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**CONNAH'S QUAY POWER STATION:
ENVIRONMENTAL NOISE SURVEY, 20/21 NOVEMBER 2012
prepared for
MR M FELGATE, PLANT MANAGER, CONNAH'S QUAY POWER STATION
by
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SUMMARY

An environmental noise survey has been completed at key residential receptors around Connaah's Quay Power Station. The survey took place on the 20/21 November 2012 and included measurements during day, evening and night time periods. The operation of the plant during the survey was broadly typical of the current operational pattern for the site. The generating units shutdown mid to late evening and then recommenced generation early/mid morning. The Gas Treatment Plant was processing gas at a variable rate throughout the period.

As with previous surveys, the noise climate is dominated by traffic noise and the noise contribution from the site is only consistently apparent at the nearest residential receptor (Woodfield 'Railway' Cottages). At more distant residential receptors it is only late at night when the number of vehicles using the road network decreases considerably that noise from the site becomes discernible. Due to the prevailing generation pattern for the plant, no units were on-load during the overnight period, however the Gas Treatment Plant and some cooling towers (Unit 4 and Purge Pond Cooling Tower) were operational throughout the period.

The noise signature from the site is made up of contributions from a wide variety of plant items and their relative dominance varies between each residential receptor. During lulls in traffic noise, the Purge Pond Cooling Tower is the most identifiable and distinctive source at the Woodfield 'Railway' Cottages.

Overall, the specific plant levels from site were less than the whole-site predicted noise levels for the EA approved modifications to the Unit 1 and 2 cooling towers. A BS4142 assessment of the site noise at Rockcliffe Cottages and Kelsterton Farm is broadly consistent with previous studies; however the prominence of the Purge Pond Cooling Tower contribution at Woodfield 'Railway' Cottages makes the BS 4142 rating level higher than previous assessments.

It is understood that operational restrictions at the time prevented the Purge Pond Cooling Tower fan from being taken out of service. If it has not occurred already, it is recommended that remedial work to the fan's gearbox/motor takes place as soon as possible to mitigate this item of plant's contribution to the environmental noise climate.

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Unit 4 recommenced generation around 06:30 and ordinarily this would have been an opportunity to quantify the impact of this aspect of site operation, however wet and rainy weather conditions prevented any reliable quantification.

An assessment of noise levels and spectra measured at the nine on-site monitoring locations has also been undertaken. There is uncertainty associated with the integrity of some of the measurements, however the results are broadly similar to previous levels - which indicate that the magnitude and character of noise emissions from the plant have remained largely unchanged.

Measurements made at Positions 6 and 7 near the Gas Treatment Plant in the November 2012 survey showed higher than normal low frequency components – however the change did not appear to affect the off-site locations.

Recommendation

It is recommended that remedial work on the Purge Pond Cooling Tower takes place as soon as possible, to mitigate this item's contribution to the environmental noise climate.

Prepared by

Approved for publication

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1 INTRODUCTION

At the request of Connah's Quay Power Station, E.ON New Build & Technology have undertaken a series of environmental noise measurements to characterise and quantify the current noise impact, upon the community, from the plant's operation. The survey was completed during a period of typical plant operation on the 20/21 November 2012.

2 SITUATION

Details of the residential receptors considered in this survey are given in Table 1 and shown in Figure 1.

During the survey the winds were very light, typically less than 1-2 m/s, and from a S/SW direction. During the evening the air temperature was around 10°C and the relative humidity was approximately 80%. Typically, maximum continuous noise levels will be generated when all four generating units are at full load and the Gas Treatment Plant (GTP) is processing and exporting gas. However, due to the prevailing electricity demand and market, these circumstances did not occur at the time of the survey. Only Units 1, 2 and 4 were available for generation during the survey period and none of these units were on-load between 23:30 and 06:30 approximately (see Figure 2 for unit load profile). The Gas Treatment Plant and some of the cooling towers were operational during the noise survey, as were the cooling tower fans for Unit 4 and the Purge Pond. Although the circumstances cannot be considered to be representative of the noisiest plant state they are currently considered typical of current winter operation.

3 MEASUREMENTS

Precision sound level meters were used meeting the requirements of BS EN 60651 and 60804 Type 1. All measurement apparatus used are maintained in calibration by regular certification, with an accredited laboratory, to BS 7580-1. Each set of measurements was preceded and followed by a calibration check using the sound level meter's acoustic calibrator. No significant drift in meter response was detected during the exercise. Calibration certificates for the equipment used in the survey are given in Figure 3.

The primary measurements were undertaken at the nearest residential locations. These positions are known to be strongly affected by traffic noise, so unattended continuous measurements were also taken at two on-site locations where residual ambient noise levels are less. For security reasons the continuous noise monitoring equipment were deployed within the site boundary at positions that were as close to Woodfield 'Railway' Cottages and Rockcliffe Cottages and as representative of their noise climates as possible.

The continuous unattended sound level meters were configured to measure overall L_{Aeq} , L_{A10} and L_{A90} levels. The meter used for the off-site survey was configured to measure 1/3rd octave band L_{Aeq} , L_{A10} and L_{A90} levels. Narrow band Fast Fourier Transform (FFT) measurements were also made to support the subjective noise signature observations. The survey consisted of performing 5 minute duration samples at each of the residential receptor locations during the day, evening and night periods. (Note: strictly speaking BS 4142 requires day and evening measurements to be of 1 hour duration but to allow measurements to be undertaken at several receptors in turn, shorter 5 minute measurements were taken; these shorter sampling measurements are still considered representative of the noise climate.)

4 RESULTS AND ASSESSMENT

The ambient noise climate is dominated by traffic noise and so the L_{Aeq} level is often not a reliable measure of the plant noise level contribution at off-site locations. Instead, the L_{A90} parameter can represent a more robust estimate of the specific operational noise, although this can still be influenced by distant vehicles. It is only when the traffic subsides overnight that the L_{A90} becomes truly indicative of the plant noise contribution.

The overall L_{A10} , L_{A90} and L_{Aeq} measured during the survey on the 20/21 November 2012 are shown in Table 2. L_{A90} values highlighted in bold-italics are considered to represent the best estimate of the specific noise level from the plant at various receptors.

The results from the continuous monitoring that took place at on-site locations near to Rockcliffe and Woodfield 'Railway' Cottages are shown in Figure 4. The L_{Aeq} and L_{A90} noise levels at the two locations show a very strong correlation and suggest that when contributions from other ambient noise sources subside (around 03:00) and the plant activities become the dominant steady noise source, levels are 41-42 dBA L_{A90} . At the continuous monitoring positions there are periods when the difference between the L_{Aeq} and L_{A90} are approximately 1 dB. This level of difference between the two metrics shows that the plant noise emissions are predominantly steady and further suggests that the specific L_{Aeq} from the plant experienced off-site can be estimated from the measured off-site L_{A90} level (i.e. $L_{Aeq} = L_{A90} + 1$ dB); this forms the basis of the estimated specific noise level shown in Table 3.

