

BIOGEN

**SOUTH QUAY STRATEGIC
DEVELOPMENT SITE, BARRY DOCKS,
VALE OF GLAMORGAN – AIR
QUALITY ASSESSMENT**

ADDENDUM

April 2009

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ADDITIONAL INFORMATION

Report Title : **South Quay Strategic Development Site, Barry Docks, Vale of Glamorgan – Air Quality Assessment**


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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.

PB have been commissioned to undertake an assessment of the potential air quality impacts of the Energy Recovery Facility (ERF) in Barry, Vale of Glamorgan on the nearby Barry Waterfront Development, specifically the South Quay and East Quay areas of the site. This assessment has been carried out as an addendum to the previous Environmental Statement for Barry ERF and should be read in conjunction with the ES.

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. The model was able to predict the contribution of the Facilities emissions to ambient pollution concentrations at potential receptors at the Barry Waterfront Development.

Emissions from the ERF were modelled for the same operating scenario as in the original ES, using the worst case meteorological data.

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

Two discrete receptors were used for the dispersion modeling. These were located at the closest points of South Quay (312104, 167055) and East Quay (312484, 167404) to the Facility and at a height of 1.5m above ground level, a typical respiration height. Figure 1 shows the approximate locations of the discrete receptors.

Figure 1 Approximate location of the East Quay and South Quay discrete receptors (blue dots).



Model Results

The predicted concentrations at the two specified receptors are given in Table 1 to Table 9.

Table 1 Modelled Process Contribution (PC) to annual mean and 99.79th percentile of 1 hour mean nitrogen dioxide concentrations ($\mu\text{g}/\text{m}^3$)

Receptor	Annual mean	% of annual mean AQS objective ($40\mu\text{g}/\text{m}^3$)	99.79 th percentile of 1 hour mean	% of 1 hour mean AQS objective ($200\mu\text{g}/\text{m}^3$)
South Quay	0.44	1.10	7.40	3.70
East Quay	1.26	3.15	13.3	6.64

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

The 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-H1¹). Since annual mean background concentrations in the area are less than 20 $\mu\text{g}/\text{m}^3$, the short term background concentration is taken to be less than 40 $\mu\text{g}/\text{m}^3$. Therefore, the maximum hourly mean PEC for nitrogen dioxide is less than 55 $\mu\text{g}/\text{m}^3$, 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% of the objective, the risk of exceedence of the air quality objective for hourly mean nitrogen dioxide is negligible.

Table 2 Modelled Process Contribution (PC) to annual mean and 90.40th percentile of 24 hour mean particulate matter (PM₁₀) concentrations ($\mu\text{g}/\text{m}^3$)

Receptor	Annual mean	% of annual mean AQS objective (40 $\mu\text{g}/\text{m}^3$)	90.40 th percentile of 24 hour mean	% of 24 hour mean AQS objective (50 $\mu\text{g}/\text{m}^3$)
South Quay	0.02	0.05	0.08	0.16
East Quay	0.06	0.16	0.27	0.53

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 3 Modelled Process Contribution (PC) to short term sulphur dioxide concentrations ($\mu\text{g}/\text{m}^3$)

Receptor	99.9 th percentile of 15 minute mean	% of 15 minute mean AQS objective (266 $\mu\text{g}/\text{m}^3$)	99.73 rd percentile of 1 hour mean	% of 1 hour mean AQS objective (350 $\mu\text{g}/\text{m}^3$)	99.2 nd percentile of 24 hour mean	% of 24 hour mean AQS objective (125 $\mu\text{g}/\text{m}^3$)
South Quay	5.28	1.98	3.58	1.02	1.19	0.95
East Quay	9.19	3.45	6.50	1.86	2.88	2.31

Short term SO₂ 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.

¹ EA (2008) Environmental Permitting Regulations H1 Environmental Risk Assessment Part 2: Assessment of point source releases and cost benefit analysis, Issue 080328

Table 4 Modelled Process Contribution (PC) to annual mean sulphur dioxide concentrations ($\mu\text{g}/\text{m}^3$)

Receptor	Annual mean	% of annual mean AOS objective ($20\mu\text{g}/\text{m}^3$)
South Quay	0.11	0.55
East Quay	0.32	1.57

The process contribution to annual average SO_2 concentrations at either receptor is less than 2% of the objective. Since background concentrations are well below the objective, this is considered to be a negligible impact.

