Environment Agency permitting decisions

Variation

We have decided to issue the variation for Glanford Brigg Generating Station operated by Centrica Brigg Limited.

The permit number is EPR/ZP3133LM.

The variation number is EPR/ZP3133LM/V007.

The application was submitted and determined as a substantial variation.

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 applicant's proposals.

Structure of this document

- Key issues: emissions to air; noise; emissions monitoring
- Annex 1 the decision checklist
- Annex 2 the consultation and web publicising responses

Key issues of the decision

Introduction

This substantial variation for Glanford Brigg Generating Station authorises Centrica Brigg to install one or two new gas turbines with a (total) electrical generating capacity of 80 - 100 MW to operate in open cycle mode. The turbine(s) will have an aggregated maximum thermal input of 280 MW. The existing four gas turbines at the site have an aggregated thermal capacity of 568 MWth.

The new open cycle gas turbine unit(s) will have a net overall efficiency, at full load, of between 36 - 44 per cent. Emissions to air from the turbine(s) will be via a 30m stack or stacks. The permit was previously varied to authorise operation of the existing gas turbines in open cycle mode for a maximum of 500 hours annually. The operating techniques currently in use will be maintained along with existing management procedures.

A pre-operational condition included in the variation requires the operator to submit detailed designs of the new turbine(s) including drainage system, abatement and location plans to the Environment Agency. The operator shall take a review of the final design / plans for the new units to ensure that:

1) The final design will meet the requirements of best available techniques (BAT);
2) The application still accurately reflects the final operating proposals; and
3) The environmental impact assessment still accurately reflects the predicted impacts from the proposal.

The operator shall submit a written report to the Environment Agency for approval, 6 months prior to construction, detailing the findings of this review.

Operation of gas turbines in open cycle is not considered a best available technique due to reduced energy efficiency and the potential increase of pollutants released to air in comparison to operating gas turbines in combined cycle mode. However, operating in open cycle enables a quick start up time of 20 minutes in order to provide energy to the National Grid to maintain electrical generation for emergency use. This variation will enable the Operator to install one or two additional gas turbines for operation in open cycle mode. It does not set BAT for open cycle operation.

The existing gas turbines are currently in open cycle mode operation under contractual agreement with the National Grid. The variation application states that there is no mechanical system in place that would allow the existing gas turbines to switch efficiently between open and combined cycle modes of operation. The by-pass stack configuration for the existing gas turbines consists of fixed structures to allow the plant to operate in open cycle mode. Following the commissioning of the new gas turbine(s), the proposal is to operate all turbines in open cycle mode on a permanent basis in line with a further planned contractual agreement with National Grid. Use of the existing heat recovery steam generation (HRSG) plant would no longer be required. If the plant were to return to combined cycle operation in the future, works to remove the fixed structure by-pass stacks to enable use of the heat recovery systems would be required.

During open cycle operation the turbines will only burn natural gas and the main pollutant of concern will be NO_2. This is in line with the previous variations V004 and V006 where the Operator assessed impact from NO_2 whilst operating the plant in unabated open cycle mode. The Operator is restricted to operation in open cycle mode for 500 hours in any one year. The assessment has modelled the impact of emissions conservatively for operation all turbines for 4,380 hours in one year (at 12 hours per day) for this variation. This approach has been taken on the basis that the full operational potential of the installation is for 12 hours per day; 6 hours in the morning and early evening to meet peak demand load periods during the day.

The Short Term Operating Reserve (STOR) contract requires the power station to generate power on demand within specific time windows to support the energy supply requirement of the National Grid. These typically occur six days per week for two periods per day of between approximately 5-6 hours. Generally open cycle runs would typically be two hours or less in duration. Where runs exceed two hours a condition in the existing permit requires the Operator to report runs where:

a) 10% of open cycle operations in a quarter exceed 2 hours in length; or

b) Any open cycle operation exceeds 4 hours in length;

the Operator shall notify the Environment Agency in writing, as soon as possible, specifying the time, date and duration of the run(s), and the reasons and purpose for which the run(s) was (were) required for both the existing units and the new unit(s).