The power station plant has operational noise limits within its consent conditions, however revised levels were suggested within the modelling assessment which accompanied the permit variation for modification to the cooling towers (PT/07/LC1202/R, March 2008). Although there was no overnight generation during the survey, it remains appropriate to compare the night time measurements with the revised values in the 2008 permit variation (see Table 3). During the survey the specific L_{Aeq} noise levels arising from site operational activities were less than the model predictions, at the three locations considered.

Observations of the noise climate during the survey are given in Table 2, and comprehensive details of the discernibility and character of the noise from the site are given in Table 4. When site noise is discernible during lulls in the traffic, this is considered to be predominantly attributable to noise from the Purge Pond Cooling Tower. Narrow band Fast Fourier Transform (FFT) spectra measured at selected receptors during the evening and night periods are shown in Figure 5. Where possible these measurements were taken during breaks in the traffic noise and therefore represent a robust characterisation of the site signature. The spectra measured suggest that it is only at the Woodfield 'Railway' Cottages where the noise climate has a tonal signature.

To quantify the Purge Pond Cooling Tower noise signature, narrow band FFT measurements were made at positions on-site (underneath the tower and on the site road near the tower). These FFT spectra are shown in Figure 6 along with the overnight spectra at Woodfield 'Railway' and Rockcliffe Cottages. The on- and off-site spectra exhibit similar tonal features (tones at 256, 586, 769, 909 and 1025Hz), which confirms that it is primarily the Purge Pond Cooling Tower responsible for the site having a tonal signature at Woodfield "Railway" Cottages.

As a consequence, the BS4142 the rating level at Woodfield 'Railway' Cottages is 5dB higher in recognition of this tonal characteristic.

4.1 Non-steady Operation

Unit 4 recommenced generation around 06:30 and ideally this would have been an opportunity to quantify the impact of this aspect of site operation, however wet and rainy weather conditions prevented any reliable quantification.

4.2 BS 4142 Assessment

In general, the steady and intermittent noise climate at residential locations is dominated by traffic on the nearby roads. It is typically only when traffic flows subside to a minimum between 01:00 and 04:00 that the steady noise contribution from the site becomes more noticeable. Although there was no generation activity overnight, there was sufficient auxiliary plant operation for the noise from the plant to be discernible at three of the residential locations. Specific and rating levels from the plant are compared to overnight background noise levels in Table 5, to allow a BS 4142 assessment.

Since the site underwent a complete shutdown in July 2012 the table contains an update on the overnight background noise levels that had previously been measured in 2007.

A BS4142 assessment of the station noise within the community is given in Table 5. The table shows specific and rating levels from the plant compared to overnight background noise levels. According to BS 4142 the difference between the rating level, L_{Ar} , and the background, L_{A90} , is an indication of the likelihood of public complaint. The Table 5 results show the likelihood of complaint ranges from '*marginal significance*' at Kelsterton Farm and Rockcliffe Cottages to '*positively likely*' at Woodfield 'Railway' Cottages.

5 ON-SITE ROUTINE MONITORING

The power station's environmental monitoring programme advises that periodic monitoring of the plant's noise 'footprint' should take place. Measurements at the nine on-site locations were completed during the 20/21 November 2012 survey and on three previous occasions during 2012. The results have been compared to previous spectra to determine whether any new noise features/degradations have occurred; see Appendix A. There is some uncertainty associated with integrity of some of the measurements but overall, it is found that the magnitude and spectra character of the station's noise remains largely unchanged relative to previous data.

6 CONCLUSIONS

At more distant residential receptors it is only late at night when the number of vehicles using the road network decreases considerably that noise from the site becomes discernible. Due to the prevailing generation pattern for the plant, no units were on-load during the overnight period. However the Gas Treatment Plant and some cooling towers (Unit 4 and Purge Pond Cooling Tower) were operational throughout the period.

The noise signature from the site is made up of contributions from a wide variety of plant items and the relative dominance of contribution varies between each residential receptor. During lulls in traffic noise, the Purge Pond Cooling Tower is the most identifiable and distinctive source at the Woodfield 'Railway' Cottages.

Overall, the specific plant levels from site were less than the predicted noise levels for the EA approved modifications to the Unit 1 and 2 cooling towers. A BS4142 assessment of the site noise at Rockcliffe Cottages and Kelsterton Farm is broadly consistent with previous studies; however the prominence of the Purge Pond Cooling Tower contribution at Woodfield 'Railway' Cottages makes the BS 4142 rating level higher than previous assessments and a positive indication that complaints are likely.

A review of the four on-site monitoring surveys taken throughout 2012 shows that, with the exception of the November impact of the Purge Pond Cooling Tower, the noise climate remains largely unchanged.

7 RECOMMENDATION

It is recommended that remedial work to the fan's gearbox/motor takes place as soon as possible to mitigate this item's contribution to the environmental noise climate.

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BS 4142 :1997. Method for rating industrial noise affecting mixed residential and industrial areas.

GLOSSARY

- dB** Decibel. Used here to represent the sound pressure level, P , expressed as twenty times the logarithm of the ratio of this pressure to a reference pressure, P_0 , $20 \times 10^{-6} \text{ N/m}^2$. Thus $\text{dB} = 20 \times \text{Log}_{10}(P/P_0)$.
- dba** As above except that the measured sound is first subject to a frequency weighting, known as the 'A' weighting, which is designed to compensate for the varying sensitivity of the human ear to sounds of different frequency.
- $L_{A90,T}$** The A-weighted sound level exceeded for 90% of the measurement period of duration T .
- $L_{Aeq,T}$** The equivalent steady dba sound level containing the same acoustic energy as the actual, measured, fluctuating level.
- $L_{A,r}$** The specific equivalent continuous dba sound pressure level, rated upwards by 5 dB if tonal or intermittent in character
- $L_{C90,T}$** The 'C'-weighted sound level exceeded for 90% of the measurement period of duration T .
- $L_{Ceq,T}$** The equivalent steady 'C'-weighted sound level containing the same acoustic energy as the actual, measured, fluctuating level.
- 1/3rd octave bands** An octave is a doubling or halving of frequency. One-third octave bands are even finer sub-divisions of the frequency range that are centred at specific frequencies, i.e. 125, 160, 200, 250, 315, 400, 500Hz etc

BS 4142 (1997) provides a procedure which can be used to assess the likelihood of public complaint based on the difference between the rated $L_{A,r}$ noise level from the installation and the background L_{A90} noise level, as follows:

- $L_{A,r} - L_{A90} < -10 \text{ dB}$, then complaints are very unlikely
- $L_{A,r} - L_{A90} > +10 \text{ dB}$, then complaints are very likely
- $L_{A,r} - L_{A90} \approx +5 \text{ dB}$, then the likelihood of complaints is of 'marginal significance'

If there is a tonal, intermittent or percussive feature in the source noise then an additional 5 dB is to be added to the L_{Aeq} specific noise source level in recognition that it is more likely to attract attention.

