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ADDITIONAL INFORMATION
(received 27/5/2009)

BIOGEN

BARRY BIOMASS PLANT
CUMULATIVE NOISE ASSESSMENT TO BS4142

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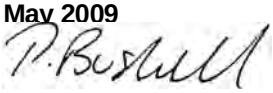
Prepared for
Biogen

Report Title	**:**	**Barry Biomass Cumulative Plant noise Assessment to BS4142**
Report Status	**:**	**Issue 1**
Job No	**:**	**FSE97027B**
Date	**:**	**May 2009**
Prepared by	**:**	 **Peter Bushell**
Checked by	**:**	 **Humphrey Roberts-Powell**
Approved by	**:**	 **Richard Perkins**

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1 INTRODUCTION

1.1 General

1.1.1 Parsons Brinckerhoff (PB) has been commissioned to undertake an assessment of the noise impact associated with the operation of two proposed Energy from Waste (EfW) Biomass facilities.

1.1.2 PB has recently undertaken a noise study of the proposed Gasification facility that is to be situated on Atlantic Road, within Barry Docks. A second EfW Biomass facility is proposed 500m to the north of the gasification facility on Woodham Road. This location is also within the Barry dockland area. This report aims to quantify the cumulative noise level from both facilities at the nearby residential noise sensitive receptors.

1.1.3 This report presents the results of the assessment.

1.2 Background

Atlantic Road Facility

1.2.1 As indicated, PB has recently undertaken a noise study of the proposed Gasification facility that is to be situated on Atlantic Road, within Barry Docks. A baseline noise survey of the surrounding area, and an assessment to BS4142 was undertaken as part of this study. The results of this study have been used within this assessment.

Woodham Road Facility

1.2.2 A previous noise study of the Woodham Road facility has been undertaken by AB Acoustics entitled; *Environmental Noise Survey, Proposed Biomass Plant, Woodham Road, Barry; Dated 23/12/08.* The results and findings of this report have been assessed and have also fed into this study.

1.2.3 For the purposes of this assessment the Atlantic Road facility shall be referred to as **Site A**, and the Woodham Road facility shall be referred to as **Site B**.

1.3 Legislative Guidance

1.3.1 BS 4142[(1)] provides guidance on the assessment of industrial and commercial noise affecting residential and industrial areas and describes a method for assessing whether industrial noise is likely to result in complaints from nearby residents. The method is based on a comparison of background noise and noise from the specific source under assessment, at an assessment location, such as a nearby residential property.

2 METHODOLOGY

2.1 Noise Sensitive Receptors

2.1.1 The noise sensitive receptors used in this study are the same as those used in the previous noise study undertaken by PB in 2008 for Site A.

2.1.2 These positions are shown on Figure 1 in the Appendix.

2.2 Measurements at Noise Sensitive Receptors

Baseline Conditions

2.2.1 The existing noise climate in the areas surrounding the proposed site has been determined by way of a baseline noise survey, undertaken between the 29th May and 3rd June 2008.

2.2.2 The full results of the baseline noise survey including monitoring locations and methodologies are documented in the PB report entitled: *EfW Barry Baseline Noise Report June 2008.* This report has been included in the Appendix for reference.

2.2.3 As part of the baseline noise assessment, attended noise monitoring took place at a number of locations around the site. Data was recorded in third octave bands to enable a detailed analysis of local noise sources. The locations were chosen based on their sensitivity to noise and the likelihood that they would be affected by any change in the local noise climate resulting from the construction or operation of the proposed facility.

2.2.4 Each measurement recorded the same five statistical parameters ($L_{A90,}$ L_{Aeq}, L_{Amax}, L_{A10}, L_{Amin}.) in un-weighted third octave bands, with the broadband figure reported after application of the A-weight adjustment on each third octave band.

2.2.5 All monitoring was conducted using a Class 1 Integrating/Averaging Sound Level Meter as defined by IEC 61672:2003 *"Electroacoustics - sound level meters"*. A field calibrator was used to calibrate and check the meter before and after the measurement period with no change in the level recorded.

2.2.6 In accordance with the standards above, the measurement microphones were positioned 1.2 to 1.5m above ground level, and at least 3.5m from any reflective structure wherever possible. Measurements were taken in weather conditions conducive to successful monitoring: zero precipitation, and wind speeds of less than $5ms^{-1}$. A wind-shield was used to minimise the effects of wind noise.

2.2.7 PB has consulted with the Environmental Health Officer at Barry Council. Information was requested on any history of previous noise complaints, issues, planning conditions, and any additional noise sensitive receptors in the area to validate and add to existing information.

Noise Sensitive Receptors

2.2.8 The Noise Sensitive Receptors (NSR's) identified below and shown in Figure 9.1 are considered to be representative of the worst case affected areas adjacent to the scheme:

1. Corner of St. Marys Avenue & Dock View Road, CF63 4LQ
2. Dyfrig Street, CF62 5TW
3. Bendrick Road, CF63 3RE
4. Y Rhodfa, CF63 4BB

2.2.9 The ambient noise level at each of these locations was sampled during the baseline noise measurement phase, and statistical data was collected. The subjective impression of the noise climate at each location is as follows:

Corner of St Marys's Avenue and Dock View Road

2.2.10 Regular local road traffic noise from Dock View Road was dominant during the day. Noise from the railway line was occasionally audible at all times of day. Activity noise from pedestrians could be heard from the street at all times.

