

Natural Resources Wales permitting decisions

Variation of a Bespoke Permit

We have decided to issue the variation for the Barry Silicon-based Manufacturing Installation operated by Cabot Carbon Limited.

The variation number is EPR/BU2110IS/V007.

We consider in reaching that decision we have taken into account all relevant considerations and legal requirements and that the permit will ensure that the appropriate level of environmental protection is provided.

Purpose of this document

This decision document:

- explains how the application has been determined
- provides a record of the decision-making process
- shows how all relevant factors have been taken into account
- justifies the specific conditions in the permit other than those in our generic permit template.

Unless the decision document specifies otherwise we have accepted the operator's proposals.

Structure of this document

- Key issues
- Annex 1 the decision checklist

Key issues of the decision

This variation is to allow an increase in the nameplate capacity of the treated silica plant from 1700 metric tonnes (MT) per annum to 3500 MT per annum. The increase will be introduced in a phased manner, with Phase 1 of the project increasing capacity 2200 MT in 2015 and Phase 2 increasing capacity to 3500 MT by 2018. This variation incorporates both phases.

The treated silica plant is a directly associated activity to the main silicon dioxide manufacturing activity at the installation.

This variation also makes changes to the requirements for monitoring emissions of chlorine and chloromethanes at emission point A1 which forms

part of the main silicon dioxide manufacturing activity. These changes have been made in response to information submitted by the operator as a result of the setting of two improvement conditions (IP24 and IP26) as part of a previous variation (variation reference EPR/BU2110IS/V005).

Finally, this variation also makes a minor change to the standard reference method for monitoring emissions of hydrogen chloride at emission point A1.

Assessment of increase to Treated Silica Plant capacity

Environmental Risk

The operator has used the H1 software tool to determine the process contribution of the following parameters:

- Formaldehyde;
- Siloxanes; and
- Carbon monoxide

from the existing emission point A13 and the new emission point A24. These emission points are co-located and the operator has considered the combined emissions from both emission points in the H1 calculations.

Formaldehyde

H1 Assessment

The process contribution (PC) was compared to the long-term and short-term Environmental Assessment Levels (EALs) for formaldehyde given in Appendix B of H1 Annex F – Air Emissions. Both the short-term PC and long-term PC exceeded the 1% and 10% insignificance thresholds of the respective EALs and therefore the operator proceeded to the second stage of assessment.

The second stage of assessment involves comparing the PC in combination with the ambient background concentration with the EAL to determine whether there is a need for detailed air dispersion modelling to predict ground level concentrations. The PC in combination with the ambient background is termed the Predicted Environmental Concentration (PEC). In the UK, ambient concentrations of formaldehyde are not routinely monitored, so the operator has used monitoring data published in the DETR report 'A pilot study of Formaldehyde Monitoring in Ambient Air'¹. This report publishes a range of values for ambient concentrations of formaldehyde and the operator has opted to use the highest value in this range, thereby taking a conservative approach.

For assessment of short-term emissions, there is a need for detailed dispersion modelling if the PC is more than 20% of the relevant short-term EAL minus twice the long-term background concentration. For short-term formaldehyde this calculation is as follows:

$EAL_{\text{short-term}} = 100 \mu\text{g}/\text{m}^3$
 $PC = 21 \mu\text{g}/\text{m}^3$
Long-term background concentration = $2.59 \mu\text{g}/\text{m}^3$

Therefore: $20\% (100 - (2 * 2.59)) = 18.96 \mu\text{g}/\text{m}^3$
 $PC (21 \mu\text{g}/\text{m}^3) > 18.96 \mu\text{g}/\text{m}^3$

On this basis the operator proceeded to carry out detailed modelling of short-term ground level concentrations which is discussed below.

For assessment of long-term emissions, there is a need for detailed dispersion modelling if the PEC is more than 70% of the relevant long-term EAL. For long-term formaldehyde this calculation is as follows:

$PC = 0.467 \mu\text{g}/\text{m}^3$
Ambient background = $2.59 \mu\text{g}/\text{m}^3$
 $EAL_{\text{long-term}} = 5 \mu\text{g}/\text{m}^3$

Therefore: $PEC = 3.057 \mu\text{g}/\text{m}^3$
 $= 61\% \text{ of } EAL_{\text{long-term}}$

This calculation indicated that detailed modelling of long-term emissions is not required.