Within this report, some additional terms have also been used to describe those situations where the level difference lies in between the three criteria described above.

Table 1: Details of monitoring positions

Position	Grid Reference Easting: Northings	Distance to Power Station centre/m (Approx)
102 Kelsterton Road	327960, 370700	380
Rockcliffe Cottages	327150, 371265	830
Kelsterton Farm	327565, 370800	480
Woodfield 'Railway' Cottages	327415, 371110	540
Kelsterton Gatehouse*	327905, 370720	360

Note: Kelsterton Hostel Gatehouse was stated within the Power Station's original Operational Noise Programme. However due to it and other properties on Kelsterton Road being screened by the A548 carriageway, surveys have historically concentrated on quantifying the nearby noise climate with measurements based at 102 Kelsterton Road only.

Supplementary noise monitoring was also undertaken near the Sheiling/Wenlo properties (see Figure 1), however subsequent assessments have concentrated on the key residential properties stated in the Operational Noise Programme

Table 2: Off-site survey results 20/21 November 2012

Site	Time	L _{Aeq}	L _{A10}	L _{A90}	Comment/Observations
102 Kelsterton Road	18:33	59.9	63.2	53.1	Traffic on B5129 and A548 is the dominant L _{Aeq} and L _{A90} noise source during day and evening. Power station noise indiscernible. No measurements made at night due to plant being shutdown or rain.
	19:29	58.9	62.8	51.1	
	11:42	62.1	65.3	54.6	
	12:42	62.3	65.4	56.1	
Kelsterton Farm	18:22	55.4	58.3	50	Traffic on B5129 and A548 is the dominant L _{Aeq} and L _{A90} noise source during day and evening. Power station noise (mainly Purge Pond Cooling Tower and Unit 4 Cooling Tower) discernible during lulls in traffic. L _{A90} at 03:57 is mainly due to noise from plant and light rain.
	19:17	54.2	56.9	49.1	
	21:56	55.6	59.9	46	
	03:57	47.4	50.9	39.1	
	11:33	57.1	60.4	50.8	
	12:33	58.5	61.7	52.4	
Rockcliffe Cottages	18:45	61	63.2	55.6	Traffic on B5129 and A548 is the dominant L _{Aeq} and L _{A90} noise source during day and evening. Power station noise indiscernible during day and evening. L _{A90} at 03:38 is mainly due to noise from GTP plant and Cooling Towers.
	21:33	56.3	59.9	48.2	
	03:38	48.1	50.4	38.1	
	11:06	54.4	56.7	48.1	
	14:01	54.5	57.1	45.7	
Sheiling/Wenlo	18:52	54.7	57.1	51.1	Traffic on B5129 and A548 is the dominant L _{Aeq} and L _{A90} noise source. But general indistinct industrial noise from GTP audible during lulls in traffic in evening. Plant indiscernible during daytime measurement.
	11:14	50.9	53.2	47.1	
Woodfield 'Railway' Cottages	18:13	64.5	66.5	57.5	During evening and daytime periods traffic is the dominant L _{Aeq} and L _{A90} noise source. Plant is discernible during lulls in traffic – mainly Purge Pond Cooling Tower, Unit 4 Cooling Tower and GTP. At Night the Purge Pond Cooling Tower is main steady noise source.
	19:03	62.6	66.3	52.1	
	21:46	55.1	59.2	48.2	
	03:47	50.1	53.6	43.9	
	11:23	58.7	62	52.5	
	12:22	60.7	63.7	53.4	
Access Road Position (On-site)	13:35	49.4	50.3	46.1	Cooling Tower noise discernible, Purge pond Cooling Tower minor contribution. L _{Aeq} and L _{A90} affected by traffic contribution.
Railway Position (On-site)	04:07	48.2	51.5	44.3	L _{A90} primarily due to Cooling Tower and Purge Pond Cooling Tower, GTP minor contribution.
Plant Conditions	See Figure 2 for details of load. Times below are approximate: - Unit 1: on-load until 23:30 20-Nov and back on-load from 11:30 21-Nov - Unit 2: on-load until 20:30 20-Nov - Unit 3: off-load throughout - Unit 4: on-load until 18:00 20-Nov and then back on-load from 06:30 21-Nov. Cooling Towers operational throughout. - Purge Pond Cooling Tower: operational throughout. - GTP – Variable flow up to 150k Sm³/h 18:00 20-Nov to 11:00 21-Nov				
Meteorological Conditions	Evening: wind 1-2m/s from S/SW, 10degC, 80%RH. Rain from 04:00 to 09:00 (v.approx). Day: wind 1m/s from W/SW. Full Cloud Cover throughout				

Table 3: Estimate of Specific Noise Level from Operations on the Site

Position	Minimum L _{A90} Nov 2012	Specific Noise Level from Site L _{Aeq} Nov 2012 [@]	Predicted Specific Noise Level from Site following Cooling Tower Modifications [#]
102 Kelsterton Road	N/A	N/A	41.4
Rockcliffe Cottages	38	39	43.7
Kelsterton Farm	39	40	41.4
Woodfield 'Railway' Cottages	44	45	45.8

[@] Specific noise level from site activities is estimated on the basis of the lowest measured L_{A90} + 1 dB correction. The correction originates from the on-site continuous monitoring which is less susceptible to ambient noise contributions. i.e. at both on-site locations the L_{Aeq} was typically only 1 dB greater than the L_{A90} during the 00:00–01:00 period. See Figure 4.