Dyfrig Street

2.2.11 Distant traffic from Ffordd y Mileniwm (north) was audible during the day. Industrial noise from the dock area was also audible during the day – mainly HGV and tipper truck movements. Some shipping noise was also present.

Bendrick Road

2.2.12 Industrial noise from the dock area (west) made the largest contribution to the ambient noise levels at all times of day. This consisted of mainly HGV and tipper truck movements during the day with some continuous low frequency noise. During the evening and at night only the continuous low frequency noise persisted.

Y Rhodfa

2.2.13 HGV movements could be heard coming from the dock area, and from the southwest, during the day. Road traffic noise from the main road (Ffordd y Mileniwm) could be heard during the day and evening when some aircraft noise could also be heard on occasion. Seagulls' made a considerable contribution to the ambient noise levels at all times.

2.2.14 Table 1 provides a summary of the lowest measured L_{A90} noise level recorded at each NSR.

Measurement Position	Lowest Recorded L_{A90} (dBA)	
	Daytime	Night-time
NSR Location 1 – Corner of St Mary's Avenue and Dock View Road	49.3	29.7
NSR Location 2 - Dyfrig Street	45.2	30.7
NSR Location 3 – Bendrick Road	43.1	38.5
NSR Location 4 – Y Rhodfa	46.8	28.5

Table 1: Summary of lowest measured background noise levels at NSR locations

3 BS4142 ASSESSMENT

3.1 Calculation of Rating Level

Noise levels for proposed plant

3.1.1 Whilst the final plant selections will be made if the scheme proceeds, a noise model based on the expected plant has been generated to estimate the worst case noise that would be produced by the proposed plant.

3.1.2 The information presented in Table 2 has been provided from a report (Ref: 8012-GW-RP-001) prepared by Energos for a comparable gasification plant.

Noise Source	Sound Pressure Level, dB(A)	Distance, (m)	Calculated Sound Power Level, dB(A)
Gasification Plant	72.0	25	108.0
Air Cooled Condenser	88.5	1	96.5
Intake Fan	71.1	2	91.1
Ventilation Outlet	79.8	2	93.8
Total	-	-	108.5

Table 2: Summary of plant noise levels anticipated for use at Site B

Prediction of Operational Noise Levels

3.1.3 The prediction of noise levels at the nearest sensitive receptors is based on an acoustic propagation model. The model has been created to estimate the contribution to noise levels from each major identified plant source, using the measured background noise levels as the project limits for the site. Corrections have been applied to account for:

- distance propagation;
- directivity effects of the sound source;
- screening effects due to existing buildings, plant, or other proposed on-site structures; and
- type of ground between source and receiver.

3.1.4 The model is intended to provide a worst-case assessment of the noise level likely to be experienced at each NSR location. A number of assumptions are made with regards to the noise control likely to be installed on major plant items, these being:

- turbines are to be housed in individual acoustic enclosures, of heavy construction, specified at 85dB(A) Sound Pressure Level at 1m.
- turbine filter and ventilation apertures are to be fitted with high performance silencers, and designed such that they face towards the existing plant or towards new plant such that all sensitive receptors benefit from screening and/or directivity corrections;
- due to the impracticality of screening stack noise, discharge noise will be controlled using high performance silencers tuned to attenuate low frequencies from the turbine exhausts; and
- the model considers normal operational noise. As such, noise due to non-normal operation plant items has not been considered.

Calculation of BS4142 Rating Level

3.1.5 BS4142 prescribes that a 5 dB correction should be added to the specific noise levels if the noise contains either a distinguishable discrete continuous note, distinct impulses, or is irregular enough to attract attention. Noise emanating from the building itself is anticipated to be steady, broadband noise and therefore no correction has been applied. The delivery of waste/waste handling would be conducted within the main building which is equipped with fast closing shutter doors that close before a waste load is discharged into the waste silo.

3.1.6 The following table shows the predictions of noise from Site A & Site B at each NSR location.

NSR Location	Predicted Noise Level Due to Site A, L_{Aeq} dB	Predicted Noise Level Due to Site B, L_{Aeq} dB	Combined Noise Level at NSR Location, L_{Aeq} dB
NSR Location 1 – Corner of St Mary's Avenue and Dock View Road	24	29	30
NSR Location 2 - Dyfrig Street	30	20	30
NSR Location 3 – Bendrick Road	30	22	31
NSR Location 4 – Y Rhodfa	28	32	33

Table 3: Cumulative noise level from Site A & Site B at each NSR

3.2 Assessment Summary

3.2.1 The table below shows a summary of the rating levels calculated at each location, together with the lowest background levels, and the resulting difference.

NSR Location	Predicted Noise Level due both Site A & Site B (Rating Level) L_{Aeq} (dB(A))	Average Recorded Night Time Background Level L_{A90} (dB(A))	Night time Noise Level Difference dB
NSR Location 1 – Corner of St Mary's Avenue and Dock View Road	30	34	-4
NSR Location 2 - Dyfrig Street	30	31.5	- 1.5
NSR Location 3 – Bendrick Road	31	40	- 9
NSR Location 4 – Y Rhodfa	33	30	3

Table 4: BS4142 Assessment Summary Table

3.2.2 In the semantics of BS4142, a difference of around +10 or more indicates that complaints are likely. A difference of around +5 is of marginal significance, and if the rating level is more than 10 dB below the measured background level then this is a positive indication that complaints are unlikely.

