

Environment Agency permitting decisions

Bespoke permit

We have decided to grant the permit for Viridis 178 Gloucester Power Plant operated by Viridis 178 Limited.

The permit number is EPR/GP3834DW

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.

Key issues of the decision

Description of the main features of the application

The proposed facility will serve the Balancing Market on the electricity grid by rapidly providing additional short term supply to meet peak demand or shortfalls in available supply from other sources. It consists of 27 type JGC 420 GS-N.L–CMUK-D spark ignition gas-fired engines. The Permit allows for the operation of a maximum of 23 engines to be operational at any one time. The aggregated thermal input of the 27 engines is 81MW. Natural gas will be utilised as the fuel.

Operating Hours

The facility will operate between 1,000 and a maximum of 1,500 hours of operation each year. Current guidance on developing best available techniques (BAT) to serve the balancing market identifies two categories; less than 500hrs and up to 1,500hrs. There is currently no guidance for the operation of this type of plant beyond 1,500hrs. Furthermore, operational periods will be between the hours of 7:00am and 9:00pm. The Applicant has not provided sufficient information on anticipated running times to determine whether reciprocating engines represent BAT for periods greater than 1,500 hours each year. The balancing market is made up of 3 services: Rapid response (2 minutes response); Short Term Operating Reserve (STOR) (30mins response); Peaking (90mins response). Without evidence of operating profiles it is unclear whether spark-ignition engines represent BAT for STOR and Peaking.

Air modelling and the noise assessment submitted has been based on 1,750 hours of operation only. The noise assessment does not identify a significant adverse impact during day or night time operation. Our assessment of air emissions identified a potential exceedance of the daily NO_x (Oxides of Nitrogen) critical level at both Sud Meadow and Alney Island Local Wildlife Sites. This resulted in the decision to limit the number of engines with unabated emissions to 23 of the 27 installed units. By doing this the revised modelling demonstrated a conservative estimate of the concentrations of NO_x at both these sites to be below the Critical Level. Should the Operator choose to operate more than the permitted 23 engines simultaneously then they will need to investigate the employment of secondary emissions abatement and improving air dispersion of emissions from the engines in support of an Application for Variation of the Permit.

Chapter III of the IED

Chapter III of the Industrial Emissions Directive (IED) applies to new and existing large combustion plants (LCPs) which have a total rated thermal input which is greater or equal to 50MW. Articles 28 and 29 explain exclusions to Chapter III and aggregation rules respectively.

The aggregation rule is as follows:

- A LCP has a total rated thermal input $\geq 50\text{MWth}$.
- Where waste gases from two or more separate combustion plant discharge through a common windshield, the combination formed by the plants are considered as a single large combustion plant.
- The size of the LCP is calculated by adding the capacities of the plant discharging through the common windshield disregarding any units $< 15\text{MWth}$.

As the combustion plant on the installation is composed of 27 x 3 MWth engines it does not form part of an LCP and so do not come under chapter III requirements. Nevertheless, they will still aggregate to be part of the Section 1.1 A(1)(a) activity listed in Schedule 1 of the Environmental Permitting regulations because they have a combined rated thermal input of 50MW or over. The installation is therefore a Chapter II installation and subject to the Medium Combustion Plant Directive

BAT assessment

Combustion technology

The Applicant carried out a review of the following candidate combustion technologies and made an assessment of the technology in order to determine which technology can be considered the best available technique (BAT).

- Combined Cycle Gas Turbines (CCGT)
- Open Cycle Gas Turbines (OCGT)
- Gas Engines (GE)
- Diesel Engines (DE)

Based on the results of this assessment, the Applicant has chosen Jenbacher Spark Ignition Gas Engines for the following reasons:

- Generation output is achieved within two minutes of start-up;
- Electrical generation efficiency is greater than alternative options;
- There is no requirement for on-site fuel storage;
- The achievement of Medium Combustion Plant Directive (MCPD) limits without the need for secondary abatement or Exhaust Gas Recirculation (EGR);
- Electronic engine management system for continuous control;
- The engines meet the operational criteria for the balancing market.