[#] Predicted post-modification noise levels, PT/07/LC1202/R, April 2008

Table 4: Subjective discernibility and character of noise from the Site

Location	Time Period		
	Day time	Evening	Around 04:00
102 Kelsterton Road	PS indiscernible due to traffic noise	PS indiscernible due to traffic noise	No observations/Measurements made due to rain
Kelsterton Farm	PS discernible but only during lulls in traffic	PS discernible but only during lulls in traffic	Purge Pond Cooling Tower and Unit 4 Cooling Tower cells are the main steady noise source
	<i>[General industrial signature – low/mid frequency range from Cooling Towers]</i>		
Rockcliffe Cottages	PS indiscernible due to traffic noise	PS discernible but only during lulls in traffic	Gas Treatment Plant and Cooling Towers are the main steady noise source
		<i>[Broad band high frequency mixed industrial noise from Gas Treatment Plant]</i>	
Woodfield 'Railway' Cottages	PS discernible during breaks in traffic,	PS discernible during breaks in traffic,	Purge Pond Cooling Tower is the main steady noise source, Minor contribution from GTP
	<i>[Low/mid frequency signature from Purge Pond Cooling Tower]</i>		

Table 5: Specific, Background and Rating levels for BS4142 Assessment

Position	Period	Plant "On" 20/21 November 2012		Background		Specific Noise Level from Site [@]	*Rating Level L _{A,r} dB	Rating Level L _{A,r} minus Background L _{A90} dB	BS4142 Likelihood of Complaint
		Mean L _{Aeq}	Mean L _{A90}	Aug 2007 Mean L _{A90}	July 2012 Mean L _{A90}				
102 Kelsterton Road	Night	N/A	N/A	33.2	33.3	N/A	N/A	N/A	N/A
Kelsterton Farm	Night	47.4	39.1	36.2	34.5	40	40	+4 to +5	Marginal Significance
Rockcliffe Cottages	Night	48.1	38.1	36.2	33.8	39	39	+3 to +5	Marginal Significance
Woodfield 'Railway' Cottages	Night	50.1	43.9	34.5	35.3	45	50	+15	Positively Likely

Note: Based on subjective observations the noise signature from the plant is only considered to have a tonal character at the Woodfield 'Railway' Cottage position. Therefore the Rating Level at this location is 5 dB greater than the specific noise level. No penalty has been applied to the other locations.

@ Note: The specific level is for the following operation: Gas Treatment Plant, BHP Above Ground Installation, Purge Pond Cooling Tower and Unit 4 Cooling Towers – no units were generating overnight.

Table 6: Comparison of Dec 2009/Dec 2010/Dec 2011 and Nov2012 BS 4142 Differences

Position	Period	Rating Level $L_{A,r}$ minus Background L_{A90}			
		December 2009	December 2010	December 2011	November 2012
102 Kelsterton Road	Night	+6	+6	+4	N/A
	Evening	+2	+2	0	N/A
	Day	-12	-12	-14	N/A
Kelsterton Farm	Night	+7	+12	+6	+5
	Evening	-2	+3	-3	N/A
	Day	-12	-7	-12	N/A
Rockcliffe Cottages	Night	+7	+7	+2	+5
	Evening	-2	-2	-7	N/A
	Day	-4	-5	-9	N/A
Woodfield 'Railway' Cottages	Night	+10	+10	+7	+15
	Evening	+2	+2	0	N/A
	Day	-5	-5	-7	N/A