3.2.3 The results of the BS4142 assessment indicate that noise levels at all NSR locations are of less than marginal significance, giving a positive indication that complaints are unlikely. NSR location 4 –Y Rhodfa shows a noise level of 3dB above existing night time background noise levels. It is understood that Y Rhodfa currently has no residential dwellings, but has planning permission for development. If development of this site goes ahead the 3dB exceedance is unlikely to cause complaint.

4 SUMMARY

4.1 Parsons Brinckerhoff has undertaken a cumulative noise assessment of the likelihood of noise complaints arising from two separate EfW facilities.

4.1.1 Information and results from previous studies has feed into the assessment, from this data noise levels associated with operations anticipated at both sites has been calculated at the noise sensitive receptors.

4.1.2 The assessment concludes that noise levels at all assessment locations are of less than marginal significance, giving a positive indication that complaints are unlikely.

References:

1. BS 4142:1997 "Method for rating industrial noise affecting mixed residential and industrial areas," BSI.

2. BS 7445: 1991 "Description and Measurement of Environmental Noise" Parts 1 to 3, BSI.

FIGURE 1

MAP SHOWING MONITORING POSITIONS IN RELATION TO PLANT

APPENDIX

NOISE SURVEY REPORT

FIGURE 1

MAP SHOWING MONITORING POSITIONS IN RELATION TO PLANT

Location	Address	GPS Coordinates
A	Corner St. Mary's Avenue and Dockview road, CF63 3RG	51.402823, -3.262393
B	No.11, Dyfrig Street, CF62 5TW	51.394582, -3.264903
C	No.4, Bendrick Road, CF63 3RE	51.399778, -3.246195
D	Y Rhodfa, CF63 4BB	51.400030, -3.263752

APPENDIX

NOISE SURVEY REPORT

BIOGEN POWER LIMITED

PROPOSED BIOGEN BARRY FACILITY - BASELINE NOISE ASSESMENT

June 2008

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Prepared for
Biogen Power Limited

Report Title	:	PROPOSED BIOGEN BARRY FACILITY - BASELINE NOISE ASSESMENT
Report Status	:	Issue 1
Job No	:	FSE97027B
Date	:	June 2008
Prepared by	:	pp ..... Chris Borak
Checked by	:	..... Peter Bushell
Approved by	:	..... Richard Perkins

CONTENTS

1 INTRODUCTION

1.1 Background

1.1.1 Parsons Brinkerhoff has been commissioned to undertake an Environmental Impact Assessment of the proposed Biogen Power Barry Facility.

1.1.2 As part of the assessment, and in order to build a picture of how the new facility will affect the noise climate in the area, PB has undertaken a baseline noise assessment to quantify the existing noise levels at the nearest noise sensitive receptors. This report details the approach and the findings.

1.2 Site Description

1.2.1 The site proposed for the Barry facility lies on Atlantic Road. In the Dock area of the town the site is approximately 200m-300m from the sea to the south. The site is bordered by other industrial activities. To the northeast (up the coast) industrial developments stretch for 2Km or so, ending in farm land.

1.2.2 The only residential noise sensitive receptors that may be affected by any change in the noise climate caused by the proposed development lie to the southwest, west and northwest of the proposed site. There is also a SSSI near the proposed site.

1.2.3 Apart from the existing industrial activity noise sources in the area include:

- A railway line running diagonally, between the docks area and the residential and commercial centre of the town, southwest to the northeast.
- Local traffic and other activity noise from the residential and commercial centre of Barry.
- Noise from shipping in the Bristol Channel.

1.3 Legislative Guidance

1.3.1 The guidance on the assessment of noise within TAN 11[1] has been adhered too. TAN 11 outlines the key considerations to be taken into account when assessing the impact of a new development on the local noise climate.

1.3.2 The method detailed in BS 7445-1:2003 [2] and BS 7445-3:1991[3], were followed during the surveys undertaken. BS 7445 defines and prescribes best practice during the recording and reporting of environmental noise. It is inherently applied in all instances when making environmental noise measurements.

2 METHODOLOGY

2.1 General

2.1.1 A noise survey has been conducted to quantify the existing ambient noise levels in the vicinity of the proposed site. A short term sampling method (spot measurements) was undertaken at the nearest Noise Sensitive Receptors (NSR's) to the proposed site. Measurements were taken during the daytime, evening and night-time periods.

2.1.2 A glossary of acoustics terminology is provided in Appendix A.

2.2 Noise Sensitive Receptors

2.2.1 There is a SSSI near the proposed site however it is only considered to contain invertebrates which are not sensitive to noise. The SSSI has therefore not been considered as one of the noise sensitive receptors.

