2009/00021/FUL

ADDITIONAL INFORMATION

BIOGEN

BIOGEN ERF, BARRY DOCKS, VALE OF GLAMORGAN – AIR QUALITY AND NOISE INCOMBINATION ASSESSMENT

ADDENDUM

May 2009

2009/00021/FUL

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Report Title	**:**	**BioGen ERF, Barry Docks, Vale of Glamorgan – Air Quality and Noise In combination Assessment.**
Report Status	**:**	**Final**
Job No	**:**	**FSE97027B**
Date	**:**	**May 2009**
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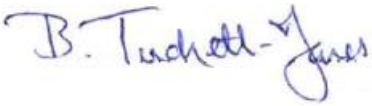
Checked by	**:**	 **Bethan Tuckett-Jones**
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Introduction

The UK government has published an Air Quality Strategy which sets out air quality objectives and policy options to further improve air quality from today into the long term. The air quality objectives are policy targets, expressed as a maximum ambient (outdoor) concentration not to be exceeded, either without exception or with a permitted number of exceedences within a specified timescale. The aim of the strategy is to achieve steady improvement in air quality over the objective implementation time scales. However, it is acknowledged that some parts of the UK will find meeting the objectives easier than others. European Union air quality directives have set similar limit values for the concentration of pollutants in air. In contrast to the objectives, which are policy targets, the limit values are legally binding.

Since the original Environmental Statement (ES) was prepared for the BioGen Power Energy Recovery Facility (ERF) in Barry, Vale of Glamorgan, potential new air quality receptors at the planned Barry Waterfront Development site have been identified and the predicted impacts of the facility on those receptors were assessed in an addendum to the ES. PB have now been commissioned to undertake an assessment of the potential cumulative air quality impacts of the ERF in Barry and a planned 9MW waste wood biomass facility of Sunrise Renewables, also in Barry. This assessment has been carried out as an addendum to the previous Environmental Statement for Barry ERF and the Barry Waterfront Addendum and should therefore be read in conjunction with these documents. The model inputs, including receptor locations, are the same as those used previously except for the addition of the biomass plant.

Significance of Impacts

The consideration of whether the impact of emissions from the Barry ERF is significant depends on the magnitude of the impact, the importance of the affected resource or population group (receptors), and the background pollution levels. For this assessment we have adopted the criteria proposed by the National Society for Clean Air (now EPUK) and detailed in the original Barry ERF ES.

Background Pollutant Concentrations

Background pollution levels refer to the pollutant concentrations in ambient air in the absence of the development under consideration. Background concentrations are detailed in the Barry ERF Environmental Statement (ES) and Technical Appendix. In summary, background concentrations in the area are well below the relevant Air Quality Strategy Objectives, EU Limit Values and Environmental Assessment Levels (EALs).

Assessment Methodology

The methodology was essentially the same as that used in the Barry ERF ES and was based on a dispersion model of the emissions from the Facility, with the addition of the biomass plant. The model was able to predict the contribution of the emissions from each source to ambient pollution concentrations at the receptors detailed in the original ES and the Barry Waterfront Addendum.

Emissions from the ERF were modelled for the same operating scenario as in the original ES, using the worst case meteorological data. For the biomass plant, the model input parameters were taken from the dispersion modelling report, prepared by RSK EHS Ltd for Sunrise Renewables[1]. Table 1 presents the biomass source parameters and Table 2 shows the biomass building parameters which were input to the model. The biomass plant is located to the north-east of the Barry Waterfront development.

Table 1 Emission parameters for the biomass plant

Parameter	Value	Units
Stack easting	312647	m
Stack northing	167668	m
Stack height	20	m
Stack diameter	0.9	m
Efflux temperature	325	^{o}C
Efflux velocity	14	ms^{-1}
NO_x emission rate	0.8132	gs^{-1}
PM_{10} emission rate	0.0407	gs^{-1}
SO_2 emission rate	0.2033	gs^{-1}
CO emission rate	0.2033	gs^{-1}
HCl emission rate	0.0407	gs^{-1}
HF emission rate	0.0041	gs^{-1}
Hg emission rate	0.0002	gs^{-1}
Dioxins and furans	$4.07E^{-10}$	gs^{-1}

[1] RSK EHS Ltd, Dispersion Modelling of Emissions to Air from a Proposed Biomass Power Plant in Barry, South Wales, Report No.660003_Rev 2

Table 2 Building details

Parameter	Value	Units
Centre point easting	312622	m
Centre point northing	167672	m
Height	14.1	m
Length	59.4	m
Width	45.6	m
Angle	54.2	Degrees

The model included the ERF building with the same size parameters as in the original ES. The ERF stack height was kept at 45m, which was determined to be a suitable height in the Barry ERF ES.