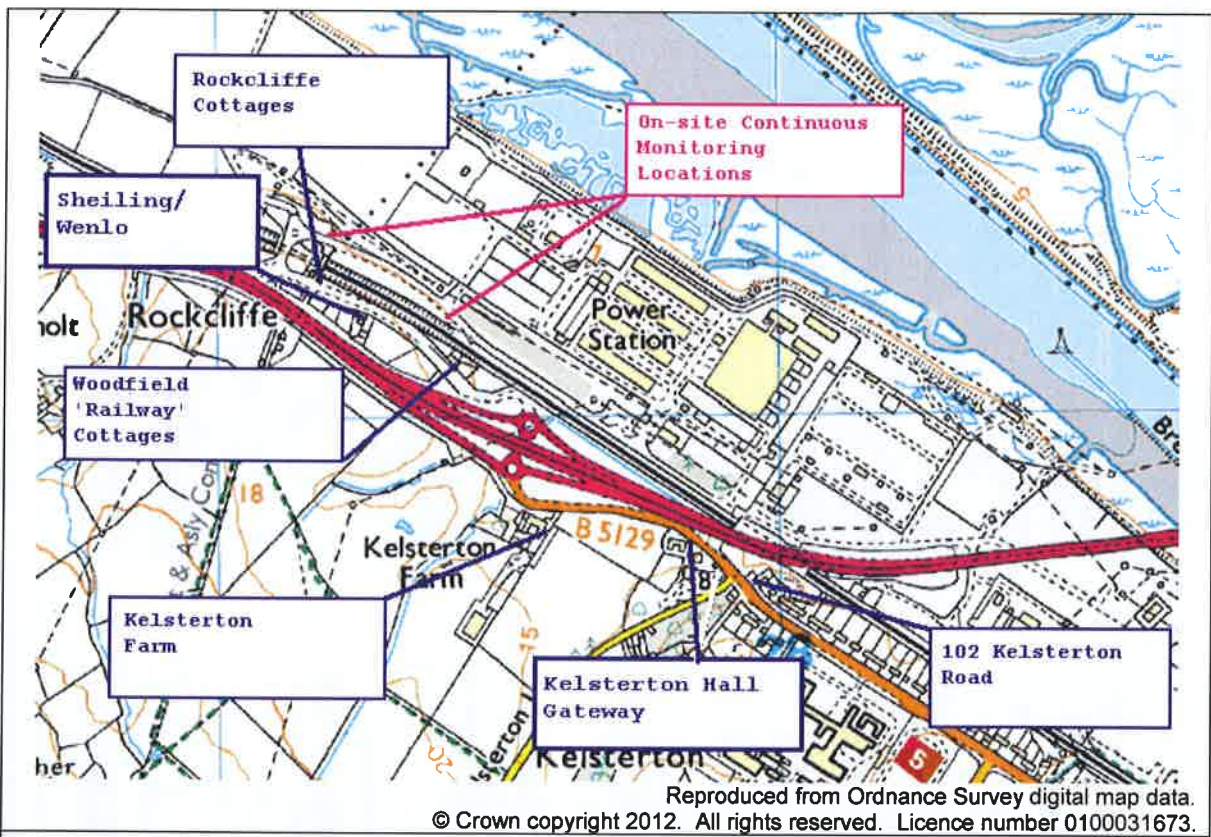


Figure 1: Map showing monitoring locations



Figure 2: Showing plant activity during measurement period

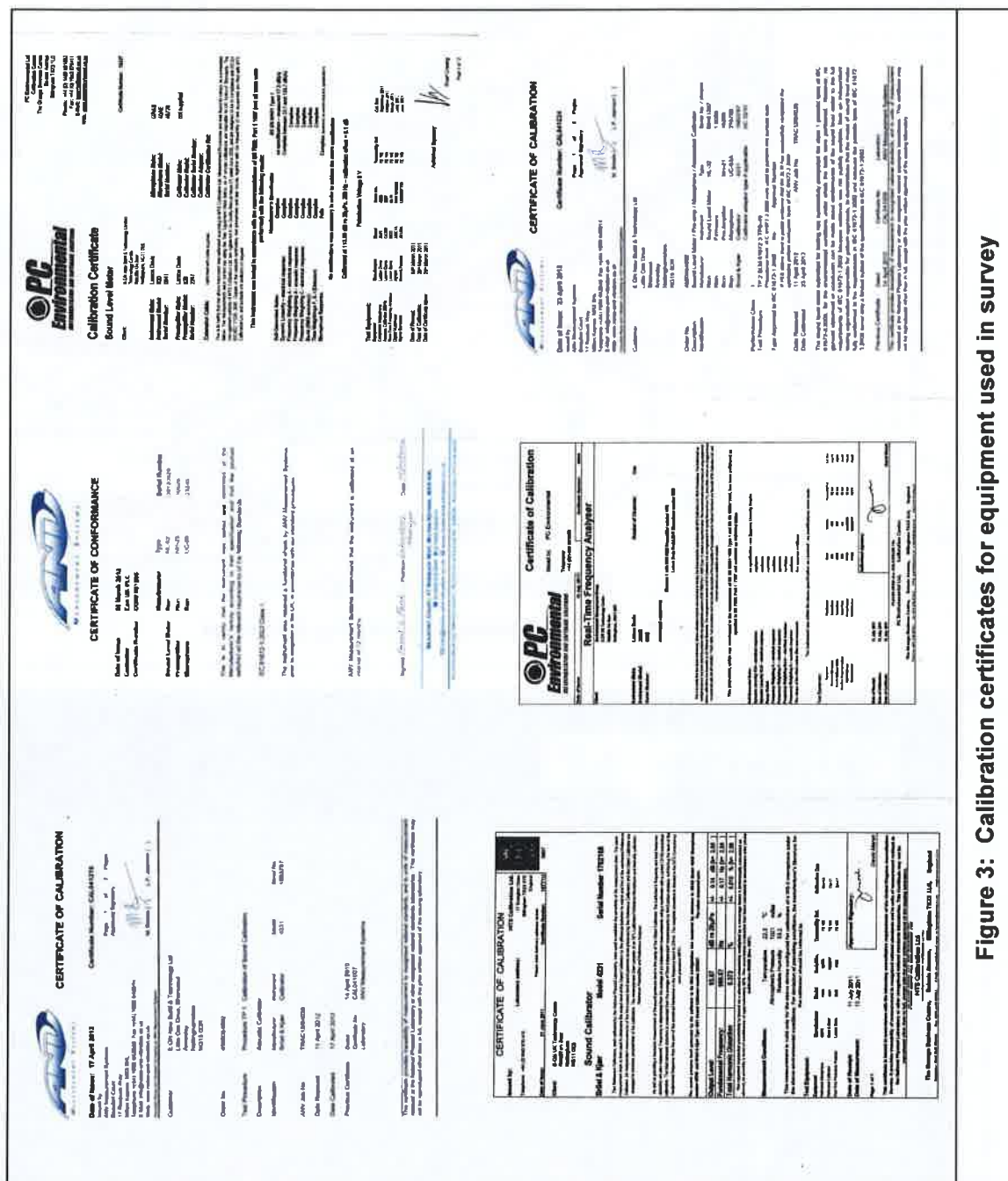


