Environment Agency permitting decisions

Permit

We have decided to grant the permit for Queens Road Power Plant operated by UK Power Reserve Limited.

The permit number is EPR/VP3032EZ/A001.

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
- Annex 1 the decision checklist
- Annex 2 the consultation and web publicising responses

Key issues of the decision

BAT assessment – combustion technology

The Applicant carried out a review of the following candidate combustion technologies:

i. Closed-cycle gas turbines (CCGT)
ii. Open-cycle gas turbines (OCGT)
iii. Compression ignition (CI) engines
iv. Spark ignition (SI) engines

Option 1 – Closed-cycle gas turbines (CCGT)

For STOR operation, CCGTs are not considered to be a feasible option, owing to the intermittent nature of operational periods and the lack of flexibility in terms of rapid start-up and shutdown. Even from a "hot" condition (e.g., after an overnight shutdown), a start-up time of an hour from stationary to full-load (i.e., full CCGT operation) would be a good performance for a CCGT. After more extended shutdowns, start-up from cold to full load can take up to 8 hours (possibly longer, depending on the type and design of the gas turbine, the heat recovery steam generator, the steam turbine and the required degree of temperature matching between the turbines).

Option 2 – Open-cycle gas turbines (CCGT)

The Applicant considers that gas turbines in OCGT mode can be BAT in some circumstances. OCGTs are not regarded as BAT for base-load power generation but may be accepted for emergency power generation where the over-riding priority is for short term generation of electricity rather than overall generation efficiency. Whilst the start-up time for lightweight aero-derivative OCGTs is much shorter than CCGTs (around fifteen minutes from stationary to full load, assuming a cold start), it is still approximately twice the start-up time for SI engines and therefore will not offer the same flexibility in terms of response time to a STOR call. Heavy duty (industrial) gas turbines are unable to match the short start-up times required for STOR operations, even in OCGT mode, owing to the need to bring the usually much larger turbine unit up to approximately operational speed using a diesel or electric motor starter unit prior to initiation of fuel combustion.

OCGTs generally require higher capital investment and have higher operating and maintenance costs than SI engines. In particular, these costs will be substantially higher where smaller, multiple gas turbines are specified for flexibility of operation. Gas turbines for power generation tend to be specified as larger capacity units in order to optimise efficiency by minimising mechanical transmission losses between the turbine and the generator and from the generator itself, which will be lower for a larger, single unit than for multiple, smaller units (typical OCGT electrical efficiency is in the range 35% - 42% at full load). However, a single large gas turbine generator set restricts operational flexibility in terms of delivering the contracted STOR commitment, since if the turbine is undergoing maintenance, no power generation is possible, whereas with smaller, multiple units, generation may continue on demand.

The Applicant reports that, whilst OCGTs may be BAT for certain circumstances, they have disadvantages in terms of operational flexibility and rapid start-up.

Option 3 – Compression ignition engines (CI)

Compression ignition (CI) engines are often used in small and medium scale CHP applications < 20 MW_e as well as for emergency and short term power generation duties such as STOR operations. Compression engines often operate on diesel fuel or heavy fuel oil but can be set up to run in a dual-fuel configuration, burning primarily natural gas with a small amount (usually around 5%) of diesel pilot fuel.

The Applicant reports that in either case, the requirement to provide storage facilities for hydrocarbon fuel is a disadvantage. The lack of available footprint for a fuel storage tank farm at the Installation drives the fuel choice towards imported natural gas as BAT. The requirement for a diesel pilot fuel and associated storage facilities therefore rules out CI engines as a prospective BAT candidate for the Installation.

Option 4 – Spark ignition engines (SI)

Modern spark ignition engines are available which have been specifically designed for the combustion of natural gas and offer a primary technique for the control of emissions which is widely accepted as BAT. The configuration of engine internals, such as cylinders, pistons and cylinder heads, is known to contribute to optimised NO_x performance and coupled with a multi-function ECU (engine control unit) with a fully sensored engine set-up, emissions performance associated with BAT is likely to be delivered without the need for secondary techniques. The Applicant reports that the selected SI gas engine (Jenbacher JMS616, or equivalent) will deliver < 500 mg/m^3 NO_x at 5% O_2.

SI engines firing natural gas for industrial power generation (or CHP) applications tend to be in the range 1 – 5 MW_e with shaft efficiencies of around 40% (the nominal engine selection of a Jenbacher JMS616 has an electrical efficiency of 43.4%). At these sizes, SI gas engines have higher shaft efficiencies and lower capital costs (in terms of £/KWe) than comparable gas turbines operating as OCGTs.