Choice of Fuel

The Applicant has chosen mains gas as this represents the most reliable and least polluting fuel available for use at the site. By using mains gas, there will be negligible emissions of sulphur and particulates and by operating in a lean-

burn mode, the quantities of Nitrogen oxides emitted comply with the Medium Combustion Plant Directive for new gas fuelled engines.

The choice of mains gas only (not dual fuel) also minimises the need to store significant quantities of raw materials on-site. We are satisfied that mains supply natural gas represents BAT in terms of fuel choice for this installation.

Water use

Water shall only be used to replenish the cooling systems of the 27 spark ignition engines. The predicted monthly average water usage is approximately 10m³. The Applicant is required to report water usage annually.

Primary emissions Controls

The Applicant has demonstrated sufficient primary emission controls are in place through the use of a computerised management system. This controls the emissions of Nitrogen Oxides by continuously adjusting the operating requirements of the engines to achieve the emission limits through Enhanced Lean Burn.

Abatement Systems

The Applicant considered a range of abatement systems. These included:

- Exhaust Gas Recirculation (Primary measure)
- Water Injection (Primary measure)
- Selective Catalytic Reduction (SCR) (Secondary measure)
- Non Selective Catalytic Reduction (NSCR) (Secondary measure)
- Lean NOx Trap (LNT) Catalysis (Secondary measure)

The conclusions regarding suitability are summarised as:

- Exhaust Gas Recirculation (Primary measure) is not suitable for lean burn gas engines as it reduces full load efficiency;
- Water injection for reciprocating engines is limited to Compression Ignition only;
- Selective Catalytic Reduction capital and operating costs are disproportionate to the environmental benefit;
- Non Selective Catalytic Reduction is only effective under stoichiometric or fuel rich operating conditions. It is therefore unsuitable for lean-burn applications;
- Lean NOx Trap (LNT) Catalysis is a recently new technique for natural gas engines, which is still emerging. There are currently very few, if any, suppliers that offer this technology in the UK market.

Assessment against BAT standards for the energy balancing market

The Applicant has compared the chosen technology against the Department of Energy and Climate Change draft report Developing Best Available Techniques for Combustion Plants operating in the balancing market, dated June 2016. We are satisfied the spark ignition engines exceed the minimum efficiency for

electrical generation and the NO_x emissions will achieve less than 95 mg/m³ and comply with the Medium Combustion Plant Directive.

Engine and stack arrangement

The Installation comprises 27 spark ignition engines, each housed in an individual container and each having a separate flue. The site layout and configuration of engines, transformers and emission points are also shown in the layout plan below. The Applicant submitted Air Dispersion Modelling, the Applicant predicted exceedences to the daily critical level at Sud Meadow LWS2 and Alney Island LWS and exceedences to the hourly ES at Alney Island LWS/LNR. In addition, our sensitivity indicates exceedences of the annual mean critical level and hourly ES at Sud Meadow LWS. The hourly ES is only relevant where members of the public are reasonably expected to spend 1 hour or more, eg a picnic area, playground or fishing at a specific location.

We made a number of observations and undertook our own check modelling as part of this audit. Our sensitivity checks, which affect the Applicants predictions and conclusions, are:-

- Our sensitivity checks indicate that in addition to those predicted by the Applicant, there will also be an exceedance of the annual mean critical level and exceedences of the hourly ES at Sud Meadow LWS. Our sensitivity has indicated that these exceedences are confined to the southern-most section of this site.
- Within the Applicant's report, they have assumed that conditions contributing to the exceedences of the hourly ES at Alney Island LWS/LNR are expected to coincide very infrequently, thus indicating a low risk of an exceedance. We have undertaken statistical analysis and if this location is a relevant human receptor, we disagree with their assumption.
- The Applicant has incorrectly screened out the exceedences of the daily NO_x critical level by indicating that due to the proximity of the habitat sites to the motorway and Gloucester conurbation, the critical level does not apply.
- The height of the stacks within their modelling files are of 7.2m. A taller stack will aid dispersion and reduce concentrations, notably where there are predicted to be exceedences nearby. Alternatively secondary abatement could be employed to reduce the concentration of NO_x emissions from the engines.