Figure 3: Calibration certificates for equipment used in survey

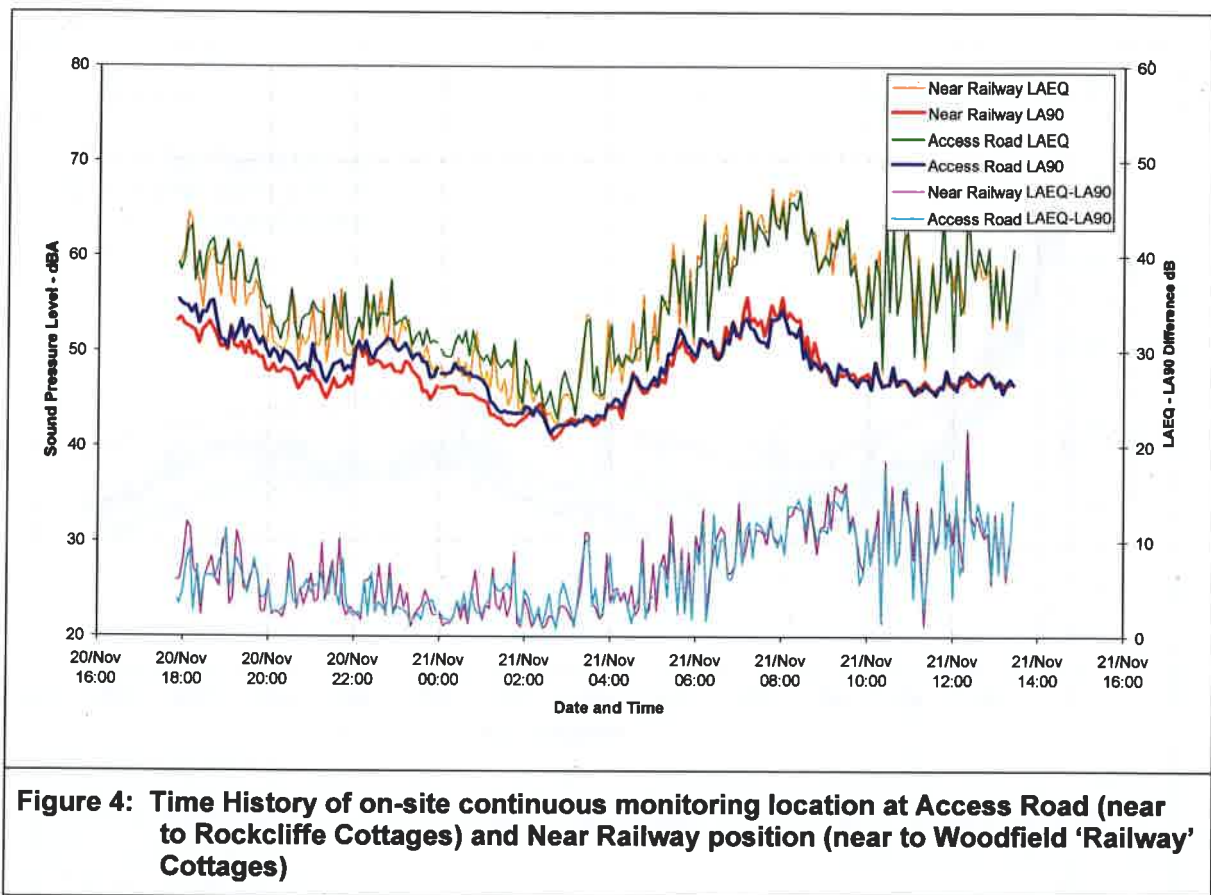
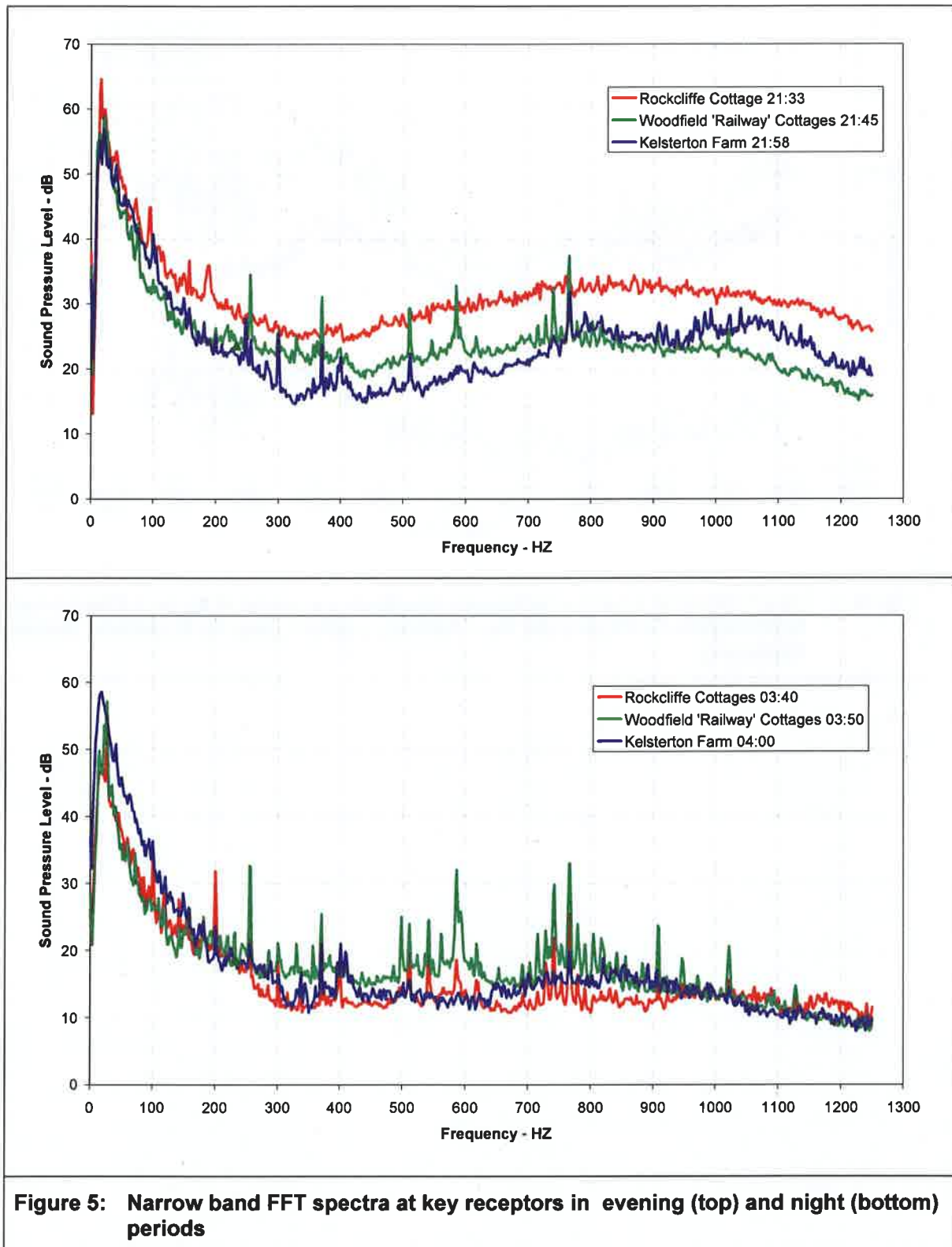
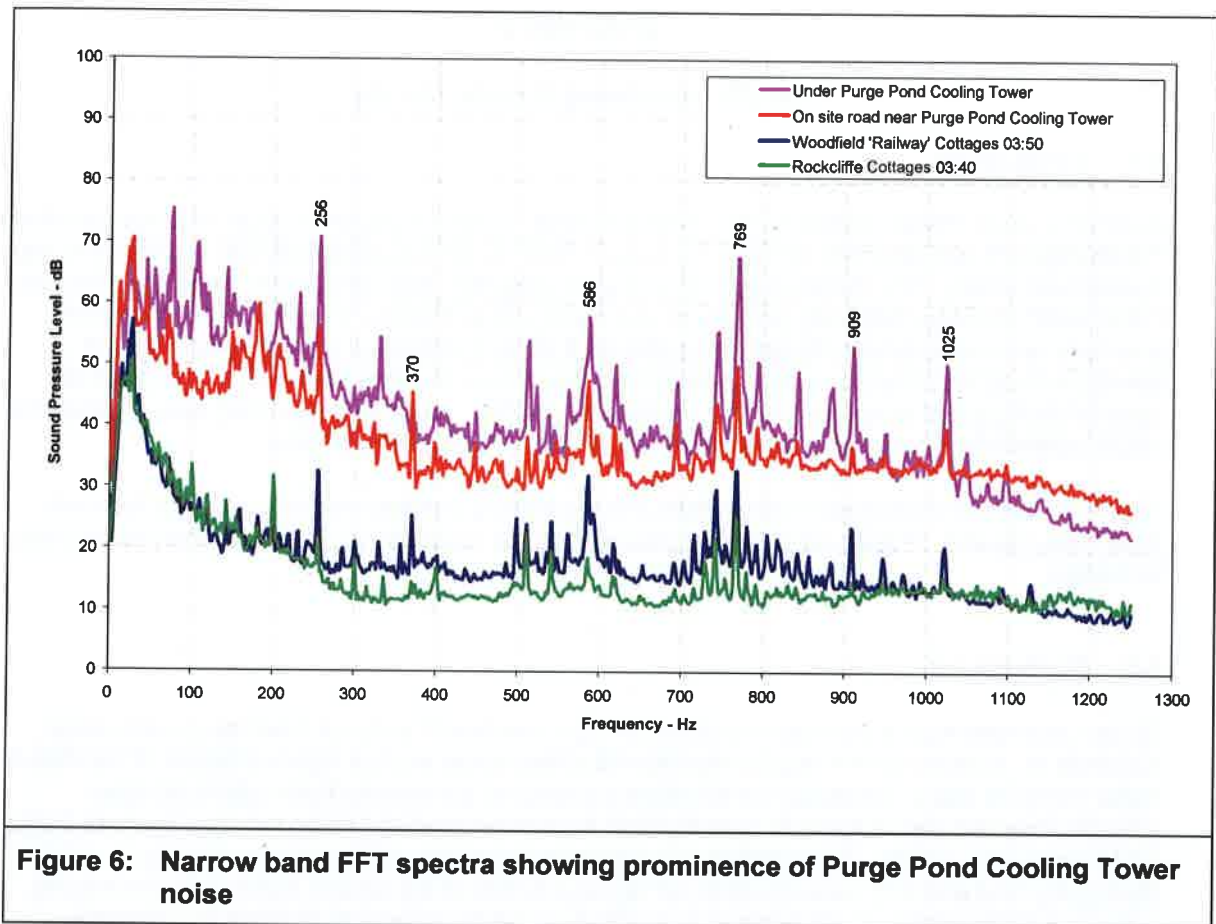