As outlined in a previous variation, the need to operating gas turbines in open cycle mode is part of improving the resilience of the electrical supply industry and therefore contributes to the emergency preparedness of the country. Under the provisions set out in Annex V of the Industrial Emissions Directive, gas turbines for emergency use that operate for less than 500 hours are not covered by the emission limit values set out in that part of the directive. In these cases, the Operator of such plants shall record operating hours as a means of monitoring and demonstrating control of emissions.

There are no emission limits or monitoring requirements in the permit for operating in open cycle. The Operator has specific conditions in the existing permit relating to the length of runs and reporting requirements when operating in open cycle mode (as detailed above). This variation does not change these conditions. There will be no change to emission limits from those set out in the permit. The limits associated with combined cycle mode operation, remain in the permit following this variation as the commissioning of the new turbines will not take place for a period of time following variation issue.

A previous trial at the site, assessed through V006 indicated that a combustion gas exhaust stack height of 30m is acceptable for the four existing turbines on the site operating in open cycle mode. Generally most open cycle runs will be short as the Operator is currently contracted to operate as a STOR facility, generating emergency power within specific time periods, to support the energy supply requirements of the National Grid.

The Operator has submitted an air dispersion modelling study as part of the supporting documentation for the variation.

Emissions to Air

Assessment of impact from operating in open cycle mode at the installation only considers emissions of NO_2 to air. This is consistent with the approach undertaken previously in variations V004 and V006 of this permit. We accept that emissions of carbon monoxide and particulates from gas turbines fired on natural gas will be insignificant.

Human Health Risk Assessment

There are no Air Quality Management Areas (AQMA) within 2 km of the installation. The closest AQMA to the site is Scunthorpe AQMA at approximately 4 km to the west. The Scunthorpe AQMA is designated for a pollutant not associated with the combustion of natural gas (PM_{10}) and therefore the installation of the new turbine(s) would not be expected to have an impact on the AQMA.

Air dispersion modelling utilising the Atmospheric Dispersion Modelling System (ADMS) software tool was used to assess the predicted impact of NO_x emissions from the installation including the proposed additional gas turbine unit(s), on ground level NO_2 concentration values.

The best available techniques reference document (BREF) wish list specifies that "*For existing and new plants operating less than 500 hours per annum, BAT is the optimisation of primary measures to minimise NO_x*". NO_x emissions from the proposed new unit(s) and the existing units will be controlled using low-NO_x burners as a minimum. The selection of the final abatement techniques will be based on recommendations from the turbine manufacturer. The NO_x emission from the existing units will be controlled using either dry low-NO_x burners or water injection. The Operator has stated that the installation of primary NO_x abatement will limit NO_x emissions to a maximum of 50 mg/m^3. This is consistent with the value set out in the document 'UK wish list LCP BREF review UKTWG1' issued May 2011 and the BAT associated emissions levels (AELs) listed in the draft Best Available Techniques (BAT) Reference Document for the Large Combustion Plants, June 2013.

Improvement condition IC8 has been included in the permit and requires the Operator to undertake a study to assess the emissions of NO_x from the gas turbines GT1A, GT1B, GT2A and GT2B following the retrofit of the NO_x abatement systems. A report detailing the findings of the study with reference to the predicted emission level of 50 mg/m^3 shall be submitted to the Environment Agency in writing for approval.

Due to the primary NO_x abatement instalment for both the existing and the new gas turbines, the predicted long and short term process contributions from the installation will decrease overall compared to the process contributions predicted for the operation of the four existing gas turbines for 500 hours annually in open cycle mode with no abatement.

The Operator has assessed the long term and short term emissions at the nearest human receptors.