The receptors used in the modeling are the same as those detailed in the original Barry ERF ES and the subsequent addendum for the Barry Waterfront development.

Model Results

The pollutants included in the model are given in Table 1, these include all pollutants which were assessed in both Barry ERF ES and the biomass plant air quality impact assessment. Results presented in this section include the total contribution from both sources. The predicted concentrations at the specified receptors are given in Table 3 to Table 10. Results for the Barry ERF alone are presented in the original ES.

Table 3 Modelled cumulative Process Contribution (PC) to annual mean and 99.79th percentile of 1 hour mean nitrogen dioxide concentrations (µg/m^3)

Receptor	Annual mean	% of annual mean AQS objective (40µg/m^3)	99.79th percentile of 1 hour mean	% of 1 hour mean AQS objective (200µg/m^3)
Hayes Lane	1.5	3.8	5.4	2.7
Hayes Point Hospital	1.0	2.5	4.1	2.0
Bendrick Road	1.7	4.3	7.6	3.8
Hayes Road	1.0	2.4	5.2	2.6
Southleigh Home	0.3	0.7	2.3	1.1
Dock View Road	0.6	1.6	8.3	4.2
Dyfrig Street	0.6	1.4	7.2	3.6
Children`s Hospice	0.5	1.4	3.0	1.5
South Quay	0.6	1.4	7.4	3.7
East Quay	1.7	4.2	13.3	6.6

The cumulative process contribution to annual mean nitrogen dioxide concentrations at all receptors is below 5% of the objective and, with background pollutant concentrations well within the objective, is considered to be a negligible impact.

The cumulative process contribution to hourly mean nitrogen dioxide concentrations is less than 7% of the objective. When calculating a total Predicted Environmental Concentration (PEC), the PC is added to the background concentration. For a short term PEC, the background is taken to be twice the annual mean background concentration (EPR-H1[2]). Since annual mean background concentrations in the area are less than 20µg/m^3, the short term background concentration is taken to be less than 40µg/m^3. Therefore, the maximum hourly mean PEC for nitrogen dioxide is less than 55µg/m^3, and less than 30% of the objective. Whilst the increment to ground level hourly mean concentrations of nitrogen dioxide is considered a minor adverse impact, with a PEC of less than 30%

[2] EA (2008) Environmental Permitting Regulations H1 Environmental Risk Assessment Part 2: Assessment of point source releases and cost benefit analysis, Issue 080328

of the objective, the risk of exceedence of the air quality objective for hourly mean nitrogen dioxide is negligible.

Table 4 Modelled cumulative Process Contribution (PC) to annual mean and 90.4th percentile of 24 hour mean particulate matter (PM_{10}) concentrations (µg/m^3)

Receptor	Annual mean	% of annual mean AQS objective (40µg/m^3)	90.4th percentile of 24 hour mean	% of 24 hour mean AQS objective (50µg/m^3)
Hayes Lane	0.08	0.19	0.18	0.4
Hayes Point Hospital	0.05	0.12	0.12	0.2
Bendrick Road	0.09	0.22	0.20	0.4
Hayes Road	0.05	0.12	0.12	0.2
Southleigh Home	0.01	0.03	0.04	0.1
Dock View Road	0.03	0.08	0.10	0.2
Dyfrig Street	0.03	0.07	0.10	0.2
Children`s Hospice	0.03	0.07	0.07	0.1
South Quay	0.03	0.07	0.09	0.2
East Quay	0.08	0.21	0.30	0.6

The process contribution to particulate matter concentrations, over all averaging periods are less than 1% of the relevant objective at both receptors. Since background concentrations are well below the objectives, this is considered to be a negligible impact.

Table 5 Modelled cumulative Process Contribution (PC) to short term sulphur dioxide concentrations (µg/m^3)

Receptor	99.9th percentile of 15 minute mean	% of 15 minute mean AQS objective (266µg/m^3)	99.73rd percentile of 1 hour mean	% of 1 hour mean AQS objective (350µg/m^3)	99.2nd percentile of 24 hour mean	% of 24 hour mean AQS objective (125µg/m^3)
Hayes Lane	3.78	1.42	2.67	0.76	1.4	1.2
Hayes Point Hospital	2.98	1.12	1.95	0.56	1.0	0.8
Bendrick Road	5.27	1.98	3.64	1.04	1.6	1.3
Hayes Road	3.70	1.39	2.60	0.74	1.0	0.8
Southleigh Home	1.77	0.66	1.08	0.31	0.3	0.3
Dock View Road	5.82	2.19	4.11	1.18	1.6	1.3
Dyfrig Street	5.13	1.93	3.55	1.01	1.8	1.5
Children`s Hospice	2.25	0.85	1.43	0.41	0.6	0.5
South Quay	5.28	1.98	3.58	1.02	1.6	1.3
East Quay	9.19	3.45	6.50	1.86	2.8	2.2

Process contributions to short term SO_2 concentrations are less than 5% of the relevant objectives. Since background concentrations are well below the relevant objectives, these are deemed to be negligible impacts.