2.2.2 The following residential locations have been identified as potential Noise Sensitive Receptors (NSR's) representative of the nearest locations that could be affected by the proposed scheme:

- **A** Corner St. Marys Avenue & Dock View Road, CF63 4LT
- **B** Dyfrig Street, CF62 5TW
- **C** Bendrick Road, CF63 3RT
- **D** Y Rhodfa, CF63 4BB

2.2.3 Exact measurement locations and coordinates are presented in Appendix B.

2.3 Monitoring

2.3.1 All noise monitoring was conducted in accordance with the guidance set out in BS 7445:2003. Measurements were made using Class 1 Integrating-Averaging Sound Level Meters as defined in IEC 61672:2003[4]. Meters were calibrated and checked before and after each measurement period, with no change in level noted. The calibration certificates for the meters used are provided in Appendix D, which also shows the serial numbers of all the equipment used. Microphones were placed 1.2 - 1.5m above the ground, and at least 1.5m from any acoustically reflective surface. Meters were set to a fast response time for all measurements.

2.3.2 Measurements took place on typical weekdays between the: 29th May 2008 and the 3rd June 2008. Weather conditions were conducive to successful monitoring; with wind speeds less than $5ms^{-1}$. Roads were dry, and there was no rain at the time of measurement. The ambient temperature was between 18 and 20°C during the daytime, reducing to 15°C during the night-time period.

2.3.3 The site engineer was Chris Borak of PB.

3 SURVEYS UNDERTAKEN

3.1 Spot Measurements

3.1.1 Measurements were taken at the monitoring locations listed in 2.2.1. The measurement sampling time for each of the periods was as follows:

- Daytime (1100 – 1700) – 15 Minutes (3 x 5 minutes)
- Evening (1900 – 2300) - 10 Minutes (2 x 5 minutes)
- Night-time (1200 – 0500) – 5 Minutes

3.1.2 Two sets of measurements were taken during the day and night time periods with at least 2 hours between repeat measurements.

3.1.3 The following statistical parameters were recorded in third octave bands, L_{A10}, L_{A90}, L_{Amax}, L_{Amin}, L_{Aeq}.

4 BASELINE RESULTS

4.1 Measured Levels

4.1.1 The full set of results for the spot measurements are shown in the Noise Monitoring Forms in Appendix C. A summary of the lowest measurements taken at each of the locations are presented in Table 1.

Location	Day		Evening		Night	
	L_{Aeq} (dB)	L_{A90} (dB)	L_{Aeq} (dB)	L_{A90} (dB)	L_{Aeq} (dB)	L_{A90} (dB)
A	61.8	49.3	50.6	49.4	35.9	29.7
B	49.3	45.2	47.9	44.8	36.2	30.7
C	48.2	43.1	43.5	41	40.8	38.5
D	50.6	46.8	46.9	44.8	36.1	28.5

Table 1: Baseline Noise Measurements

4.2 Subjective Impressions of the Noise Climate

4.2.1 **Location A –** Regular local road traffic noise from Dockview Road was dominant during the day. Noise from the railway line was occasionally audible at all times of day. Activity noise from pedestrians could be heard from the street at all times.

4.2.2 **Location B -** Distant traffic from Ffordd y Mileniwm (north) was audible during the day. Industrial noise from the dock area was also audible during the day – mainly HGV and tipper truck movements. Some shipping noise was also present.

4.2.3 **Location C –** Industrial noise from the dock area (west) made the largest contribution to the ambient noise levels at all times of day. This consisted of mainly HGV and tipper truck movements during the day with some continuous low frequency noise. During the evening and at night only the continuous low frequency noise persisted.

4.2.4 **Location D –** HGV movements could be heard coming from the dock area, and from the southwest, during the day. Road traffic noise from the main road could be heard during the day and evening when some aircraft noise could also be heard on occasion. Seagulls' made a considerable contribution to the ambient noise levels at all times.