Dispersion Modelling

ADMS modelling software (ADMS 5) was used to predict maximum ground level concentrations associated with the increased production capacity. Ground level concentrations at the nodal points of a 1km^2 Cartesian grid of receptors (i.e. 20 m distance between receptors) were modelled.

The short-term PC was modelled as a 1-hour average and the long-term PC as a mean annual average. These figures were found to be $3.03 \mu\text{g}/\text{m}^3$ and $0.10 \mu\text{g}/\text{m}^3$ respectively. For long-term formaldehyde the PEC as a percentage of the EAL is 53.8%; as this is lower than 70% we are satisfied that no exceedance of the EAL will be caused. The assessment calculation for short-term formaldehyde is as follows:

$EAL_{\text{short-term}} = 100 \mu\text{g}/\text{m}^3$
 $PC = 3.03 \mu\text{g}/\text{m}^3$
Long-term background concentration = $2.59 \mu\text{g}/\text{m}^3$

Therefore: $20\% (100 - (2 * 2.59)) = 18.96 \mu\text{g}/\text{m}^3$
 $PC (3.03 \mu\text{g}/\text{m}^3) < 18.96 \mu\text{g}/\text{m}^3$

As the PC is less than 20% of the EAL minus twice the long-term background, we are satisfied that no exceedance of the EAL will be caused. This means that formaldehyde concentrations are not expected to pose a significant risk to public health or the environment.

Siloxanes

There are no formal legislative limits or EALs for cyclic or linear polydimethylsiloxanes (siloxanes). The operator therefore completed a review of available toxicological data in order to derive long-term and short-term EALs for siloxanes. The method used to derive EALs follows guidance on derivation of EALs given in H1 and takes a conservative approach by using the lowest 'no observed adverse effect level' available in published literature.

The process contribution (PC) was compared to the derived long-term and short-term Environmental Assessment Levels (EALs) for siloxanes. The long-term PC exceeded the 1% insignificance threshold for long-term EALs and therefore the operator proceeded to the second stage of assessment. The short-term PC was less than 10% of the short-term EAL, and therefore screens out as insignificant.

The long-term PC for siloxanes was taken to a second stage of assessment. In the UK, ambient concentrations of siloxanes are not routinely monitored and therefore for the purposes of this assessment, ambient concentrations were assumed to be zero. The calculation for the second stage of assessment is therefore as follows:

$$\begin{aligned} \text{PC} &= 7.06 \mu\text{g}/\text{m}^3 \\ \text{Ambient background} &= 0 \mu\text{g}/\text{m}^3 \\ \text{EAL}_{\text{long-term}} &= 108 \mu\text{g}/\text{m}^3 \end{aligned}$$

$$\begin{aligned} \text{Therefore: PEC} &= 7.06 \mu\text{g}/\text{m}^3 \\ &= 6.54\% \text{ of EAL}_{\text{long-term}} \end{aligned}$$

This calculation indicated that detailed modelling of long-term emissions is not required. This means that concentrations of siloxanes are not expected to pose a significant risk to public health or the environment.

Carbon Monoxide

The process contribution (PC) was compared to the EU Limit Value and UK Air Quality Objective for short-term carbon monoxide, which is 10 mg/m³ (10000 µg/m³) as given in Appendix B of H1 Annex F. There is no corresponding long-term value for Carbon Monoxide. The short-term PC was 10% of the short-term Limit Value / Objective, and therefore could not be screened out as insignificant. The operator therefore proceeded to the second stage of assessment; the calculation for which is as follows:

$$\begin{aligned} \text{EAL}_{\text{short-term}} &= 10000 \mu\text{g}/\text{m}^3 \\ \text{PC} &= 1000 \mu\text{g}/\text{m}^3 \\ \text{Long-term background concentration} &= 155 \mu\text{g}/\text{m}^3 \end{aligned}$$

$$\begin{aligned} \text{Therefore: } 20\% (10000 - (2 * 155)) &= 1938 \mu\text{g}/\text{m}^3 \\ \text{PC (1000 } \mu\text{g}/\text{m}^3) &< 1938 \mu\text{g}/\text{m}^3 \end{aligned}$$

This calculation indicated that detailed modelling of short-term emissions is not required. This means that carbon monoxide concentrations are not expected to pose a significant risk to public health or the environment.