Table 6 Modelled cumulative Process Contribution (PC) to annual mean sulphur dioxide concentrations (µg/m^3)

Receptor	Annual mean	% of annual mean AQS objective (20µg/m^3)
Hayes Lane	0.38	1.90
Hayes Point Hospital	0.25	1.25
Bendrick Road	0.43	2.16
Hayes Road	0.24	1.20
Southleigh Home	0.07	0.33
Dock View Road	0.16	0.80
Dyfrig Street	0.14	0.70
Children`s Hospice	0.14	0.69
South Quay	0.14	0.69
East Quay	0.42	2.11

The process contribution to annual average SO_2 concentrations at all receptors is less than 3% of the objective. Since background concentrations are well below the objective, this is considered to be a negligible impact.

Table 7 Modelled cumulative Process Contribution (PC) to 8 hour mean carbon monoxide concentrations (mg/m^3)

Receptor	8 hour running mean	% of 8 hour mean AQS objective ($10mg/m^3$)
Hayes Lane	0.0021	0.02
Hayes Point Hospital	0.0015	0.01
Bendrick Road	0.0026	0.03
Hayes Road	0.0017	0.02
Southleigh Home	0.0006	0.01
Dock View Road	0.0026	0.03
Dyfrig Street	0.0028	0.03
Children`s Hospice	0.0010	0.01
South Quay	0.0029	0.03
East Quay	0.0054	0.05

The process contribution to 8 hour mean carbon monoxide concentrations is less than 1% of the objective at all receptors and can be considered to be a negligible impact, based on the low background concentrations.

Table 8 Modelled cumulative Process Contribution (PC) to Hydrogen Chloride (HCl) concentrations (µg/m^3)

Receptor	Annual mean	% of long term EAL (20µg/m^3)	100th percentile of 1 hour mean	% of hourly EAL (750µg/m^3)
Hayes Lane	0.08	0.38	0.62	0.08
Hayes Point Hospital	0.05	0.25	0.49	0.07
Bendrick Road	0.09	0.43	0.85	0.11
Hayes Road	0.05	0.24	0.63	0.08
Southleigh Home	0.01	0.07	0.30	0.04
Dock View Road	0.03	0.16	0.90	0.12
Dyfrig Street	0.03	0.14	0.84	0.11
Children`s Hospice	0.03	0.14	0.37	0.05
South Quay	0.03	0.14	0.88	0.12
East Quay	0.08	0.42	1.43	0.19

The process contribution to hydrogen chloride concentrations is below 1% of the relevant EAL for all receptors over all averaging periods. This is deemed to be a negligible impact.

Table 9 Modelled cumulative Process Contribution (PC) to Hydrogen Fluoride (HF) concentrations (µg/m^3)

Receptor	Annual mean	100th percentile of 1 hour mean	% of hourly EAL (160µg/m^3)
Hayes Lane	0.008	0.06	0.04
Hayes Point Hospital	0.005	0.05	0.03
Bendrick Road	0.009	0.08	0.05
Hayes Road	0.005	0.06	0.04
Southleigh Home	0.001	0.03	0.02
Dock View Road	0.003	0.09	0.06
Dyfrig Street	0.003	0.08	0.05
Children`s Hospice	0.003	0.04	0.02
Bendrick Rock	0.027	0.18	0.11
Barry Island	0.003	0.10	0.06
South Quay	0.003	0.09	0.05
East Quay	0.008	0.14	0.09

There is no EAL for annual mean HF concentrations against which the impacts of the ERF can be assessed. The maximum process contribution to concentrations of HF over a 1 hour averaging period is deemed to have a negligible impact since the maximum is less than 0.2% of the EAL. It is assumed, therefore, that since the impacts of the 100th percentile of 1 hour mean concentrations are negligible (less than 0.2% of the objective), the annual averaged impacts will also be negligible.