5 REFERENCES

1 TAN 11: 1997 "TECHNICAL ADVICE NOTE 11 - NOISE", PLANNING GUIDANCE WALES

2 BS 7445-1: 2003 "DESCRIPTION AND MEASUREMENT OF ENVIRONMENTAL NOISE: GUIDE TO QUANTITIES AND PROCEDURES", BSI

3 BS 7445-3: 1991 "DESCRIPTION AND MEASUREMENT OF ENVIRONMENTAL NOISE: GUIDE TO APPLICATION TO NOISE LIMITS ", BSI

4 IEC 61672:2003 "ELECTROACOUSTICS - SOUND LEVEL METERS", BSI

APPENDIX A

GLOSSARY OF TERMS

Decibel (dB)	The decibel scale is used in relation to sound because it is a logarithmic rather than a linear scale. The decibel scale compares the level of a sound relative to another. The human ear can detect a wide range of sound pressures, typically between $2x10^{-5}$ and 200 Pa, so the logarithmic scale is used to quantify these levels using a more manageable range of values.
Sound Pressure Level (SPL)	The Sound Pressure Level has units of decibels, and compares the level of a sound to the smallest sound pressure generally perceptible by the human ear, or the reference pressure. It is defined as follows: $SPL\ (dB) = 20\ Log_{10}(P/P_{ref})$ where P = Sound Pressure (in Pa) P_{ref} = Reference Pressure $2x10^{-5}$ Pa An SPL of 0dB suggests the Sound Pressure is equal to the reference pressure. This is known as the *threshold of hearing*. An SPL of 140dB represents the *threshold of pain*.
Loudness	The loudness of a sound is subjective, and differs from person to person. The human ear perceives loudness in a logarithmic fashion, hence the suitability of the decibel scale. Generally, a perceived doubling or halving of loudness will correspond to an increase or decrease in SPL of 10dB. Note that a doubling of sound energy corresponds to an increase in SPL of only 3dB.
A-Weighting	The human ear can detect a wide range of frequencies, from 20Hz to 20kHz, but it is more sensitive to some frequencies than others. Generally, the ear is most sensitive to frequencies in the range 1 to 4 kHz. The A-weighting is a filter that can be applied to measured results at varying frequencies, to mimic the frequency response of the human ear, and therefore better represent the likely perceived loudness of the sound. SPL readings with the A-weighting applied are represented in dB(A).
Equivalent Continuous Level ($L_{eq,T}$)	The Equivalent Continuous Level represents a theoretical continuous sound, over a stated time period, T, which contains the same amount of energy as a number of sound events occurring within that time, or a source that fluctuates in level. For example, a noise source with an SPL of 80 dB(A) operating for two hours during an eight-hour working day, has an equivalent A-weighted continuous level over eight hours of 74 dB, or $L_{Aeq,8hrs}$ = 74 dB. The time period over which the L_{eq} is calculated should always be stated.
Maximum Sound Level (L_{max})	The maximum sound level, L_{max} (or L_{Amax} if A-weighted) is the highest SPL that occurs during a given event or time period.
Minimum Sound Level (L_{min})	Similarly, the minimum sound level, L_{min} (or L_{Amin} if A-weighted) is the lowest SPL that occurs during a given event or time period.
L_{90} or L_{A90} and other percentile measures	This represents the SPL which is exceeded 90% of the time, expressed in dB or dB(A). L_{A90} is used to quantify background noise levels (see below). Other percentiles exist and are used for various types of noise assessment. These include L_{01}, L_{10}, L_{50}, L_{99}.

Noise	A noise can be described as an unwanted sound. Noise can cause nuisance.
Ambient Noise	The totally encompassing sound in a given situation, at a given time, including noises from any source in any direction.
Background Noise	This is defined as the L_{A90} of the residual noise.
Noise Sensitive Receptors (NSR's)	Any identified receptor likely to be affected by noise. These are generally human receptors, which may include residential dwellings, work places, schools, hospitals, and recreational spaces.
Octave	In reference to the frequency of a sound, an octave describes the difference between a given frequency and that which is double that frequency, e.g. 125Hz to 500Hz, or 4kHz to 8kHz.
Octave/Third Octave Bands	A sound made up of more than one frequency can be described using a frequency spectrum, which shows the relative magnitude of the different frequencies within it. The possible range of frequencies is continuous, but can be split up into discrete bands, often an octave or third-octave in width. Each octave band is referred to by its centre frequency, generally 63Hz, 125Hz, 250Hz, 500Hz, 1kHz etc.

APPENDIX B

MEASUREMENT LOCATIONS AND MAP

Location	Address	GPS Coordinates
A	Corner St. Mary's Avenue and Dockview road, CF63 3RG	51.402823, -3.262393
B	No.11, Dyfrig Street, CF62 5TW	51.394582, -3.264903
C	No.4, Bendrick Road, CF63 3RE	51.399778, -3.246195
D	Y Rhodfa, CF63 4BB	51.400030, -3.263752

APPENDIX C

NOISE MONITORING FORMS AND SITE PHOTOGRAPHS

Noise Monitoring Form

Project:	Biogen Barry	**Job No.:**	FSE97027C
Location:	A	**Date:**	03/06/2008

Equipment:	Rion NA-28	**Engineer:**	Chris Borak
Pre-Calibration Level:	93.9 dB	**General Weather Description:**	No rain, Some cloud cover, High Humidity
Post-Calibration Level:	93.9 dB		

Measurement Period				Weather			Statistical Noise Levels / dB(A)					
Date	**Start**	**Elapsed**	**End**	**Wind Speed (m/s)**	**Wind Direction from**	**Temp (ºC)**	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{10}**	**L_{90}**	**Description of Audible Noise**
29/05/2008	14:40	00:05	14:45	1.6	N	19	73.4	47.8	61.8	66.3	49.9	Regular local traffic from Dockview road
29/05/2008	14:45	00:05	14:50	1.6	N	19	91.9	46.4	66.5	68.3	52.6	Bird Noise
29/05/2008	14:50	00:05	14:55	1.6	N	19	74.3	47.1	62.1	65.9	50.0	Trains on railway track.
29/05/2008	16:30	00:05	16:35	1.6	N	19	75.3	47.1	63.1	67.3	50.5	Regular local traffic from Dockview road
29/05/2008	16:35	00:05	16:40	1.6	N	19	79.2	47.2	64.9	68.3	49.3	Bird Noise
29/05/2008	16:40	00:05	16:45	1.6	N	19	80.0	48.7	65.0	68.5	51.5	Trains on railway track.
29/05/2008	21:00	00:05	19:45	0.5	N	18	84.5	50.6	67.0	68.5	54.4	Traffic flows lower than day time but still the dominant
29/05/2008	21:05	00:05	19:50	0.5	N	18	75.2	47.3	63.2	67.6	51.2	noise source.
03/06/2008	01:10	00:05	01:15	0.5	N	15	67.6	31.4	43.9	46.9	34.2	Occational local traffic. Some activity in building and on street.
03/06/2008	03:40	00:05	03:45	0.5	N	15	64.4	31.2	35.9	39.3	29.7	