Operating techniques

The increase in throughput will be achieved by a combination of technology conversion, minor plant improvements, operational adjustments and extended operating hours. Additional product milling and storage will also be installed to handle the increased rate of production from the reaction plant. This equipment is identical to that already installed in the treated silica plant.

Additional emissions abatement equipment will be installed to control emissions of particulate, formaldehyde and siloxanes generated within the process. The additional abatement plant will include:

- The use of fabric bag filters for control of particulate emissions from the new plant. The use of fabric filters is BAT as described in the 'Large Volume Inorganic Chemicals – Solids and Other Industry' (LVIC-S and OI) Best Available Techniques Reference Document (BRef). These filters are able to achieve particulate emission levels of less than 10 mg/m³ which is described as the Best Available Technique (BAT) in LVIC-S and OI and EPR 4.03 'The Inorganic Chemicals Sector'; and
- The use of a wet scrubber column for abatement of formaldehyde and siloxanes. Wet chemical scrubbing is BAT for this activity as described in LVIC-S and OI.

Emissions of formaldehyde and siloxanes are associated with another area of the new plant; however, emissions from this part of the process are expected to be extremely low and the environmental benefits which could be achieved by abating this emission are far outweighed by the costs to implement and operate such abatement systems.

We consider that the measures taken by the operator to abate and control emissions are satisfactory and represent BAT for this activity.

Emission limits

This variation adds a new emission point (A24) which is located 0.5m from the existing emission point (A13) for the treated silica plant.

EPR 4.03 stipulates a benchmark emission limit value (ELV) of 20 mg/m³ for total Class A VOCs where a mass emission of 100 g/hr is exceeded. The operator has stated in the application that the maximum mean emission of formaldehyde from A24 will be 5.93mg/m³ and the maximum peak emission concentration will be 10.1mg/m³. For A13, these figures are stated as 5.33 mg/m³ and 9.19 mg/m³ respectively. The operator states that the total flow per

hour will be 973m³/hr for A13 and 1044m³/hr for A13. These figures have been used in the H1 assessment. Considering the figures for maximum peak emission, this equates to an emission of 9.82g/hr for A24, and 9.59g/hr for A13, which combined gives 19.41g/hr. Monitoring returns for 2014 for A13 suggest that the emission from A13 is, in reality, lower than this; the 2014 return states a combined emission of 3.94 g/hr (with an uncertainty of +/- 36%: therefore a maximum of 5.35 g/hr) for the scrubber and the TF 38 filter. On this basis we are satisfied that the operator has demonstrated that compliance with the new mass emission limit stipulated in EPR 4.03 is easily achievable.

In order to ensure that this poses no significant risk to public health or the environment, we have lowered the emission limit value for A13 and combined it with A24, such that the combined emissions of formaldehyde from A13 and A24 shall not exceed 100g/hr.

Changes in response to Improvement Condition submissions

Chlorine

This variation also makes changes to the monitoring requirements for emissions of chlorine from the main silicon dioxide production activity at the site.

The Large Volume Inorganic Chemicals-Solids and Others Industries (LVIC-S and OI) BRef states that an emission of <10 mg/m³ chlorine in the off-gas leaving the scrubber is achievable. This value is included in the permit as an emission limit of 10mg/m³ as an hourly average. However, historically, chlorine emissions have, on occasion, exceeded this value, due to fluctuations caused by variations in production. Although occasional exceedences of this value have occurred, the operator has previously demonstrated that the occasionally elevated releases are insignificant in terms of environmental risk.

A variation (ref. EPR/BU2110IS/V005) granted in 2011 allowed the operator to install new burner train technology which reduced the variability in chlorine emissions. This variation also imposed two improvement conditions which required the operator to: (i) inform the Environment Agency (NRW's predecessor body) when the new technology was operational (improvement condition IP24); and (ii) investigate the efficacy of methods for sampling chlorine emissions to determine which method was most applicable and accurate to the set-up at the site (improvement condition IP26). Both improvement conditions were subject to time limits. Whilst the improvement works and investigation was ongoing a temporary increase in the emission limit value to 20 mg/m³ as an hourly average was allowed.