Table 1 - Maximum predicted long term process contribution of NO_2 at human receptors

Reference period	EAL	PC ($\mu g/m^3$)	PC as % of EAL	Background ($\mu g/m^3$)	PEC ($\mu g/m^3$)	PEC as % of EAL
Annual mean	40	3	7.5	13.5	16.5	41

Table 1 above indicates that the annual mean process contribution (PC) is greater than 1% of the relevant long term environmental assessment level (EAL) for NO_2, and therefore cannot be considered insignificant. However, the predicted environmental concentration (PEC) is less than 70%. Where the PEC is less that 70% of the relevant EAL we can conclude that it is unlikely that the emissions from the installation will cause an exceedance of the air quality standard.

The applicant has modelled the worst case impact. The installation is limited to 500 hours operation per year, where as the model assumes operation of each turbine for 12 hours each day throughout the year, a total of 4,380 hours. As a result of the limitation in operational hours, the long term impact of operation in open cycle mode is likely to be insignificant.

Table 2 - Maximum predicted short term process contribution of NO_2 at human receptors

Reference period	EAL	PC ($\mu g/m^3$)	PC as % of EAL	Background ($\mu g/m^3$)	Headroom (EAL - 2 x long term background) ($\mu g/m^3$)	PC as % of headroom
1 hour	200	32.1	16	27.1	172.9	18.6

Table 2 above shows that the hourly PC is 18.6% of the headroom between the EAL and the background. This indicates that there is adequate headroom between the PEC and the EAL so that a resultant exceedance of the EAL is unlikely. The maximum predicted short term PC, detailed in the table above, will occur approximately 60m north east of the installation boundary on the western side of the New River Ancholme, away from the nearest sensitive receptor located further east on the eastern side of the River Ancholme.

We have reviewed the modelling output and we agree with the Operators' conclusions that the worst case long term and short term PC are not likely to be insignificant; but taking the background concentration into account the PECs of NO_2 are likely to be below the respective EAL.

Based on the addition of the gas turbine(s) operating in open cycle mode and the modelling submitted by the Operator, emissions from the stacks are not likely to result in an exceedance of the relevant EAL.

Assessment of impact on Ecological Sites

There are no Special Areas of Conservation (SAC), Special Protection Areas (SPA) or Ramsar sites within 10km of this installation.

Castlethorpe Tufas Site of Special Scientific Interest (SSSI) within the relevant distance threshold of 2km. However, this site is designated for a geological feature and there is no mechanism for NO_x emissions to impact this site. Therefore no further assessment of this site is considered necessary.

There are 6 Local Wildlife Sites (LWS) within 2km of the installation. These are:

- Traffords Covert;
- Scawby Park;
- Farnway & Thirty Foot Drains;
- Newstead Drain;
- Candley Beck, Westrun;
- Silversides Settling Ponds.

The closest sites are Silversides Settling Ponds approximately 250m and Newstead Drain approximately 890m from the facility. The impacts at these sites are shown in the tables below. The maximum long term PC as a percentage of the critical level is 4.0% of the critical level at the LWSs. The maximum short term PC as a percentage of the critical level is 20% of the critical level at the LWSs. None of the other non-statutory sites listed above is greater than 4.0% of the long term or 20% of the short term critical level.

Table 3 - Predicted long term process contributions

LWS	Substance and reference period	Critical level (µg/m^3)	Predicted PC (µg/m^3)	PC as % of critical level
Silversides Settling Ponds	NO_x annual	30	1.2	4.0
Newstead Drain	NO_x annual	30	0.3	1.0

Table 3a - Predicted short term process contributions

LWS	Substance and reference period	Critical level (µg/m^3)	Predicted PC (µg/m^3)	PC as % of critical level
Silversides Settling Ponds	NO_x daily mean	75	15.0	20
Newstead Drain	NO_x daily mean	75	9.6	13

The Operator has predicted that the PEC at Silversides Settling Ponds and Newstead Drain LWSs would be a maximum of 73% and 57% respectively of the short term critical level. The modelled prediction is based on continuous operation for 12 hour periods. This is a worst case scenario that does not reflect the lower risk from operations at the installation which would normally involve running periods of less than two hours duration twice a day.

We agree with the applicant's conclusions that there is unlikely to be any damaged caused to the ecological sites by the emissions of NO_x from the plant.