Figure 4: Time History of on-site continuous monitoring location at Access Road (near to Rockcliffe Cottages) and Near Railway position (near to Woodfield 'Railway' Cottages)





APPENDIX A

On-site Monitoring Results Review

A1 Introduction

Connah's Quay Power Station's PPC environmental noise management plan requires that noise measurements are routinely undertaken around nine monitoring positions that are close to key operational areas. The monitoring positions were originally selected on the basis that the plant noise level would be relatively prominent and readily quantifiable. In addition the monitoring positions were specifically chosen to be remote from any individual plant item so that the resultant noise level would comprise of contributions from multiple sources. Any significant upward drift in plant noise level at the monitoring position could be interpreted as a change that might potentially elevate plant noise levels at off-site residential locations.

Figure A1 shows photographs taken from the monitoring positions looking towards the main local noise source. Figure A2 shows a map of the nine positions in relation to the power plant buildings.

A2 Background

Since commencing the routine noise monitoring a number of surveys have been completed, however an analysis of the results has identified that some are not representative of the steady noise from the plant. Because the monitoring positions are remote from individual noise sources they are also subject to contributions from other ambient noise sources such as traffic and human site activity. Regrettably, this has meant that the results of measurements made during day and evening periods were not representative of the steady noise from the normal operation of the plant. In response to this situation it was recommended that subsequent surveys should be conducted overnight when intermittent site and traffic activity has subsided to a minimum. Under these conditions the variation in noise level during the sample (as indicated by the spread in L_{01} , L_{10} , L_{50} & L_{90} values) is much smaller and hence the results better represent the steady noise from the plant.

During 2012, survey of the plant noise level at the nine positions was undertaken by power station personnel on the following dates:

11 January 2012	19:00 to 20:00
04 May 2012	18:00 to 19:00
21 August 2012	11:00 to 12:00
20 November 2012	19:00 to 20:00

Before considering any trends in the monitoring results it is worth reiterating which plant items contribute to the noise climates at each location. The positions were originally selected to quantify the general noise level in a given plant area but there are local sensitivities which influence what can be inferred from the measurements.

- Positions 1, 2 and 9 are relatively close to plant items that would be expected to be operational under normal circumstances. They are also less susceptible to interference from ambient noise sources or changes due to propagation conditions. Therefore the measurements made at these positions would not be expected to show very much natural variation between surveys.

- Positions 3, 4 and 5 are relatively remote from plant items and therefore more susceptible to contributions from other non-plant/ambient sources and variable propagation conditions.
- Positions 6, 7 & 8 are representative of the BHP Compound and the Gas Treatment Plant (GTP) and as such the measurement are subject to contributions which vary according to the specific operational state of these plant items.

A3 Data Review and Assessment

An initial review of the measurement data reveals that there was some uncertainty associated with configuration of the meter and data storage during the 11 January 2012 and hence this data has been excluded from further analysis. The lower measurement range of the meter during the 04 May and 21 August survey was 45 dB, which has meant that the meter was slightly insensitive at distant/quieter locations has been lost – the main impact of this is drop-outs in the L_{C90} spectra.

The three sets of survey data has been compared to previous reliable measurements. Figure A3 shows the trend in overall L_{Aeq} and L_{A90} noise levels measured since June 2007 (some measurements have been affected by non-steady noise sources not associated with the continuous operation of the power station).

Any difference between L_{Aeq} and L_{A90} levels suggests that the sample was affected by unsteady noise – which is probably not associated with the power station and hence the L_{Aeq} is probably not representative of the steady noise from the plant.

Position 1, 2 & 3	The May 2012 and August 2012 levels show variations between the L_{Aeq} and L_{A90} levels, suggesting that the sample was affected by non-steady power station noise. Overall the 2012 results are within the range of previous measurements
Positions 4,5 & 6	The overall L_{Aeq} and L_{A90} levels at these positions fall broadly within the range of historic levels, although the integrity of the August 2012 measurements are compromised by the insensitivity of the meter.
Position 7,8 & 9	The small differences between the L_{Aeq} and L_{A90} levels at these positions during 2012 indicate that the results are quantification of a steady noise climate.

For further detail the 1/3rd Octave L_{C90} spectra have been examined and are shown in Figures A4 to A6. The following are general observations regarding how the current spectrum compares to previous spectra:

All Positions:	The configuration of the sound level meter for the May and August 2012 surveys is responsible for 'drop-outs' in L_{C90} spectra when the 1/3 rd octave level is less than 45dB.
Positions 1&2	There is some higher than normal low frequency noise (frequency less than 100Hz) apparent in the August 2012 spectra. However as this feature is absent from the November spectra it is not considered to be a issue.