 Table 5 Modelled Process Contribution (PC) to 8 hour mean carbon monoxide concentrations ($\mu\text{g}/\text{m}^3$)

Receptor	8 hour running mean	% of 8 hour mean AOS objective ($10\text{mg}/\text{m}^3$)
South Quay	0.11	0.001
East Quay	0.31	0.003

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

 Table 6 Modelled Process Contribution (PC) to Hydrogen Chloride (HCl) concentrations ($\mu\text{g}/\text{m}^3$)

Receptor	Annual mean	% of long term EAL ($20\mu\text{g}/\text{m}^3$)	100 th percentile of 1 hour mean	% of hourly EAL ($750\mu\text{g}/\text{m}^3$)
South Quay	0.02	0.11	0.88	0.12
East Quay	0.06	0.31	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 7 Modelled Process Contribution (PC) to Hydrogen Fluoride (HF) concentrations ($\mu\text{g}/\text{m}^3$)

Receptor	Annual mean	100 th percentile of 1 hour mean	% of hourly EAL ($160\mu\text{g}/\text{m}^3$)
South Quay	0.002	0.09	0.05
East Quay	0.006	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 0.1% of the EAL. It is assumed, therefore, that since the impacts of the 100th percentile of 1 hour mean concentrations are negligible (less than 0.1% of the objective), the annual averaged impacts will also be negligible.

Table 8 Modelled Process Contribution (PC) to annual mean concentrations of non-AQS metals ($\mu\text{g}/\text{m}^3$)

Receptor	Cadmium	Thallium	Mercury	Antimony	Arsenic	Chromium	Cobalt	Copper	Nickel	Vanadium
South Quay	5.48E-5	5.48E-5	1.10E-4	1.22E-4	1.22E-4	1.22E-4	1.22E-4	1.22E-4	1.22E-4	1.22E-4
East Quay	1.57E-4	1.57E-4	3.15E-4	3.50E-4	3.50E-4	3.50E-4	3.50E-4	3.50E-4	3.50E-4	3.50E-4

The maximum process contribution to annual mean concentrations of non-AQS metals at the specific receptors is less than 4% of the relevant EAL for all metals except arsenic, for which the PC is less than 6%. 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.

Table 9 Modelled Process Contribution (PC) to 100th percentile of 1 hour mean concentrations of non-AQS metals ($\mu\text{g}/\text{m}^3$)

Receptor	Cadmium	Thallium	Mercury	Antimony	Arsenic	Chromium	Cobalt	Copper	Manganese	Nickel
South Quay	2.19E-3	2.19E-3	4.38E-3	4.86E-3	4.86E-3	4.86E-3	4.86E-3	4.86E-3	4.86E-3	4.86E-3
East Quay	3.58E-3	3.58E-3	7.16E-3	7.96E-3	7.96E-3	7.96E-3	7.96E-3	7.96E-3	7.96E-3	7.96E-3

The process contribution to hourly mean concentrations of the non-AQS metals at the specific receptors is less than 1% of the relevant EAL for all pollutants. Since background concentrations are well below the EALs, this is considered to be a negligible impact.

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.

