sound level.

The plant items associated with the site as existing, including the existing CHP unit (A2) and odour abatement system (A15 and A16) on site were operational during our previous noise survey. A comparison has also been made with the noise survey undertaken by Dynamic Response on behalf of Bio Dynamic Ltd (Report Ref: *DYN160913A/5 Rev.1 dated Oct 2020*), which is understood to have taken place with both existing CHP units (A1 and A2) in operation.

There is good correlation between the two noise surveys, and as such the plant noise emission limits set on the basis of the 2020 noise survey (dBx Acoustics Ltd Report Ref: *20083 BD Permits Biogas Upgrading Facility R01 dated 11th November 2020*) remain relevant.

Table 3 below presents plant noise limits at nearest sensitive receptors (NSR). This recommendation is based upon the context of the area in which the receptors are located (residential area dominated by traffic noise) and the understanding that plant will be operating 24 hours a day, 7 days a week.

Table 3—Proposed Biogas Upgrading Unit Rating Noise Level Limits

Noise Sensitive Receptors	External Plant Unit Noise Limit ($L_{A,r,Tr}$) dB	
	Daytime 07:00 – 23:00 hours (T = 1 hour)	Night-time 23:00 – 07:00 hours (T = 15 minutes)
Residential dwellings overlooking the Holme Lane	47 dB	37 dB
Horse-riding school (Oakfield Livery) overlooking Island Lane	47 dB	44 dB
Residential dwellings overlooking the Oak Avenue Road	44 dB	42 dB

Noise Impact Assessment

Acoustic Modelling Exercise

The noise model created for the assessment of the Biogas Upgrading Unit has been modified to add noise from the new plant units (Table 2) associated with this application. This methodology ensures that, although the Upgrading Unit was not operational during the original noise survey, noise from the current application will be controlled such that there is no associated 'noise creep' as a result of the cumulative development.

The model has been used to predict the resultant noise levels experienced at the nearest sensitive locations (Table 1) as a result of the proposed development.

The noise modelling exercise is based on the following drawings supplied by the Client;

- *Stage 2 Upgrade Elevations to existing AD Facility; Drawing no: 125-07, dated 11.05.2021;*
- *Permit Boundary and Emissions Points Plan; Drawing No: 125-08 dated 09.04.2021.*

The following figures presents screen shots from the model indicating the surrounding noise sensitive properties, and the locations of the external plant items.

Figure 4: Acoustic Model

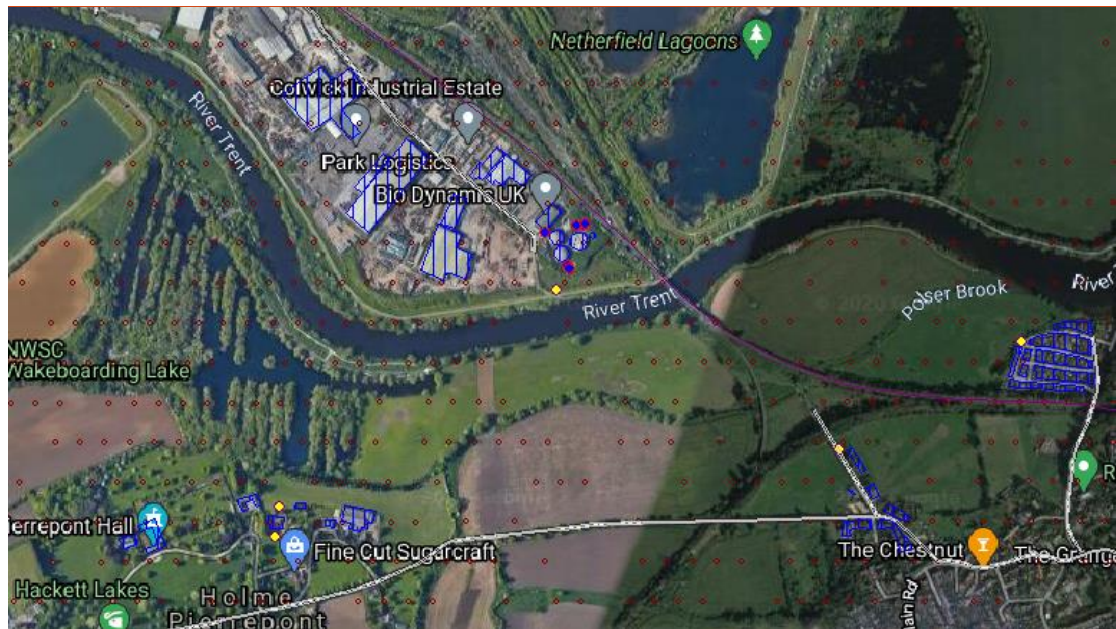
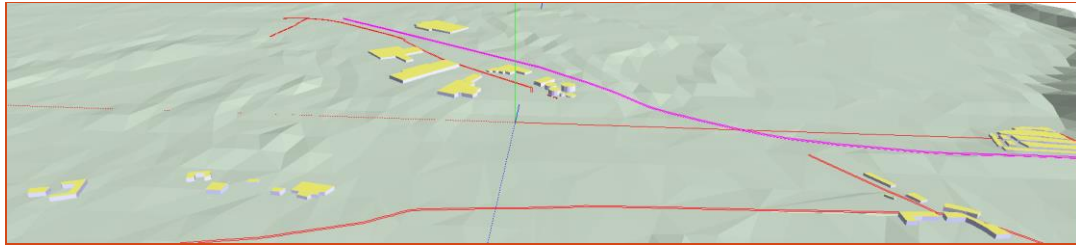