The Applicant states that, in conjunction with the far greater operational flexibility allowed by multiple SI engines and the faster start-up times permitted (7 minutes is proposed for the Queens Road operation under STOR), SI engines firing on natural gas offer a more optimum solution than OCGTs. The STOR facility will be contracted to deliver at least 90% of stated capacity in response to all STOR calls. The configuration of the site with twelve engines allows secure delivery of this contractual requirement (with one engine or two engines offline for maintenance), assuming a minimal parasitic load for the site of around 1.5%.

The Applicant concludes that SI engines, firing on natural gas, with a multiple engine configuration is BAT for the Queens Road STOR Installation.

Choice of fuel

The Applicant considers that other combustion technologies may operate using a range of fossil fuels. However, owing to the primary need for flexibility, requiring immediate and relatively simple fuel availability for rapid start-up, the optimum fuel choice is natural gas, delivered directly from the national grid.

The choice of fuel is also based on lack of available space for storing large volumes of hydrocarbon fossil fuel with the associated potential for significant environmental impact in the event of spillage or loss. Natural gas has therefore been selected as BAT in terms of fuel choice for this Installation. We agree that in this case, natural gas is BAT for this Installation.

Operating techniques – number of operating hours

The new bespoke application is to allow UK Power Reserve Limited to operate twelve spark ignition engines (Jenbacher JMS 616 engines or equivalent) in order to enable fast start up to supply electricity to meet the National Grid emergency requirements. The purpose of operating the gas engines is to prevent instability on the electricity grid by rapidly providing additional short term supply to meet peak demand or where there is a shortfall of available supply from other sources. The proposed installation of 12 engines will ensure that the contractual STOR requirement for delivery of at least 90% of stated power export can be assured even with one engine offline and undergoing maintenance.

Chapter III of the Industrial Emissions Directive (IED) allows up to 500 hours of unabated operation under emergency conditions in a calendar year. In these emergency situations, emission limits specified in Annex V of the IED do not apply. Whilst the individual units are too small to come under Chapter III, we have applied the same principle and have therefore limited the operation of the gas engines to 500 hours in any calendar year via permit condition 2.1.1 and table S1.1. This ensures consistency across the industry whilst a BAT review is undertaken.

The Applicant reports that the facility is expected to operate for approximately 200 – 300 hours per annum under the STOR operating regime but may operate for up to 1500 hours per annum. Operational flexibility is essential for the installation owing to the short notice calls for generation during peak hours from the National Grid under the Short Term Operating Reserve (STOR). We have therefore set an improvement condition (IC1) which requires the submission of a BAT assessment with regards to emissions to air, energy efficiency and cost-benefit analysis in comparison with other technologies. As part of this BAT assessment, the improvement condition requires the operator to consider the effect of operating the gas engines up to 1500 hours which is the threshold for the peaking market. Information from the improvement condition will enable the Environment Agency to establish BAT for operation of spark ignition engines for emergency use under the balancing market.

The Applicant reports that the proposed engines to be employed at the facility are Jenbacher JMS 616 natural gas spark ignition engines or equivalent.

Information relating to energy efficiency was submitted as part of the Application. We have therefore set an improvement condition (IC2) which requires the submission of a report detailing the outcome of the commissioning programme including any changes to the operating techniques provided in the Application.

Emissions of noise

The primary source of noise at this installation will be the gas engines. The Applicant carried out a survey of background noise levels in April 2013 and the nearest receptors assessed for potential noise impacts. The assessment was carried out in accordance with the guidance contained in British Standard 4142:1997 *Method for rating industrial noise affecting mixed residential and industrial areas* to determine whether the proposed installation would give rise to complaints from the occupants of nearby residential properties.

The results showed that the predicted noise rating level would lead to a situation where complaints would be likely during both the daytime and evening period. Based on the above, mitigation measures were proposed in order to reduce the potential for complaints.

Mitigation measures

The results of the noise assessment showed that the main contributors to the noise impacts at the residential receptor on Queens Road were the emissions from the exhaust stacks and engine containers. The Applicant proposed the following mitigation measures:

- In order to reduce the noise levels emitted by the exhaust stack consideration has been given to upgrading the silencer system from an unnamed 24dB(A) rated silencer system to a reactive system rated at 45dB(A), such as an Industrial and Marine BTS3.