- Position 3** The May and August 2012 spectra are incomplete due to the configuration of the sound level meter. The November spectra is complete and indicates higher than normal noise in the 1/3rd Octave Bands above 800Hz. Comments made at the time of measurement indicated that there was falling water noise from the nearby purge pond. As this is a local broadband noise source it is not considered to constitute a problem for noise propagation to off-site locations.
- Position 4** Where complete spectra are available, the 2012 data is broadly similar to previous measurements and there are no new peaks in the spectrum.
- In November 2012 the spectral character around the 400Hz octave band (key signature of the nearby cooling tower) is on the upper range of historic levels and similar to that measured in 2009. Subjective observations at the time of the survey suggested that the noise climate was dominated by the purge pond cooling tower, see Section 4 and Figure 6.
- This position remains an important monitoring location for tracking cooling tower noise emissions that might affect off-site locations.
- Position 5** The latest measurement in November 2012 is within the spread of recent values. Interestingly, despite its relative close proximity to the Purge Pond Cooling Towers, the spectra measured at this location on this occasion is not overly affected by the raised noise emissions for this plant item.
- Position 6** The May 2012 results are noticeably higher at this location than previous spectra and there are raised low frequency levels around 80 Hz in the November data. Subjective observations made in November indicate that the low frequency character originates from the Gas Treatment Plant.
- Position 7** Relative to historic trend the May and November 2012 spectra exhibit similar changes as those noted at Position 6, which is consistent with the noise climate at these locations being dominated by the Gas Treatment Plant (GTP).
- An increase in low frequency noise level at two locations could be indicative of a change/operational state that might be affect offsite noise levels.
- Position 8** This position is on eastern edge of the GTP compound. Although some raised levels are seen in August, the May and November 2012 are broadly consistent with those measured in previous exercises. Despite being closer to the GTP than Positions 6 and 7, there isn't any increase in the low frequency characteristic at this location.
- Position 9** The L_{C90} spectra are very similar to the narrow band of previous measurements and does not exhibit any new peaks in the spectrum.

Broadly speaking, a comparison of the historic trend in L_{Aeq}/L_{A90} levels and L_{C90} 1/3rd Octave levels suggests that the plant noise emissions are similar to previous levels, within measurement uncertainty.

Importantly, the measurements at Positions 3, 4 and 5 (which quantify the plant's noise emission in the direction of the nearest residential receptors) indicate that the character and magnitude of the plant's noise emission is unlikely to alter the plant's noise impact at residential locations.

The spectra measured at Position 6 and 7 in November 2012 contained a greater low frequency component from the GTP than has been detected in previous years. As these measurements could indicate a change in plant noise emission it is appropriate to investigate whether similarly raised levels are detected at the nearby residential locations.

Narrow band FFT spectra of measurements made at Rockcliffe Cottages (the residential receptor where the GTP noise is most noticeable) are given in Figure 5 of the main text. On this occasion the residential low frequency noise climate remains unaffected by the apparent increase in noise emission.

A4 Discussion

Although four on-site measurement surveys were completed by power station personnel during 2012, the usefulness of some of the measurements at more distant locations was compromised by the sound level meter configuration. Care should be taken in the configuration of the meter in future surveys to ensure that the measurement range of the meter is appropriate to the noise climate being quantified.

With regard to future surveys it is worth re-emphasising that the measurements should, where possible and appropriate to normal power station operation, be undertaken overnight when contributions/interference from ambient noise sources is at a minimum.



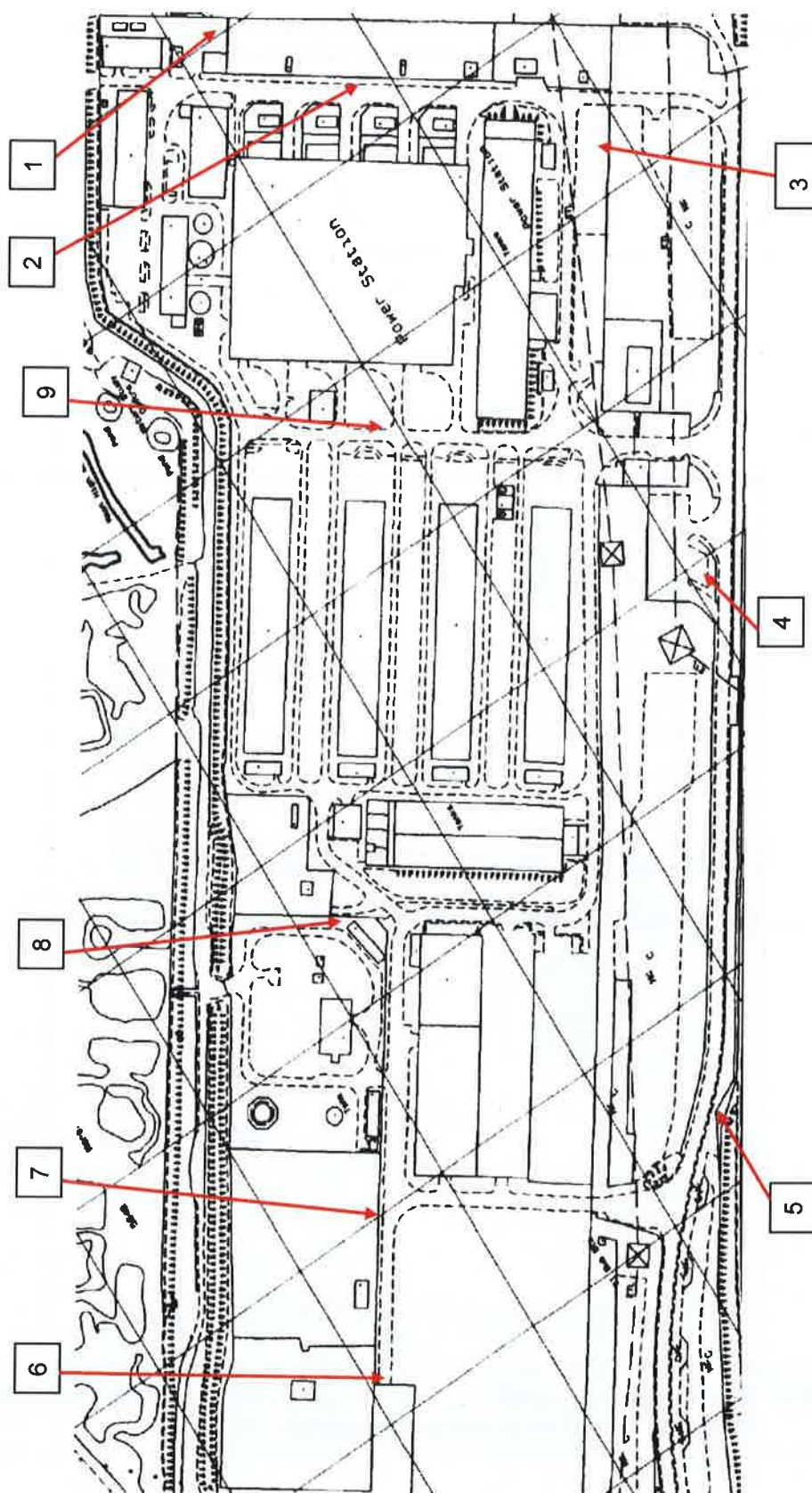


Figure A2: Map of Connah's Quay power station with the positions for noise measurements