Noise Monitoring Form

Project:	Biogen Barry	**Job No.:**	FSE97027C
Location:	B	**Date:**	03/06/2008

Equipment:	Rion NA-28	**Engineer:**	Chris Borak
Pre-Calibration Level:	93.9 dB	**General Weather Description:**	No rain, Some cloud cover, High Humidity
Post-Calibration Level:	93.9 dB		

Measurement Period				Weather			Statistical Noise Levels / dB(A)					
Date	Start	Elapsed	End	Wind Speed	Wind Direction	Temp (ºC)	L_{max}	L_{min}	L_{eq}	L_{10}	L_{90}	Description of Audible Noise
29/05/2008	13:30	00:05	13:35	1.6	N	20	69.5	45.0	51.3	52.7	46.5	Distant Traffic from the north, bird song
29/05/2008	13:35	00:05	13:40	1.6	N	20	75.0	43.5	55.5	51.3	45.2	Some distant shipping noise.
29/05/2008	13:40	00:05	13:45	1.6	N	20	67.3	44.0	51.6	53.7	46.3	HGV movements and tipper trucks (industrial) from northeast.
29/05/2008	15:30	00:05	15:35	1.6	N	19	72.4	44.2	49.3	50.1	46.0	Distant Traffic from the north, bird song
29/05/2008	15:35	00:05	15:40	1.6	N	19	74.6	43.6	49.9	49.4	45.3	Some distant shipping noise.
29/05/2008	15:40	00:05	15:45	1.6	N	19	74.2	44.2	53.4	50.2	46.2	HGV movements and tipper trucks (industrial) from northeast.
29/05/2008	19:00	00:05	19:05	0.5	N	18	71.1	41.7	50.9	49.8	44.8	Distant traffic.
29/05/2008	19:05	00:05	19:10	0.5	N	18	59.7	43.1	48.0	49.2	45.0	Distant traffic.
03/06/2008	01:20	00:05	01:25	0.5	N	15	61.8	28.9	36.2	36.6	30.7	Seaguls, very distant road traffic noise.
03/06/2008	03:50	00:05	03:55	0.5	N	15	56.0	27.0	36.8	35.5	31.5	

Noise Monitoring Form

Project:	Biogen Barry	**Job No.:**	FSE97027C
Location:	C	**Date:**	03/06/2008

Equipment:	Rion NA-28	**Engineer:**	Chris Borak
Pre-Calibration Level:	93.9 dB	**General Weather Description:**	No rain, Some cloud cover, High Humidity
Post-Calibration Level:	93.9 dB		

Measurement Period				Weather			Statistical Noise Levels / dB(A)					
Date	**Start**	**Elapsed**	**End**	**Speed (m/s)**	**Wind Direction from**	**Temp (ºC)**	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{10}**	**L_{90}**	**Description of Audible Noise**
29/05/2008	14:00	00:05	14:05	1.6	N	19	66.8	45.3	50.5	52.6	46.9	Some wind noise in trees, distant chain saw (south),
29/05/2008	14:05	00:05	14:10	1.6	N	19	64.4	45.0	49.8	52.2	46.5	Low frequency industrial hum from dock area,
29/05/2008	14:10	00:05	14:15	1.6	N	19	58.9	44.4	48.2	50.5	45.5	large vehicle and tipper truck movements from dock area.
29/05/2008	16:00	00:05	16:05	1.6	N	19	66.0	41.5	52.8	57.8	43.1	Local Traffic, distant chain saw (south),
29/05/2008	16:05	00:05	16:10	1.6	N	19	64.3	41.6	48.6	52.0	43.4	Low frequency industrial hum from dock area,
29/05/2008	16:10	00:05	16:15	1.6	N	19	66.4	42.8	52.6	55.7	45.4	large vehicle and tipper truck movements from dock area.
30/05/2008	19:00	00:05	19:05	0.5	N	18	65.9	39.7	49.3	52.2	41.6	Owl hooting, other birds,
30/05/2008	19:05	00:05	19:10	0.5	N	18	55.1	39.1	44.5	47.5	41.0	distant road traffic noise.
03/06/2008	01:30	00:05	01:35	0.5	N	15	58.9	36.5	40.8	41.8	38.5	Wind in trees, some local road traffic noise,
03/06/2008	04:00	00:05	04:05	0.5	N	15	58.2	37.5	41.3	43.2	49.1	Industrial noise to the west.

Noise Monitoring Form

Project:	Biogen Barry	**Job No.:**	FSE97027C
Location:	D	**Date:**	03/06/2008

Equipment:	Rion NA-28	**Engineer:**	Chris Borak
Pre-Calibration Level:	93.9 dB	**General Weather Description:**	No rain, Some cloud cover, High Humidity
Post-Calibration Level:	93.9 dB		