As the normal operating periods at the installation will be significantly less than the modelled hours, we consider that the daily mean critical level is unlikely to be exceeded at the non-statutory sites.

Table 4 – Predicted nutrient nitrogen and acid deposition

LWS	Substance and reference period	Critical load kgN/ha/yr (taken from APIS)	Predicted PC	PC as % of critical load
Silversides Settling Ponds	Nitrogen deposition	10	0.17 kgN/ha/yr	1.7
Newstead Drain	Nitrogen deposition	10	0.04 kgN/ha/yr	0.4

Deposition results are low with neither site greater than 2% of the relevant critical load and therefore unlikely to affect the LWSs. Neither of the LWSs assessed is sensitive to acid deposition as they are aquatic features and therefore this parameter has not been considered. Nitrogen deposition and acidification impacts are both only referenced to annual impact consideration, therefore it is reasonable to consider that impacts will be insignificant when operation is limited to only 500 hours per year.

We agree with the applicant's conclusions with respect to the impacts at ecological receptors and that there is a low risk of the impacts from annual mean and 24 hour NO_2 exceeding the screening criteria of 100% at non-statutory sites within 2km of the installation.

Noise

There is the potential for an increase in noise from the two new gas turbines. It is anticipated that the overall noise produced by the plant will be of a constant and steady nature during operational hours. The main sources of intermittent noise will be the operation and testing of safety valves which will be carried out during daytime hours. The following key measures are proposed to minimise noise emitted from the plant:

- Gas turbines enclosed within acoustic enclosures.
- Gas turbine intake/exhaust fitted with silencers.
- Splitter silencers on the main gas turbine inlets.
- Acoustic insulation fitted to the gas turbine inlet ductwork downstream of the inlet silencer.
- Pumps and motors are housed inside buildings.

The noise impact of the proposed site has been assessed in accordance with BS 4142. The results of the assessment indicate that predicted noise levels at the nearest sensitive receptors are unlikely to cause annoyance or complaints. We agree with the conclusions reached by the operator.

We are satisfied that appropriate measures have been taken to minimise the potential for noise at the facility.

Emission Monitoring

Under Annex V of the IED, gas fired plant that operates for less than 500 hours per year for emergency use are not covered by emission limits. The Operator will not be required to monitor emissions from the existing by-pass stacks or the new gas turbine stacks but they will be required to record the operating hours. This requirement is covered by condition 2.3.5 of the existing permit.

Emission points A1, A2, A3 and A4 associated with the combined cycle operation of the existing turbines have been removed from table S4.1(a) of the permit.

The emission points for the gas turbine(s) are detailed in table 5 below.

Table 5

Gas turbine	Emission point in combined cycle (main stack)	Emission point in open cycle (by-pass stack)
GT 1A	A1	A1a
GT 1B	A2	A2a
GT 2A	A3	A3a
GT 2B	A4	A4a
GT 3A	-	A32
GT 3B	-	A33

Annex 1: decision checklist

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

Aspect considered	Justification / Detail	Criteria met Yes
Consultation		
Scope of consultation	The consultation requirements were identified and implemented. The decision was taken in accordance with RGN 6 High Profile Sites, our Public Participation Statement and our Working Together Agreements.	✓
Responses to consultation and web publicising	The web publicising and consultation responses (Annex 2) were taken into account in the decision. The decision was taken in accordance with our guidance.	✓
Operator		
Control of the facility	We are satisfied that the applicant (now the operator) is the person who will have control over the operation of the facility after the grant of the permit. The decision was taken in accordance with EPR RGN 1 Understanding the meaning of operator.	✓
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	The operator has provided a plan which we consider is satisfactory, showing the extent of the site of the facility. A plan is included in the permit and the operator is required to carry on the permitted activities within the site boundary.	✓
Biodiversity, Heritage, Landscape and Nature Conservation	The application is within the relevant distance criteria of a site of heritage, landscape or nature conservation, and/or protected species or habitat. A full assessment of the application and its potential to affect the sites has been carried out as part of the permitting process. We consider that the application will not affect the features of the sites. See key issues section for further details. There are no European Sites within the relevant screening distance or SSSIs which aren't only designated for geological interest, therefore Natural England were not consulted with either an Appendix 11 or Appendix 4 in relation to the application.	✓