Table 10 Modelled cumulative Process Contribution (PC) to annual mean concentrations of mercury (µg/m^3)

Receptor	Annual mean	% of long term EAL (0.25µg/m^3)	100th percentile of 1 hour mean	% of hourly EAL (7.5µg/m^3)
Hayes Lane	0.0004	0.15	0.003	0.041
Hayes Point Hospital	0.0002	0.10	0.002	0.033
Bendrick Road	0.0004	0.17	0.004	0.057
Hayes Road	0.0002	0.10	0.003	0.042
Southleigh Home	0.0001	0.03	0.002	0.020
Dock View Road	0.0002	0.06	0.004	0.059
Dyfrig Street	0.0001	0.06	0.004	0.056
Children`s Hospice	0.0001	0.05	0.002	0.025
Bendrick Rock	0.0013	0.53	0.009	0.118
Barry Island	0.0002	0.07	0.005	0.067
South Quay	0.0001	0.06	0.004	0.058
East Quay	0.0004	0.17	0.007	0.096

The maximum cumulative process contribution to concentrations of mercury at the specific receptors is less than 1% of the relevant EAL over all averaging periods. Since background concentrations are well below the EALs, this is considered to be a negligible to minor adverse impact, but the risk of exceedences of the EALs is negligible in all cases.

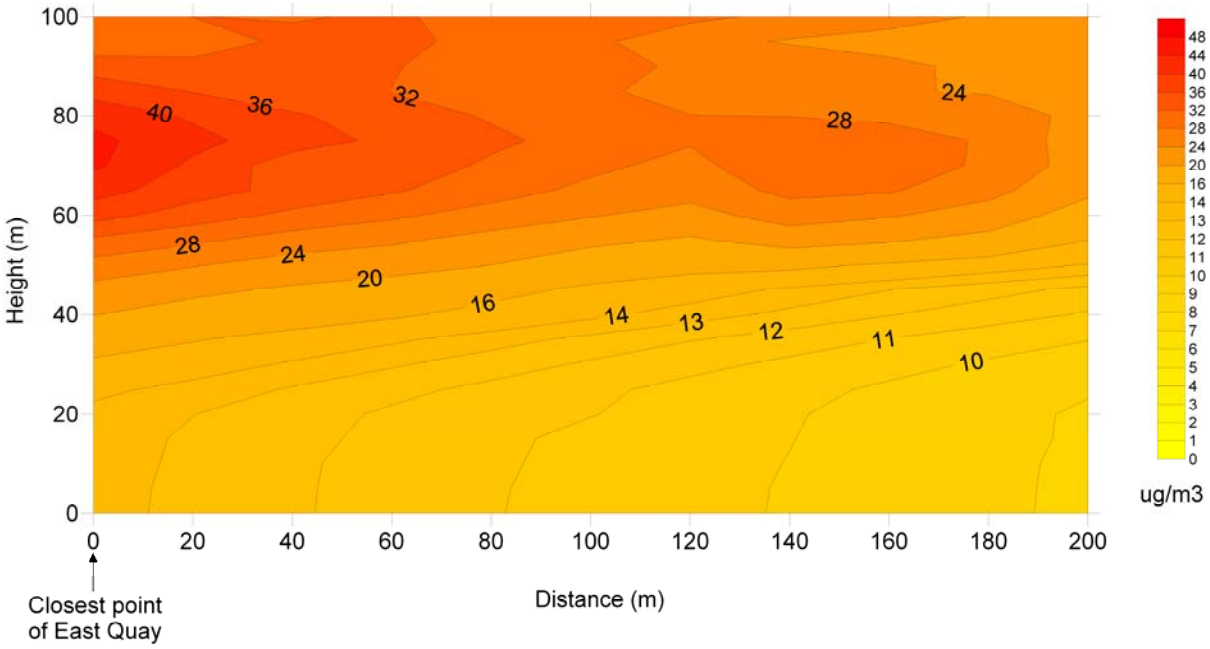
Concentrations above ground level

The Barry Waterfront Development potentially includes buildings of several storeys in height. Locations at the facades, on the upper floors of these buildings may be considered to be locations of relevant exposure and requiring assessment. The East Quay, where pollutant concentrations are higher than South Quay, has been used to illustrate the potential impacts of the ERF in the vertical. Furthermore, hourly mean nitrogen dioxide is the pollutant with the most significant process contribution (in terms of the PC expressed as a percentage of the objective) and is used for illustrative purposes in the assessment.

The detailed assessment of pollutant concentrations considers short term nitrogen dioxide concentrations in the vertical across the East Quay site, downwind of the ERF stack from the closest point of the East Quay to the stack. Details of the specific receptors used are outlined in the Barry Waterfront Addendum.