- In order to reduce the noise levels emitted by the containers consideration has been given to acoustically treating the containers housing the gas engines. The following treatments are suggested:
    i. Lining the interior walls and doors of the container with 50mm think mineral wool retained by 0.7mm perforated steel sheet; and;
    ii. Treating any apertures with acoustic louvers or attenuators which would achieve a minimum noise reduction of 25dB(A).
- The Applicant reports that all gas engines will be subject to planned preventative maintenance, which will minimise the risk of failure-related noise increases.

The Applicant carried out a revised assessment (with proposed mitigation measures implemented). The results showed that the mitigated noise rating level, would lead to a situation between marginal significance and a positive indication that complaints are unlikely during both the daytime and the evening period.

The Applicant also considered that the suggested mitigation measures would remove much of the tonal characteristics of the noise sources and that the 5 dB penalty could, in fact, be discounted as a consequence. With the removal of the 5 dB penalty, noise rating level would lead to a situation between marginal significance and a positive indication that complaints are unlikely during both the daytime and the evening period, with predicted rating levels below the prevailing background noise level at all times.

The Applicant proposes a further precautionary noise survey which will be undertaken following commissioning of the plant to confirm the absence of impact. We have therefore set an improvement condition (IC3) which requires the submission of a report detailing the outcome of the noise survey (post plant commissioning) and proposals for carrying out mitigation measures from the results of the survey (if required).

Secondary containment

Based upon the information submitted in the application, we are not fully satisfied that appropriate measures are in place to ensure that accidents that may cause pollution through spillage are minimised. The Applicant confirms that oil storage tanks will be double–skinned with low level alarms connected to site control and monitoring systems. We have set pre-operational conditions (POC 1 and POC 2) which requires the submission of a report confirming the construction and integrity of the oil storage tanks, pipework and secondary containment are fit for purpose and in accordance with industry standards prior to the start of operations. This will ensure that the proposed site infrastructure are properly designed to minimise risks to the environment and reduce the risks of accidents and their consequences.

Assessment of impact on air quality

The Applicant's assessment of the impact of air quality is set out in the Application. The assessment comprises:

- Dispersion modelling of emissions to air from the operation of the spark ignition engines
- A study of the impact of emissions on nearby habitat/conservation sites

Meteorological data for the assessment comprises five years continuous monitoring from Donna Nook meteorological station (2005-2009) located 27 km south east of the proposed site. The Applicant considered this station as the most suitable source of meteorological data due to its proximity to the facility. The impact of the terrain surrounding the site and buildings upon plume dispersion was considered in the dispersion modelling. As well as calculating the peak ground level concentration, the Applicant has modelled the concentration of key pollutants at a number of specified locations within the surrounding area. The modelling has considered the plant operating continuously for a total of 1500 hours per calendar year.

Human receptors

The Applicant's modelling predictions are presented in Table 1 below. The figures shown indicate the predicted peak ground level exposure to pollutants

in ambient air. We have made our own verification of the percentage process contribution/deposition and predicted environmental concentration submitted by the Applicant. These may be very slightly different to those shown in the Application. Any such minor discrepancies do not materially impact on our conclusions. The assessment in this section focuses on the impact of nitrogen dioxide on human health only as emissions of other pollutants were screened out (insignificant).

Table 1 Maximum modelled nitrogen dioxide concentrations at the most sensitive human receptors (Queens Road)

Pollutant	EQS / EAL	Back-ground	Process Contribution (PC)		Predicted Environmental Concentration (PEC)	
	µg/m^3	µg/m^3	µg/m^3	% of EAL	µg/m^3	% of EAL
NO_2 (annual)	40	27.6	0.5	1.3	28.1	70.3
NO_2 (1 hour)	200	55.2	77.9	39.0	133.1	66.6

From the table above, nitrogen dioxide cannot be screened out as insignificant in that the process contribution is >1% of the long term EQS/EAL and >10% of the short term EAQ/EAL. Although nitrogen dioxide did not screen out as insignificant, we consider that it is unlikely to give rise to significant pollution in that the predicted environmental concentration (PEC) is less than 100% (taking expected modelling uncertainties into account) of both the long term and short term EQS/EAL.

We checked the modelling data and our results are consistent with the Applicant's assessment. The conclusion is that there will be no significant impact to human health caused by the operation of the this installation.

Ecological receptors

1. Toxic contamination – nitrogen dioxide

The modelling information provided by the Applicant has predicted that the process contribution slightly exceeded 1% of the relevant long-term critical level but did not exceed 10% of the relevant short-term critical level for nitrogen dioxide at the *Humber Estuary* (see Table 2 below).