Measurement Period				Weather			Statistical Noise Levels / dB(A)					
Date	**Start**	**Elapsed**	**End**	**Speed (m/s)**	**Wind Direction from**	**Temp (ºC)**	**L_{max}**	**L_{min}**	**L_{eq}**	**L_{10}**	**L_{90}**	**Description of Audible Noise**
29/05/2008	12:45	00:05	12:50	1.6	N	19	60.8	45.3	51.7	54.3	47.6	HGV movements from depo to the southwest, bird song,
29/05/2008	12:50	00:05	12:55	1.6	N	19	64.5	43.5	52.6	55.3	47.3	regular road traffic noise from the main road (north), dog walkers,
29/05/2008	12:55	00:05	13:00	1.6	N	19	60.5	45.0	50.9	52.9	48.0	Continuous loud bird noise, aircraft noise.
29/05/2008	15:00	00:05	15:05	1.6	N	19	70.7	44.2	50.6	52.3	46.8	HGV movements from depo to the southwest, bird song,
29/05/2008	15:05	00:05	15:10	1.6	N	19	66.1	44.1	52.2	53.8	47.8	regular road traffic noise from the main road (north), dog walkers,
29/05/2008	15:10	00:05	15:15	1.6	N	19	59.4	44.3	51.7	54.0	48.0	Continuous loud bird noise, aircraft noise.
29/05/2008	19:25	00:05	19:45	0.5	N	18	59.5	43.8	50.3	52.5	46.0	Local road traffic noise, voices of fishermen, bird noise.
29/05/2008	19:30	00:05	19:50	0.5	N	18	61.0	43.3	50.6	53.0	46.2	
03/06/2008	01:40	00:05	01:45	0.5	N	15	58.7	26.4	36.1	38.1	28.5	Seaguls, Lapping of the sea.
03/06/2008	04:10	00:05	04:15	0.5	N	15	60.2	26.3	36.9	37.8	30.0	

Location A

Location D

Location B

Location C

APPENDIX D

CALIBRATION CERTIFICATES

CERTIFICATE OF CALIBRATION

Certificate Number	**CAL010817**
Date of Issue	**31st January 2008**
Customer	**Parson Brinkerhoff**

	Description of Instrument Including Manufacturer / Supplier
Sound Level Meter	Rion NA-28 Sound Level Analyser [Serial No. 01070573] with Rion NH-23 preamplier [Serial No.70589] and Rion UC-59 Microphone [Serial No.00367] fitted with a WS-10 foam windshield. The instrument conforms to Class 1 of BS EN 61672-1:2003 The instrument was running Version 1.60 Firmware
Associated Calibrator	Rion NC-74 [Serial No.35173440] with ½" adaptor type NC-74-002 fitted. This calibrator was calibrated by ANV Measurement Systems on 30/01/2008 [Certificate No. CAL010816]
Date of Calibration	30/01/2008.
Test Procedure	ANV/CAL/SLM/001 Calibration Results currently at Issue 2 Test procedures in accordance with BS EN 61672-3:2006 NOTE: Test 10.1 (Self Generated Noise with Microphone Installed) omitted.
Test Engineer	Andy Jones

APPROVED SIGNATORY .....

Les Jephson ☐ / Mike Breslin ☐

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ACOUSTICS NOISE AND VIBRATION LIMITED. REGISTERED IN ENGLAND NO. 3549028. REGISTERED OFFICE AS ABOVE.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO. **CAL010817**
DATE OF ISSUE **31/01 /2008.**

Information relating to the operation and adjustment of the sound level meter were obtained from the data contained in the Rion Instruction Manual 50490 and associated Technical Notes 50860. Additional information relating to measurement uncertainties required by clause 11.3 has been provided by the Rion European Office and is available for inspection upon request.

Results

Tests on the Sound Level Meter were principally performed on the Main Channel. Limited tests were also performed using the Sub-Channel.

When the Acoustic Calibrator supplied with the instrument was applied the Sound Level Meter initially read 94.0dB (A). No adjustment was made to the meter.

The environmental conditions at the start and end of the calibration were within the specified range for calibration and were noted to be as follows:

Conditions	Measured Value at Start	Measured Value at End
Atmospheric Pressure	101.8 kPa	101.7 kPa
Temperature	23.7 °C	23.8 °C
Relative Humidity	33.1 %	30.5 %

The self generated noise levels of the instrument with the microphone replaced by the electrical input device were as follows:

11.1 dB(A);
14.0 dB(C); and
21.2 dB(Z).

These measured levels were within the specified limits defined within the instruction manual.

The sound level meter submitted for testing has successfully completed the Class 1 Periodic tests of BS EN 61672, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about the conformance of the sound level meter to the full requirements of BS EN 61672-1:2003 because evidence was not publically available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements of BS EN 61672-1:2003 and because the periodic tests of BS EN 61672-3:2006 only cover a limited subset of the specifications in BS EN 61672-1:2003.
No information on the uncertainty of measurement, required by 11.7 of IEC 61672-3:2006, of the adjustment data given in the instruction manual or obtained from the manufacturer of the Sound Level Meter, or the manufacturer of the Microphone, or the manufacturer of the multi-frequency Sound Calibrator was published in the instruction manual or made available by the manufacturer or supplier. The uncertainty of measurement of the adjustment data has therefore been assumed to be numerically zero for the purpose of this periodic test. If these uncertainties are not actually zero, there is a possibility that the frequency response of the Sound Level Meter may not conform to the requirements of IEC 61672-1:2002.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO. **CAL010817**
DATE OF ISSUE **31/01 /2008.**

No information on the uncertainty of measurement, required by 11.7 of IEC 61672-3:2006, of the adjustment data given in the instruction manual or obtained from the manufacturer of the Sound Level Meter, or the manufacturer of the Microphone, or the manufacturer of the multi-frequency Sound Calibrator was published in the instruction manual or made available by the manufacturer or supplier. The uncertainty of measurement of the adjustment data has therefore been assumed to be numerically zero for the purpose of this periodic test. If these uncertainties are not actually zero, there is a possibility that the frequency response of the Sound Level Meter may not conform to the requirements of IEC 61672-1:2002.