Figure 5: Acoustic Model (3D)



Noise Modelling Results

The noise maps output by the model illustrate how noise from the plant units propagates in the local area and affects the proposed development site. The different coloured noise contours correspond to different levels of noise exposure.

Figure 6 and Figure 7 below presents the predicted external noise levels across the site.

Figure 6: Acoustic Noise Model (3D)

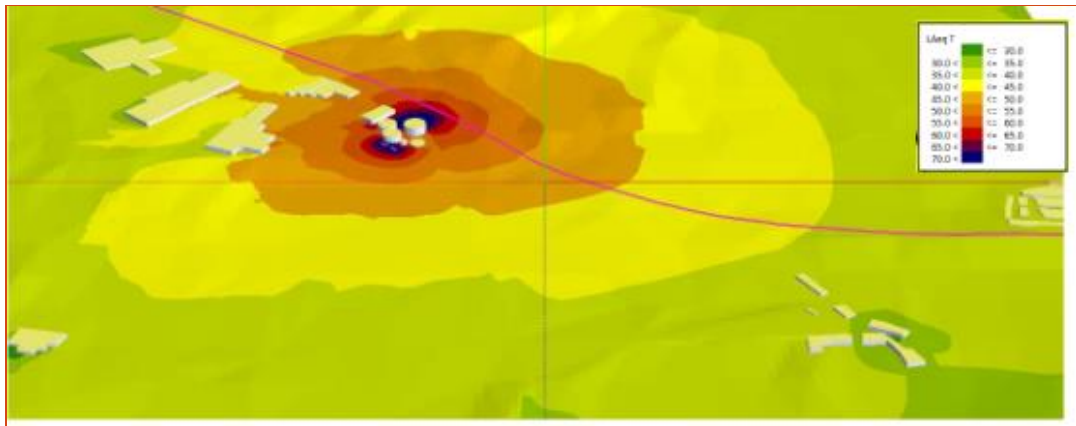


Figure 7: Acoustic Noise Model

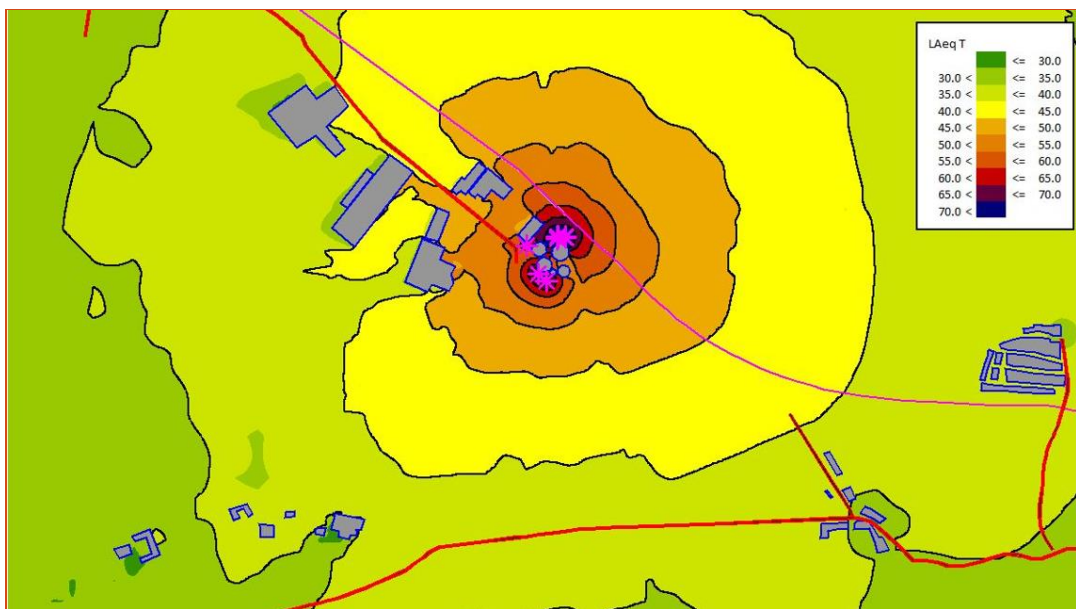


Table 4 below presents the predicted specific sound level from the new plant experienced at the noise sensitive receptors.

Table 4 - Summary of Predicted Specific Sound Levels at NSRs

Location (Figure 1)	Predicted Specific Sound Level (dB $L_{Aeq,T}$)
Residential dwellings overlooking the Holme Lane	36 dB $L_{Aeq,T}$
Horse-riding school (Oakfield Livery) overlooking Island Lane	39 dB $L_{Aeq,T}$
Residential dwellings overlooking the Oak Avenue Road	37 dB $L_{Aeq,T}$

BS 4142 Assessment

Based on the measured noise levels at NSRs and the predicted noise levels from the plant units, the following BS4142 assessment is presented for residential dwellings along Holme Lane, and Oakfield Livery on Island Lane, which are considered to be worst-case locations for potential noise impact.

Table 5: BS 4142 Assessment (Noise Sensitive Receptor - Oakfield Livery)

Item	Calculation	Relevant Clause	Comments
Measured background sound level - daytime	47 dB $L_{A90, 1hr}$	8.3	The typical background sound level measured during the daytime period.
Measured background sound level – night-time	44 dB $L_{A90, 15min}$	8.3	The typical background sound level measured during the night-time period.
Specific sound level	39 dB $L_{Aeq,T}$	7.3.3	A prediction made using the methodology outlined above, includes all sources, screening and distance corrections.
Assessment made during the daytime and night-time periods so reference period is 1 hour, and 15 minutes, respectively		7.2	-
Rating Level	39dB $L_{Ar,Tr}$	9.2	The predicted Rating Level during the daytime and night-time period.
Background sound level - daytime	47 dB $L_{A90, 1hr}$	8	The typical background sound level measured.