Investigations by the operator in response to IP26 indicated that United States Environmental Protection Agency (US EPA) method 26A was most appropriate, although, in certain circumstances, the operator discovered results can be unreliable at concentrations under 15 mg/m³. US EPA method 26A is given in

TGN M2 'Monitoring of Stack Emissions to Air' as a standard reference method for measuring both gas-phase and aerosol halides. We have therefore varied the permit to remove the temporary emission limit of 20 mg/m³ and altered the 10 mg/m³ to take into account of the uncertainty encountered at concentrations below 15 mg/m³. We are satisfied that this emission limit is sufficiently protective of health and the environment.

Chloromethane and other associated substances

Improvement condition IP26 also required the operator to investigate various methods of sampling chloromethane (and other associated substances) to determine which method is most appropriate. The investigations indicated that the method outlined in BS EN 13649 'Stationary source emissions. Determination of the mass concentration of individual gaseous organic compounds' is most applicable. We have therefore varied the permit to include this method as the reference method for sampling chloromethane (and other substances) at emission point A1.

Change to Standard Reference Method for Hydrogen Chloride

We have changed the monitoring standard reference method for Hydrogen Chloride at emission point A1. The revised reference method allows the use of instrumental methods in line with TGN M22 'Measuring stack gas emissions using FTIR instruments', as well manual methods in line with BS EN 1911. Both methods are given TGN M2 'Monitoring of Stack Emissions to Air' as standard reference methods for monitoring Hydrogen Chloride emissions.

Annex 1: decision checklist

This document should be read in conjunction with the application and supporting information and permit / notice.

Aspect considered	Justification / Detail	Criteria met
Receipt of submission		
Confidential information	<p>A claim for commercial or industrial confidentiality has been made by the operator.</p> <p>We have accepted the claim for confidentiality. We consider that the inclusion of the relevant information on the public register would prejudice the operator's interests to an unreasonable degree. The reasons for this are given in the notice of determination for the claim. The decision was taken in accordance with our guidance on commercial confidentiality.</p>	✓
European Directives		
Applicable directives	All applicable European directives have been considered in the determination of the application.	✓
The site		
Extent of the site of the facility	<p>The operator has provided a plan which we consider is satisfactory, showing the extent of the site of the facility including the location of the part of the installation to which this permit applies on that site.</p> <p>A plan is included in the permit and the operator is required to carry on the permitted activities within the site boundary.</p>	✓
Biodiversity, Heritage, Landscape and Nature Conservation	<p>The application is within the relevant distance criteria of a site of heritage, landscape or nature conservation, and/or protected species or habitat .</p> <p>A full assessment of the application and its potential to affect the habitats has been carried out as part of the permitting process. We consider that the application will not affect the features of the habitats.</p>	✓
Environmental Risk Assessment and operating techniques		
Environmental risk	<p>We have reviewed the operator's assessment of the environmental risk from the facility. The operator's risk assessment is satisfactory.</p> <p>See Key Issues section.</p>	✓

Aspect considered	Justification / Detail	Criteria met
		Yes
Operating techniques	<p>We have reviewed the techniques used by the operator and compared these with the relevant guidance notes.</p> <p>The proposed techniques/ emission levels for priorities for control are in line with the benchmark levels contained in the TGN EPR 4.03 'The Inorganic Chemicals Sector' and we consider them to represent appropriate techniques for the facility.</p> <p>We consider that the emission limits included in the permit reflect the BAT for the installation.</p> <p>See Key Issues section.</p>	✓
The permit conditions		
Incorporating the application	<p>We have specified that the operator must operate the permit in accordance with descriptions in the application, including all additional information received as part of the determination process.</p> <p>These descriptions are specified in the Operating Techniques table in the permit.</p>	✓
Emission limits	<p>We have decided that emission limits should be set for the parameters listed in the permit.</p> <p>See Key Issues section.</p>	✓
Reporting	<p>We have specified reporting in the permit for the new emission points A24. The reporting frequency is every 12 months.</p> <p>We have also specified new reporting requirements of every 12 months for monitoring of chlorine and chloromethane emissions at emission point A1 as an annual average.</p>	✓
Operator Competence		
Environment management system	<p>There is no known reason to consider that the operator will not have the management systems to enable it to comply with the permit conditions. The decision was taken in accordance with RGN 5 on Operator Competence.</p>	✓

¹ Final Report on DETR contract EPG 1/3/155 – A Pilot Study of Formaldehyde Monitoring in Ambient Air. W. Bell, N. Davies, D. Butterfield, K. Blakely, K. Lancaster, P. Quincey and M. Henderson, July 2000.