A schedule 5 Notice requesting further information, was issued on 24/01/2017 which required the Applicant to consider the above determinations. The Applicant responded saying that they needed to investigate further the most suitable methods of minimising the impacts of NO_x emissions to air for all the 27 engines and whether fitting NO_x abatement such as Selective catalytic Reduction (SCR) or increasing the individual stack heights to air dispersion or combining individual flues into a number of common exhaust stacks, or a combination of any or all of the above. To this end, and to minimise the delay in planned commissioning work at the site, the Applicant proposed locking out 4 of the 27 engines and remodelled the emissions from just 23 engines operating simultaneously. These revised models predicted no exceedences of

Environmental Standards at the sites described above. We again produced our own check modelling and agreed with the Applicants conclusions.



Highlighted engines A12, A23, A26 and A27 to be “locked out” so that only the other 23 engines may operate.

Emissions and operating techniques assessment

Emissions of noise

The primary source of noise at this installation is the gas engines.

The Applicant has reviewed the onsite noise generating sources and the potential for impact in line with our H3 Noise guidance Part 2 – Noise Assessment and Control and BS4142 2014.

The Applicant has concluded on the basis of a numerical noise impact prediction that there is no indication of a significant adverse night-time impact on the nearest sensitive receptor on Gibbons Street.

We have assessed the Applicant's proposals and predict a lower numerical noise impact.

Noise Mitigation

To ensure there is no significant risk of noise at the site, the Applicant outlined a number of measures to manage noise emissions and submitted a Noise Management Plan:

- the engines will be housed in containerised units which are acoustically treated to reduce external noise emissions to an acceptable level;
- Unit flues are fitted with silencers;
- All units will be subject to planned preventative maintenance, which will minimise the risk of noise from vibration and plant failure.

Based on the results of the noise assessment and the proposed mitigation measures, we are satisfied that the Applicant has implemented BAT to manage the risk of noise emissions from the facility. It should be noted that restricted operating hours to between 07:00 – 21:00 only apply. We have inserted an improvement condition (IC2) into the permit to ensure the Applicant undertakes monitoring of noise post-commissioning to validate the conclusions of the noise assessment submitted with the application.

Secondary containment

Oils are the only List I or List II substances stored on site. The Applicant may install a tank for the storage of 5,000 litres of lubricating oil. Otherwise, there shall be no bulk storage of chemicals on site. If installed, all tanks will be double skinned and located in bunded areas with 110% of the tanks capacity. Engine containers are bunded to prevent fugitive emissions during operation and maintenance. Oil and chemicals will be brought on to the site in volumes of less than 220 litres.

Flood protection

The Applicant has outlined measures to prevent significant failure of infrastructure or pollution due to flood. These include:

- Engine containers and the control room door will be bunded;
- Cooling oil and engines are contained within sealed systems; and
- The storage of chemicals on site is minimal.

We have assessed the Applicant's proposals and we are satisfied the risk of pollution of surface water and groundwater is negligible. They therefore represent the best available techniques.

Emissions to air

There is insufficient evidence regarding the effects of enhanced lean burn (ELB) on methane slip and formaldehyde production by oxidation or incomplete combustion of hydrocarbons at raised carbon monoxide levels. Improvement Conditions IC 3 and IC 4 have been included to establish these emission levels under ELB, compare them with the manufacturer's specifications and appropriate benchmark levels and undertake an assessment of the impacts of carbon monoxide emissions and possible impacts of formaldehyde in line with our H1 guidance or equivalent methodology. These improvement conditions are applied to all new installations using spark-ignition engines to serve the balancing market on the electricity Grid.

Emissions to Surface water and groundwater

There will be no generation of process water within the installation and therefore no emissions to surface water or ground water. Rain water drain-off in unbunded areas of the site will be to ground.