Background sound level – night-time	44 dB $L_{A90, 15min}$	8	The typical background sound level measured.
Excess of Rating Level over background sound level - daytime	-8 dB	11	-
Excess of Rating Level over background sound level - night-time	-5 dB	11	-
Assessment indicates low likelihood of adverse impact		11	Predicted Rating Level exceed the measured typical background level by more than 10dB. This is an indication of the development having significant adverse impact.
Uncertainty of the assessment	Low	10	Background sound level based on repeatable measurements. The predicted Rating Level is based on established prediction methodologies.

Table 6: BS 4142 Assessment (Noise Sensitive Receptor - Holme Lane)

Item	Calculation	Relevant Clause	Comments
Measured background sound level - daytime	47 dB $L_{A90, 1hr}$	8.3	The typical background sound level measured during the daytime period.
Measured background sound level – night-time	37 dB $L_{A90, 15min}$	8.3	The typical background sound level measured during the night-time period.
Specific sound level	36 dB $L_{Aeq,T}$	7.3.3	A prediction made using the methodology outlined above, includes all sources, screening and distance corrections.
Assessment made during the daytime and night-time periods so reference period is 1 hour, and 15 minutes, respectively		7.2	-
Rating Level	36 dB $L_{Ar,Tr}$	9.2	The predicted Rating Level during the daytime and night-time period.
Background sound level - daytime	47 dB $L_{A90, 1hr}$	8	The typical background sound level measured.
Background sound level – night-time	37 dB $L_{A90, 15min}$	8	The typical background sound level measured.
Excess of Rating Level over background sound level - daytime	-11 dB	11	-
Excess of Rating Level over background sound level -night-time	-1 dB	11	-
Assessment indicates low likelihood of adverse impact		11	Predicted Rating Level exceed the measured typical background level by more than 10dB. This is an indication of the development having significant adverse impact.
Uncertainty of the assessment	Low	10	Background sound level based on repeatable measurements. The predicted Rating Level is based on established prediction methodologies.