Figure 1 shows the 99.79th percentile of 1 hour nitrogen dioxide concentrations on the vertical grid. It can be seen that concentrations decrease rapidly as the distance from the ERF increases. In the vertical, concentrations remain fairly constant up to 20-25m above ground level and begin to increase more rapidly above 30-40m, depending on distance from the ERF. There is a secondary maximum at around 70m height, 150m distance from the closest point which is due to the contribution from the biomass plant. This has little effect on concentrations below 40m above ground level on the grid. At no height does the pollutant concentration exceed 25% of the standard, and the risk of exceedences of the objective is negligible.

Figure 1 99.79th percentile of short term (1 hour) nitrogen dioxide concentrations on a vertical grid, downstream from the closest point of East Quay (0m on the x-axis) to the Barry ERF. The AQS objective is 200µg/m^3.



Health Risk Assessment

Although there are no subsistence farmers living at the modelled receptors, a screening has been undertaken to assess the maximum worst case intake of dioxins.

For the worst case exposure scenario of a subsistence farmer and child of subsistence farmer, the total intake is less than 2pg/kg-bw/day and does not exceed the World Health Organization (WHO) recommended Tolerable Daily Intake (TDI) of 1-4pg/kg-bw/day. The total daily intake for an infant is expected to be 1 order of magnitude greater than that of an adult based on a 'per kilogramme' amount. This is, however, only sustained for a very short period of the individuals' life.

Nitrogen Deposition

The predicted nitrogen deposition on nearby sensitive ecosystems resulting from the cumulative process contribution of the ERF and the biomass plant are given in Table 11.

Table 11 Concentrations of nitrogen oxides and nitrogen deposition for nearby sensitive ecosystems

Receptor	NOx concentration (µg/m^3)	% of AQS objective (30µg/m^3)	Nitrogen deposition (kg N/ha/yr)	% of critical load
Bendrick Rock	5.4	13.4	0.5	5
Barry Island	0.7	1.7	0.1	1

Since background concentrations of NOx in the area are well below the objective for the protection of vegetation, and given the conservative nature of this assessment, the cumulative impact on NOx concentrations is considered to be, at worst, minor adverse. No exceeedence of the air quality objective for the protection of vegetation is likely.

The critical load for the sensitive ecosystems is 10-15 kg N/ha/yr, background deposition reported in the Barry ES was approximately 12kg N/ha/yr. Therefore, nitrogen deposition exceeds the critical load, with or without the contributions from the ERF and biomass plant. The cumulative process contribution adds up to 5%, which, according to the NSCA significance criteria detailed in the Barry ES, constitutes a minor adverse impact. However, it should be noted that the assessment is conservative and actual impacts are likely to be considerably less.

Summary

Based on the significance criteria proposed by the NSCA (now EPUK), it has been demonstrated that , taking into account the cumulative impacts of the Barry ERF and biomass plant to ambient pollutant concentrations, there is a negligible risk of exceeding the relevant assessment levels.

Furthermore, at receptors relevant for human exposure, the cumulative process contribution to pollutant concentrations is negligible, for all pollutants and all averaging periods. The exception to this is the predicted process contribution to hourly mean nitrogen dioxide concentrations which is 6.6% of the objective at the East Quay receptor. This is the same as reported in the Barry Waterfront Addendum. This concentration is based on the 99.79th percentile and as can be seen from Figure 1, the impact of the biomass boiler has little cumulative effect at the East Quay receptor, and there is no change in the result.

For ecological receptors, the maximum impact has been determined to be minor adverse. No exceedence of the nitrogen oxides air quality objective for the protection of vegetation and ecosystems is likely (critical level assessment) with the ERF and biomass plant in operation. Background nitrogen deposition level potentially exceeds the lower limit of the range of critical load given for Bendrick Rock and Barry Island whether or not the plants are operating. The cumulative contribution of the energy plants is minor adverse, as is the contribution of either plant alone.

This assessment has been carried out with a high degree of conservatism, including the nearness of the discrete receptors to the stack, the modelling of emissions at the WID emissions limits at all times, and particularly important for the ecological receptor assessment, the assumption of 100% conversion of NO_X to NO_2 from the plant emissions.

Concentrations have been shown to decrease rapidly with distance from the East Quay discrete receptor and, therefore, the reported concentrations are taken to be the worst case at the East Quay site. Since short term mean background concentrations of nitrogen dioxide are taken to be less than 40µg/m^3, given the degree of conservatism within the assessment, the impacts on receptors at the Barry Waterfront Development, due to hourly mean nitrogen dioxide concentrations, are not considered to be significant. The risk of exceedences of the EALs is considered to be negligible.

Although the biomass plant is closer to the East Quay and South Quay receptors than the Barry ERF, the emissions are lower and so the cumulative impact is largely just a small incremental increase.