Table 2 – Maximum modelled NO_2 concentrations of at the *Humber Estuary* site

Pollutant	Critical Level (CLe)	Back-ground	Process Contribution (PC)		Predicted Environmental Concentration (PEC)[1]	
	µg/m^3	µg/m^3	µg/m^3	% of CLe	µg/m^3	% of CLe
Humber Estuary SAC/SPA/Ramsar/SSSI						
NO_2 (annual)	30	29.87	0.35	1.2	30.22	100.73
NO_2 (daily)	75	--	5	6.0	--	--
Note [1]: Where the PC is less than 1% of the benchmark for a long term measurement or less than 10% for a short term measurement, the impact is considered to be insignificant. In these cases, examination of the PEC is not required.						

The process contribution exceeded 1% of the long term critical level at the *Humber Estuary SAC/SPA/Ramsar* – an increase of 0.2%. However background concentrations are significantly above the relevant critical level at the habitat site. The facility will contribute a small increase in nitrogen dioxide emissions but we do not consider that there would be a significant impact on interest features of the habitat site. This approach is in line with Environment Agency Technical Guidance (*Operational Instruction 67_12*).

2. Nutrient nitrogen enrichment

The background concentrations for nutrient nitrogen at the *Humber Estuary* were obtained from the APIS website. Table 3 below shows the predicted nutrient nitrogen deposition rates at the *Humber Estuary*. The lower range of the critical load (20 kgN/ha/yr) has been used to assess deposition at the *Humber Estuary SAC* for coastal lagoons and mud flats. The lower range of the critical load (10 kgN/ha/yr) has been used to assess deposition at the *Humber Estuary SPA/Ramsar* for the most sensitive species.

The Applicant has provided information indicating that nitrogen nutrient deposition will not exceed 1% of the critical load at the *Humber Estuary*. The Environment Agency conducted check modelling of the air quality assessment and the results were consistent with those of the Applicant. The Environment Agency can conclude no likely effect from nutrient nitrogen deposition at the *Humber Estuary SAC/SPA/Ramsar* as process contribution is less than 1% of the critical load.

Table 3 – Maximum modelled nutrient nitrogen deposition at the *Humber Estuary* site

Habitat Site	Critical Load (CLo) kgN/ha/yr	Background N deposition kgN/ha/yr	PC N deposition kgN/ha/yr	PC as % of minimum threshold level	Significance
Humber Estuary SAC	20-30 kgN/ha/yr Atlantic salt meadows; Salicornia and other annuals colonising mud and sand	31.08	0.05	0.25	Insignificant: PC<1% of CLo
	20-30 kgN/ha/yr Coastal lagoons	57.68	0.05	0.25	Insignificant: PC<1% of CLo
Humber Estuary SPA/Ramsar	10-20 kgN/ha/yr Little tern – Eastern Atlantic – Breeding	30.38	0.05	0.5	Insignificant: PC<1% of CLo
	15-30 kgN/ha/yr European marsh harrier – Breeding	30.38	0.05	0.5	Insignificant: PC<1% of CLo

3. Acid deposition

The acid deposition rates were obtained from APIS website to obtain species-based critical loads for the *Humber Estuary* site. The results are presented in Table 4.

Table 4 – Maximum modelled acid deposition rates at the *Humber Estuary* site

Habitat Site	Critical Load (CLo) keq/ha/yr	Background deposition keq/ha/yr	PC deposition keq/ha/yr	PC as % of threshold level	Significance
Humber Estuary SAC	Atlantic salt meadows; Salicornia and other annuals colonising mud and sand *No critical load – site is not sensitive to acidification*	N: 2.22 S: 0.26 T: 2.48	0.004	--	--
	Coastal lagoons *No critical load – site is not sensitive to acidification*	N: 4.12 S: 0.31 T: 4.43	0.004	--	--
Humber Estuary SPA/Ramsar	Little tern – Eastern Atlantic; European marsh harrier – Breeding	N: 2.17 S: 0.26 T: 2.43	0.004	--	--

	No critical load – site is not sensitive to acidification				
	Waterfowl assemblage – Wintering *No critical load – site is not sensitive to acidification*	N: 3.96 S: 0.31 T: 4.27	0.004	--	--

There are currently no critical loads for acid deposition at the *Humber Estuary* as the site is not sensitive to acid deposition. The Environment Agency conducted check modelling of the air quality assessment and the results were consistent with those of the Applicant. The Environment Agency can conclude no likely adverse effect from acid deposition at the *Humber Estuary* site.