Based on the assessment results it is anticipated that there will be no adverse impact upon residents as a result of the proposed biogas upgrading facility.

Conclusions

dBx Acoustics Ltd has been appointed by Bio Dynamic UK Limited to undertake a noise impact assessment for the proposed refurbishment of the existing AD facility, which includes the addition of two new CHP engines, a boiler unit, and an increase in vehicle movements to and from the site at the Colwick Industrial Estate, Nottingham, NG2 2JT.

dBx Acoustics Ltd. has previously undertaken a noise survey and BS4142 noise impact assessment for the adjacent Biogas Upgrading Unit site (Report Ref: *20083 BD Permits Biogas Upgrading Facility R01 dated 11th November 2020*). Noise limits for this assessment were set on the basis that the BS4142 rating limit for the new plant should not exceed the existing background sound level. This would be expected to have a low noise impact given the context of the site and receptors.

A modelling exercise has been carried out to predict the specific sound level arising from the proposed plant at the residential receptors. A BS4142 assessment has then been presented which indicates that the rating level $L_{A,r,T,r}$ is below the existing background sound level during the most sensitive night-time period at all receptors. This indicates a low likelihood of adverse impact.

On this basis we would recommend that there are no reasons relating to noise impact which would prevent this development.

Appendix A – Glossary of Acoustic Terminology

Decibel, dB	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (L_p) the reference quantity is $2 \times 10^{-5} \text{ N/m}^2$. The sound pressure level existing when microphone measured pressure is $2 \times 10^{-5} \text{ N/m}^2$ is 0 dB, the threshold of hearing.
L	Instantaneous value of Sound Pressure Level (L_p) or Sound Power Level (L_w).
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
A-weighting	Arithmetic corrections applied to values of L_p according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source.
$L_{eq,T}$	Equivalent continuous level of sound pressure which, if it actually existed for the integration time period T of the measurement, would possess the same energy as the constantly varying values of L_p actually measured.
$L_{Aeq,T}$	Equivalent continuous level of A weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of L_p actually measured.
$L_{n,T}$	L_p which was exceeded for n% of time, T.
$L_{An,T}$	Level in dBA which was exceeded for n% of time, T.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during time, T.
$L_{Amax,T}$	The instantaneous maximum A weighted sound pressure level which occurred during time, T.

Appendix B – Manufacturer’s Datasheets

CHP Units – A5 & A6

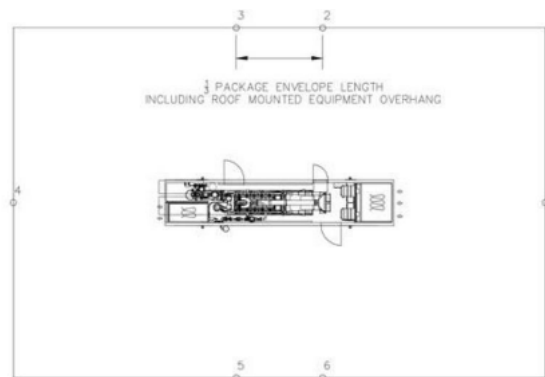
Noise Specification

The containers are designed to meet an average noise level of 65 dBA at 10 metre from the extremity of the exterior of the unit 1.5 metres above ground level, with the generator working on full load in free field conditions.

The overall average measurement is in according to ISO11203 and ISO3744 in free field conditions per unit LA90, taken as average value from 6 measurements around the package as per the figure below.

Finning (UK) Ltd, Anaergia

23



10m Average Measurement points locations X 6

The measurements are taken at a distance of 10m and 1,5m height above ground level. Each point has a potential variance on each reading of +/- 2dB(A) meaning each of the points could be potentially measure between 63-67dB(A). The noise level stated is based on a design ambient of 30°C