Emissions to Sewer

There will be no generation of process water within the installation and therefore no emissions to sewer.

Annex 1: decision checklist

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

Aspect considered	Justification / Detail	Criteria met
		Yes
Receipt of submission		
Confidential information	A claim for commercial or industrial confidentiality has not been made.	✓
Identifying confidential information	We have not identified information provided as part of the application that we consider to be confidential. The decision was taken in accordance with our guidance on commercial confidentiality.	✓
Consultation		
Scope of consultation	<p>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.</p> <p>For this application we consulted the following bodies:</p> <ul style="list-style-type: none"> • Local Authority Environmental Protection Department – Gloucester City Council • Health and Safety Executive • National Grid • Public Health England and the relevant Director of Public Health – Gloucester City Council • Food Standards Agency 	✓
Responses to consultation and web publicising	<p>The web publicising and consultation responses (Annex 2) were taken into account in the decision.</p> <p>The decision was taken in accordance with our guidance.</p>	✓
Applicant		
Control of the facility	We are satisfied that the applicant (now the Applicant) 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 Applicant.	✓
European Directives		
Applicable directives	All applicable European directives have been considered in the determination of the application.	✓

Aspect considered	Justification / Detail	Criteria met
		Yes
The site		
Extent of the site of the facility	<p>The Applicant has provided a plan which we consider is satisfactory, showing the extent of the site of the facility including discharge points.</p> <p>A plan is included in the permit and the Applicant is required to carry on the permitted activities within the site boundary.</p>	✓
Site condition report	<p>The Applicant has provided a description of the condition of the site.</p> <p>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).</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 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 of this document).</p>	✓
Environmental Risk Assessment and operating techniques		
Environmental risk	<p>We have reviewed the Applicant's assessment of the environmental risk from the facility.</p> <p>The Applicant's risk assessment is satisfactory, subject to the key issues raised above and the facility being limited to the operation of no more than 23 engines simultaneously.</p> <p>The assessment shows that, applying the conservative criteria in our guidance on Environmental Risk Assessment or similar methodology supplied by the Applicant and reviewed by ourselves, all emissions may be categorised as environmentally insignificant (again see key issues section of this document).</p>	✓
Operating techniques	<p>We have reviewed the techniques used by the Applicant and compared these with the relevant guidance notes. (See Key Issues)</p>	✓
The permit conditions		
Use of conditions	<p>Based on the information in the application, we consider that we do not need to impose conditions other than</p>	✓

Aspect considered	Justification / Detail	Criteria met
		Yes
other than those from the template	those in our permit template, which was developed in consultation with industry having regard to the relevant legislation.	
Improvement conditions	<p>Based on the information on the application, we consider that we need to impose improvement conditions.</p> <p>IC1 has been included to ensure the Applicant reports the outcome of the commissioning of the installation to the Environment Agency. This is to ensure we are aware of any change to infrastructure or operating techniques.</p> <p>IC2 has been included to ensure the Applicant undertakes an additional noise survey post commissioning and provides a report to the Environment Agency to demonstrate whether additional noise management and/or mitigation techniques need to be implemented. It shall also allow the Environment Agency to review the limit on the operation of the installation between the night time hours of 23:00 - 07:00.</p> <p>IC3 has been included to provide evidence to establish the methane emissions from the engines when operating at Enhanced Lean Burn (ELB)</p> <p>IC4 has been included to provide evidence to establish the emissions and relationship (if any) of Carbon Monoxide and formaldehyde from the engines when operating at Enhanced Lean Burn (ELB) and to undertake an assessment of the impacts of these emissions</p> <p>IC5 has been included to ensure the Operator has fully considered the Best Available Techniques to minimise the impacts of emissions to air by considering the potential of secondary abatement of Oxides of Nitrogen emissions and the potential for improvements in dispersion of emissions to air. The condition also ensures that should operation of the full 27 installed engines or any increase in operational hours be desired that an Application for Variation of the Permit is required and further assessment of emission control is required. A revised environmental risk assessment, supported by updated air dispersion modelling as appropriate, must be submitted to demonstrate how compliance with the relevant Environmental Standards relating to Air Quality for Human Health, Wildlife and Critical Levels for the protection of Sensitive Receptor Sites and Habitats.</p>	✓