Assessment of non-statutory sites

The Applicant's assessment of non-statutory sites (*Immingham Docks Reed Bed, Laporte Road Brownfield Site, North Moss Lane Meadow*) was reviewed by the Environment Agency and we agree with the conclusions, that the proposal will not damage the special features of the non-statutory sites. As there are no specific regulations for the protection of these sites *(beyond our requirements to enhance biodiversity under the Natural Environment and Rural Communities Act 2006 and our wider conservation duties under the Environment Act*), we are required to ensure that the permitting of the Installation will not result in significant pollution.

In accordance with Environment Agency guidance, we consider that given the size of the process contribution which is a small fraction of the critical level/load, the impact on the sites is not likely to cause significant pollution. As modelling and assessment has demonstrated that the predicted ground level environmental concentrations of pollutants in the area even at a maximum will not compromise any Air Quality Objectives then we are satisfied that the operation of the facility will not compromise the integrity of the above sites.

The Environment Agency is therefore satisfied that the operation of the facility is unlikely to have a significant effect on any of the sites identified in this assessment either alone or in-combination with other plans and projects.

Monitoring and emission limits

No stack emissions monitoring is proposed for the spark ignition engines. The Applicant has proposed to undertake manual and automatic tuning as a means for maintaining peak engine performance to control exhaust emissions at the required levels, whilst also providing consistently good combustion and energy efficiency. In addition, the Applicant has proposed planned and reactive maintenance activities to maintain optimal performance of the gas engines and ensure that unexpected maintenance issues are quickly

resolved. We have therefore not set any emission limits for the spark ignition engines. We have specified process monitoring and reporting requirements for the operation of the engines as proposed in the Application.

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.	✓
Site condition report	The operator has provided a description of the condition of the site. We consider this description is satisfactory. The decision was taken in accordance with our guidance on site condition reports and baseline reporting under IED – guidance and templates (H5).	✓
Biodiversity, Heritage, Landscape and Nature	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	✓

Aspect considered	Justification / Detail	Criteria met Yes
Conservation	carried out as part of the permitting process. We consider that the application will not affect the features of the sites.	
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. The assessment shows that, applying the conservative criteria in our guidance on Environmental Risk Assessment [or similar methodology supplied by the operator and reviewed by ourselves], all emissions may be categorised as environmentally insignificant (see Key Issues).	✓
Operating techniques	We have reviewed the techniques used by the operator and compared these with the relevant guidance notes (see Key Issues).	✓
The permit conditions		
Pre-operational conditions	Based on the information in the application, we consider that we need to impose pre-operational conditions (see Key Issues).	✓
Improvement conditions	Based on the information on the application, we consider that we need to impose improvement conditions (see Key Issues).	✓
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.	✓
Emission limits	We have not set emission limits in the permit (see Key Issues).	✓
Monitoring	We have not specified monitoring of stack emissions at this facility. However, we have decided that process monitoring should be carried out as described in the Application (see Key Issues).	✓
Reporting	We have specified reporting in the permit (see Key Issues).	✓

Aspect considered	Justification / Detail	Criteria met Yes
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.	✓
Relevant convictions	The National Enforcement Database has been checked to ensure that all relevant convictions have been declared. No relevant convictions were found. The operator satisfies the criteria in RGN 5 on Operator Competence.	✓
Financial provision	There is no known reason to consider that the operator will not be financially able to comply with the permit conditions. The decision was taken in accordance with RGN 5 on Operator Competence. The financial provision arrangements satisfy the financial provisions criteria.	✓

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.

Response received from Health and Safety Executive on 22/04/14	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No concerns raised	No further action taken

Response received from Anglian Water on 24/04/14	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No concerns raised.	No further action.

Response received from Public Health England on 15/05/14	
Brief summary of issues raised:	Summary of action taken / how this has been covered
Public Health England has no significant concerns regarding the risk to the health of the local population from this facility.	No further action.

Response received from Natural England on 15/05/14	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No issues raised. In respect of the Appendix 11 submission, Natural England agreed with the Environment Agency conclusions that there was no likely impact on the *Humber Estuary SAC, SPA, Ramsar.*	No further action.
No issues raised. In respect of the Appendix 4 (CROW Act form) submission, Natural England agreed with the Environment Agency conclusions that there was no likely impact on the *Humber Estuary SSSI.*	No further action.

Response received from the Director of Public Health, North East Lincolnshire Council on 21/05/14	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No concerns raised.	No further action.

Response received from North East Lincolnshire Council (Planning Authority)	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No comments made or received	No further action taken

Response received from North East Lincolnshire Council (Environmental Protection)	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No comments made or received	No further action taken

Response received from members of the public	
Brief summary of issues raised:	Summary of action taken / how this has been covered
No comments made or received	No further action taken