The total expanded measurement uncertainties associated with the calibration equipment and procedures is based on a standard uncertainty multiplied by a coverage factor k=2 to provide a confidence of approximately 95% in the results. The assessment of uncertainty has been carried out in accordance with national and international guidance upon the calculation of uncertainties in metrology.

Notes

1. The wind screen correction on the instrument was set to *on* and the diffuse field correction set to *off* for the duration of the calibration.

2. The tests were conducted principally on the main channel, with a limited number of tests conducted for the sub channel. The Peak C sound level measurements were carried out for the sub channel as they are only available on this channel.

CERTIFICATE OF CALIBRATION

Certificate Number	**CAL010816**
Date of Issue	**31st January 2008**
Customer	**Parson Brinkerhoff**
	Description of Instrument
Calibrator	Rion NC-74 [Serial No.35173440] with ½" adaptor type NC-74-002 fitted.
Date of Calibration	30/01/2008.
Test Procedure	ANV/CAL/SLM/003 Calibration Results currently at Issue 1 Test procedures in accordance with BS EN 60942: 2003 (Annex B)
Test Engineer	Chazz Gill

APPROVED SIGNATORY .....

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CERTIFICATE OF CALIBRATION

CERTIFICATE NO. **CAL010816**
DATE OF ISSUE **31/01/2008.**

Results

The sound pressure level generated in its half inch configuration was measured using a Rion UC-53A microphone with its protective grid in position.

The environmental conditions at the start and end of the calibration were within the specified range for calibration and were noted to be as follows:

Conditions	Measured Value at Start	Measured Value at End
Atmospheric Pressure	101.7 kPa	101.7 kPa
Temperature	24.3 °C	24.8 °C
Relative Humidity	30.4 %	30.1 %

The mean level of the calibrator output was **94.08 ± 0.32dB**.

The fundamental frequency of the sound output was **1002.6Hz 0.3 %** and its total distortion was **1.59 ± 0.02%.**

The Sound Calibrator has been shown to conform to the Class 1 requirements for periodic testing, described in Annex B of IEC 60942: 2003 for the sound pressure level and frequency stated, for the environmental conditions under which the tests were performed. However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942: 2003, no general statement or conclusion can be made about conformance of the Sound Calibrator to the requirements of IEC 60942: 2003.

The total expanded measurement uncertainties associated with the calibration equipment and procedures is based on a standard uncertainty multiplied by a coverage factor k=2 to provide a confidence of approximately 95% in the results. The assessment of uncertainty has been carried out in accordance with national and international guidance upon the calculation of uncertainties in metrology.

Notes

1. The manufacturer states that the instrument compensates for the effects of atmospheric pressure (96 – 106 kPa ± 0.03 dB).
2. The Sound Calibrator has not been adjusted.

Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number	**CAL040803**
Date of Issue	**02/04/2008**
Customer	**Parsons Brinckerhoff Ltd**
	Description of Instrument
Calibrator	Rion NC-74 [Serial No. 01020510] With ½" adaptor type NC-74-002 fitted.
Date of Calibration	02/04/2008.
Test Procedure	ANV/CAL/SLM/003 Calibration Results currently at Issue 1 Test procedures in accordance with BS EN 60942: 2003 (Annex B)
Test Engineer	Amrat Patel

APPROVED SIGNATORY .....

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CERTIFICATE OF CALIBRATION

CERTIFICATE NO. **CAL040803.**
DATE OF ISSUE **02/04/2008.**

Results

The sound pressure level generated in its half inch configuration was measured using a Rion UC-53A microphone with its protective grid in position.

The environmental conditions at the start and end of the calibration were within the specified range for calibration and were noted to be as follows:

Conditions	Measured Value at Start	Measured Value at End
Atmospheric Pressure	101.4 kPa	101.4 kPa
Temperature	21.5 °C	21.7 °C
Relative Humidity	35.0 %	34.8 %

The mean level of the calibrator output was **93.97 ± 0.29 dB**.

The fundamental frequency of the sound output was **1001.1 Hz ± 0.1%** and
Its total distortion was **1.22 ± 0.02%.**

The Sound Calibrator has been shown to conform to the Class 1 requirements for periodic testing, described in Annex B of IEC 60942: 2003 for the sound pressure level and frequency stated, for the environmental conditions under which the tests were performed. However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942: 2003, no general statement or conclusion can be made about conformance of the Sound Calibrator to the requirements of IEC 60942: 2003.

The total expanded measurement uncertainties associated with the calibration equipment and procedures is based on a standard uncertainty multiplied by a coverage factor k=2 to provide a confidence of approximately 95% in the results. The assessment of uncertainty has been carried out in accordance with national and international guidance upon the calculation of uncertainties in metrology.

Notes

1. The manufacturer states that the instrument compensates for the effects of atmospheric pressure (96 – 106 kPa ± 0.03 dB).
2. The Sound Calibrator has not been adjusted