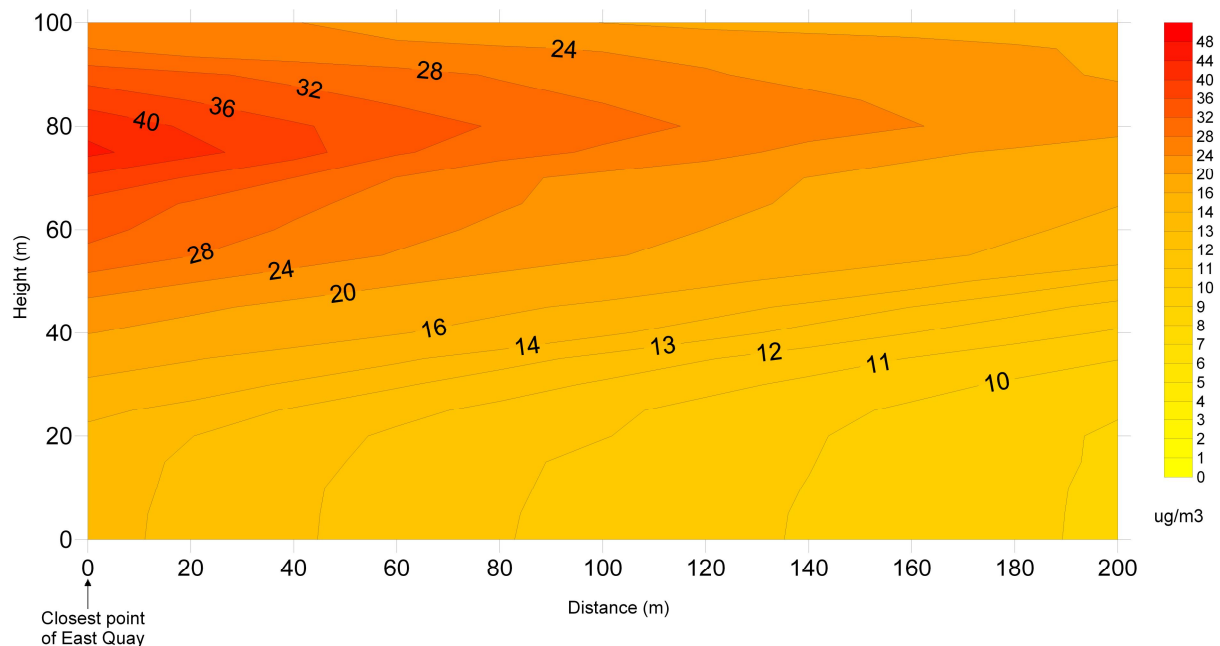
The detailed assessment of pollutant concentrations considers concentrations in the vertical across the East Quay site, downwind of the stack from the closest point of the East Quay to the stack. Table 10 shows the ground level locations of the vertical receptor grid. Receptors were added every 5m in the vertical above these locations.

Table 10 Receptor locations for the vertical grid. Receptors were arranged downstream of the stack location, at 20m intervals in the horizontal from the nearest point of the East Quay site to the stack. At each of these locations, receptors were placed at 5m intervals in the vertical, between 0m and 100m above ground level.

Receptor	Easting	Northing
0m (closest to stack location)	312484	167404
20m	312467.8	167415.7
40m	312451.5	167427.3
60m	312435.3	167439
80m	312419	167450.7
100m	312402.8	167462.3
120m	312386.5	167474
140m	312370.3	167485.7
160m	312354	167497.3
180m	312337.8	167509
200m	312321.6	167520.7

Figure 2 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 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. However, at no height, does the pollutant concentration exceed 25% of the standard, and the risk of exceedences of the objective is negligible.

Figure 2 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/m³.



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.

Summary

Based on the significance criteria proposed by the NSCA (now EPUK), it has been demonstrated that concentrations of all pollutants, over all averaging periods, at the South Quay and East Quay receptors are negligible, with negligible risk of exceeding the relevant assessment levels. The

exceptions to this are the predicted process contribution to hourly mean nitrogen dioxide concentrations at East Quay which is 6.64% of the relevant objective at the East Quay receptor, and annual mean arsenic, which is 5.8% of the EAL.

This assessment has been carried out with a high degree of conservatism, including the nearness of the discrete receptors to the stack, located at the closest points of the South and East Quay sites, as well as the modelling of emissions at the WID emissions limits. 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 $40\mu\text{g}/\text{m}^3$ and background concentrations of arsenic are also taken to be well below the relevant EAL, given the degree of conservatism within the assessment, the impacts on receptors at the Barry Waterfront Development, due to hourly mean nitrogen dioxide concentrations or arsenic, are not considered to be significant. The risk of exceedences of the EALs is considered to be negligible.