Aspect considered	Justification / Detail	Criteria met
		Yes
Incorporating the application	<p>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.</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>The following substances have been identified as being emitted in significant quantities and ELVs and equivalent parameters or technical measures have been set for those substances</p> <ul style="list-style-type: none"> • Oxides of Nitrogen (NO_x and NO₂ expressed as NO₂). These limits have been imposed in line with the requirements of the Medium Combustion Plant Directive MCPD for this type of plant. • Noise during night time hours. <p>It is considered that the ELVs/ equivalent parameters or technical measures described above will ensure that significant pollution of the environment is prevented and a high level of protection for the environment secured.</p>	✓
Monitoring	<p>We have decided that monitoring should be carried out for the parameters listed in the permit, using the methods detailed and to the frequencies specified.</p> <p>These monitoring requirements have been imposed in order to meet the requirement of the Medium Combustion Plant Directive (MCPD) to monitor emissions from Medium Combustion Plant with a rated thermal input greater than 20MW on an annual basis.</p> <p>Based on the information in the application we are satisfied that the Applicant's techniques, personnel and equipment have either MCERTS certification or MCERTS accreditation as appropriate.</p>	✓
Reporting	<p>We have specified reporting in the permit.</p> <p>Reporting frequencies are based on annual requirement for monitoring and that the site operates at 1,500 hours per year. The result will allow us to compare air emissions and operating hours projected in the air quality modelling</p>	✓

Aspect considered	Justification / Detail	Criteria met
		Yes
	to ensure they reflect those achieved in practice are in line with Medium Combustion Plant Directive.	
Applicant Competence		
Environment management system	There is no known reason to consider that the Applicant 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 Applicant 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 Applicant satisfies the criteria in RGN 5 on Applicant Competence.	✓
Financial provision	There is no known reason to consider that the Applicant will not be financially able to comply with the permit conditions. The decision was taken in accordance with RGN 5 on Applicant Competence.	✓

Annex 2: Consultation and web publicising

Summary of responses to consultation and web publication and the way in which we have taken these into account in the determination process.

<i>Response received from</i>
Public Health England. Centre for Radiation, Chemical and Environmental Hazards (CRCE) on 01 st December 2016.
<i>Brief summary of issues raised</i>
Public Health England stated that it is assumed that the site will comply in all respects with the EPR and that compliance with the legislation, together with good process management, should ensure that the site will present a low risk to human health receptors (residential and commercial). Based on the application, this development does not present any obvious cause for concern.
<i>Summary of actions taken or show how this has been covered</i>
We agree that the Applicant's predictions for human health can be used for permit determination. The conclusion is that there will be no significant impact on human health caused by the operation of this installation. This prediction is based upon a highly conservative assessment of emissions of oxides of nitrogen under certain meteorological conditions not breaching Environmental Quality Standards at locations that might be frequented by humans during the life of the Installation. To ensure a higher certainty that breaches of EQS we have limited operation to just 23 engines at any time. We also agree with the Applicant's conclusion that it is not likely there will be an exceedences of any annual critical levels or critical loads.
<i>Response received from</i>
Gloucester City Council – Environmental Health Department.
<i>Brief summary of issues raised</i>
GCC – EH commented that during the Operator's Planning Application that initial concerns relating to site drainage and flood risk had been satisfied with the final submission from this perspective.
<i>Summary of actions taken or show how this has been covered</i>
The site is within a flood zone that is classified by the Environment Agency to have a "High" potential for surface flooding. We agree with GCC that the made ground, bunded structure for the engine pads, drainage and other mitigations taken by the Operator are acceptable.

The Local Authority Environmental Protection Department, Health and Safety Executive, Food Standards Agency and National Grid were also consulted. However, no responses were received from these Consultees.

This proposal was also publicised on our website between 12/11/2016 and 12/12/2016 and no representations were received.