Aspect considered	Justification / Detail	Criteria met Yes
Environmental Risk Assessment and operating techniques		
Environmental risk	We have reviewed the operator's assessment of the environmental risk from the facility. The operator's risk assessment is satisfactory. **See key issues section for further information.**	✓
Operating techniques	We have reviewed the techniques used by the operator and compared these with the relevant guidance notes. See key issues section for further information.	✓
The permit conditions		
Pre-operational conditions	We have included a pre-operational condition in the variation which requires the operator to specify the details of proposed gas turbines including, selected number, model, abatement and commissioning plan in writing to the Environment Agency for approval prior to installation.	✓
Improvement conditions	Based on the information on the application, we consider that we need to specify an improvement condition to ensure that: ➢ emissions of NO_x from the existing turbines in open cycle mode operating with retrofitted abatement are established and compared with those values used with the air quality impact assessment submitted with the application.	
Incorporating the application	We have specified that the applicant must operate the permit in accordance with descriptions in the application, including all additional information received as part of the determination process. These descriptions are specified in the Operating Techniques table in the permit.	✓
Reporting	We have specified reporting in the permit. Operating hours in open cycle mode are required to be reported for the new turbine(s), in order to demonstrate compliance with permit conditions that limit the operating hours.	✓
Operator Competence		
Environment management system	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.	✓

Annex 2: Consultation and web publicising responses

Summary of responses to consultation and web publication and the way in which we have taken these into account in the determination process. (Newspaper advertising is only carried out for certain application types, in line with our guidance.)

Response received on 06/08/14 from
The Director of Public Health, North Lincolnshire Council
Brief summary of issues raised
No objections to the application being granted with the proviso that the permit holder takes all appropriate measures to prevent and control pollution using the processes described in the application. For the protection of human health and of particular importance are the measures described which need to be implemented to reduced: • nitrogen dioxide emissions • prevention of noise
Summary of actions taken or show how this has been covered
Predicted emissions of nitrogen dioxide to air and their minimisation and emissions of noise have been considered during the determination of this permit variation – see key issues section above. The operating hours of the turbines in open cycle mode will be limited through the permit which will limit the emissions of nitrogen dioxide which will be released from the installation. The new gas turbines will be fitted with nitrogen dioxide abatement in the form of low NO_x burners as a minimum and the existing gas turbines will be fitted with either low NOx burners and/or water injection. The selection of the final abatement techniques will be based on recommendations from the turbine manufacturer. The standard condition 3.4 relating to noise and vibration is included in the consolidated permit. The site will be regulated against compliance with this condition. No further action required at this stage.

Response received from
Environmental Protection Team, North Lincolnshire Council
Brief summary of issues raised
No response received
Summary of actions taken or show how this has been covered
No further action required

Response received from
Planning Department, North Lincolnshire Council
Brief summary of issues raised
No response received
Summary of actions taken or show how this has been covered
No further action required

Response received on 15/07/14 from
Public Health England
Brief summary of issues raised
Based on the information contained in the application, Public Health England has no significant concerns regarding the risk to the health of the local population from the installation. The consultation response is based on the assumption that the permit holder shall take all appropriate measures to prevent or control pollution, in accordance with the relevant sector guidance and industry best practice.
Summary of actions taken or show how this has been covered
No further action required.

Response received from
Food Standards Agency
Brief summary of issues raised
No response received.
Summary of actions taken or show how this has been covered
No further action required.

Response received on 05/08/14 from
National Grid Plant Protection, National Grid
Brief summary of issues raised
Acknowledgement of receipt of documents and letter stating that National Grid has no objection to the proposal.
Summary of actions taken or show how this has been covered
No further action required.

Response received on 08/07/14 from
Health and Safety Executive
Brief summary of issues raised
Acknowledgement of receipt of consultation. No comments made.
Summary of actions taken or show how this has been covered
No further action required.