



Environmental Permit Application

Best Available Techniques and Operating Techniques

Avonmouth Data Centre Limited

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1.0 INTRODUCTION

SLR Consulting Limited (SLR) has been instructed by Avonmouth Data Centre Limited (ADC) to prepare a bespoke environmental permit (EP) application for the proposed data centre development located at Severn Road, Pilning, Bristol, United Kingdom, BS11 0YU (the 'site').

Electricity for operation of the data centre will be provided from a number of sources:

- Connection to the local electricity transmission network;
- Via direct wire from the adjacent Viridor operated energy from waste (EfW) facility. This will be a bridging arrangement whereby the EfW facility will provide 80% of the electricity demand of the data centre until grid connections are possible to provide the full electrical demand (anticipated to be late 2027 / early 2028); and
- Potentially from on-site solid oxide fuel cells (SOFC), if further resilience is required due to delays with the grid connection.

However, given the nature of data centres and their requirement to have an available energy supply at all times, the site also incorporates a number of emergency standby generators (SBGs).

The data centre will have 32 SBGs, designated for use as emergency backup generators:

- 32 x 2.424MWe generators, each with a thermal rated input of 7.29MWth.

The total rated thermal input (under standby power operating conditions) of the 32 SBGs will be 233.28MWth.

The SBGs will provide power to the data centre in the event of an emergency situation such as a brown-out or black-out of the local electricity transmission network where there are fluctuations or loss of the electrical power. During such an event, there is the potential for a delay between fault detection and initial operation of the SBGs; on-site battery arrays will provide a temporary uninterruptible power supply to cover such delays and the potential for a loss/reduction in the power supply to on-site equipment.

The SBGs, in accordance with the manufacturer requirements, will be subject to planned maintenance and testing. There are currently no agreements in place for the elective generation of electricity for commercial export to the electricity grid.

The SBGs will be fuelled with diesel or hydrogenated vegetable oil (HVO), as such for the purpose of this EP application, the air emissions risk assessment has been based on the use of diesel fuel.

This Best Available Techniques and Operating Techniques document (BATOT) is submitted on behalf of the Client, to support the EP application for the data centre. This report is an integrated document which describes both the operating techniques that are implemented at the site with respect to operation of the diesel SBGs to ensure compliance with guidelines and demonstrates that BAT will be employed.

For the purpose of this BATOT, key technical standards in the following documents have been referenced:

- Develop a management system: environmental permits guidance, April 2023;
- Risk assessments for your environmental permit guidance, December 2025;
- Emergency backup diesel engines on installations: best available techniques (BAT), 23 August 2023;
- Best Available Techniques: environmental permits, January 2026;



- Data Centre FAQ, Draft Version 21.0 to TechUK for Discussion 15/11/22; and
- Specified generator: comply with permit conditions, December 2022.

1.1 Pre-Application Advice

Enhanced pre-application advice was sought from the EA via a call (Microsoft Teams) on 23rd March 2026. During the meeting the EA confirmed the following:

- That a bespoke EP application for *a Section 1.1 Part A(1)(a) burning any fuel in an appliance with a thermal rated input of 50 megawatts or more* is required.
- Directly associated activities are limited to the storage of raw materials (diesel or HVO) and surface water drainage.
- The application fee and the supporting documents required for the EP application.
- Confirmation of the standards and guidance relevant to the EP application for the data centre.

The EA also provided a Habitats Screening Report, the Data Centre FAQ TechUK v21 15/11/22 BAT guidance document and Data Centre Air Quality Appendix to Combustion Pre App v1.1_external circulation pre-application advice document.

A copy of the EA enhanced pre-application advice letter (reference EPR/ZP3925MP/P001) is presented in Appendix A.



2.0 REGULATED ACTIVITIES

The regulated activities at the Installation will consist of 32 SBGs with a total net thermal rated input of 233.28MWth.

2.1 Schedule 1 Activities

Combustion activities that require an EP are defined in Part 2, Schedule 1 of the Environmental Permitting (England and Wales) Regulations (as amended) 2016 (EPR):

- Section 1.1 Part A(1)(a) burning any fuel in an appliance with a rated thermal input of 50 or more megawatts.

The EPR clarify that:

“...where two or more appliances with an aggregated rated thermal input of 50 or more megawatts are operated on the same site by the same operator, those appliances must be treated as a single appliance with a rated thermal input of 50 or more megawatts.”

The SBG provision includes for a level of redundancy to the SBG system such that, even in a worst-case blackout scenario, only the required number of SBGs would start up to deliver the required electrical IT load for the data centre; the number of operational SBGs at the time of a blackout would be dependent on the extent of the blackout. However, it is noted that, without specific physical controls preventing operation of an SBG, the thermal input of all SBGs is required for determining the capacity of the site.

2.2 Stationary Technical Unit (STU)

The definition of a STU is not included in the EPR. However, the EA ‘RGN 2 Understanding the meaning of regulated facility’ (May 2019) states:

“The essence of a “technical unit” is that it can carry out the Activity, or Activities, on its own. This means that the technical unit must include enough plant and machinery to allow the Activity to take place in a controlled manner for a sufficient period of time for the operation to reach its designed or intended output.”

Each SBG could be considered as an STU (for the purposes of combusting fuel) however, in accordance with A2.5 of RGN 2:

“If there are two or more STUs on the same site they will be treated as a single STU if they are technically connected and one of the following criteria is met:

- a) they carry out successive steps in an integrated industrial activity;
- b) one of the listed activities is a Directly Associated Activity (DAA) of the other; or
- c) both units are served by the same DAA.

In the event of a worst-case blackout scenario of the local transmission system, potentially all the SBGs at the data centre will be operated to deliver the required IT load. In the event of operational redundancy in case of engine failures or SBGs under maintenance, the remaining SBGs will be operated to the required load, but this can only be identified at that time. Therefore, the operation (under emergency) of individual SBGs is linked to the ‘availability’ of other SBGs, and all SBGs in the data centre are thus considered to be technically connected.

Discussion of the DAAs at the site are provided in Section 2.3.



2.3 Directly Associated Activities

Schedule 1, Part 1 Regulation 2(1) of the EP Regulations provides that a DAA is an operation that, in relation to any other activity:

- has a technical connection with the activity;
- is carried out on the same site as the activity; and
- could have an effect on pollution.

As stated in A2.19 of RGN 2, a DAA must “serve” a STU. Therefore, a DAA will normally be something that would not be in place if the STU was not present on-site. A2.22 continues that there are four types of technical connection with a STU including “...*input activities concerned with the storage and treatment of inputs into the stationary technical unit.*”

A2.11 of RGN-2 states:

“Storage facilities may be technically connected. [...] Stores at the same location are normally technically connected, and as their operation can give rise to pollution, either locally or at the Activity, they are likely to be DAAs.”

In addition to the above, it must also be clear how a DAA may affect emissions from the data centre. Incorrect storage of a raw material/fuel, or the discharge of contaminated surface water could cause off-site releases of these substances.

Therefore, storage of fuel and surface water drainage from the permitted Installation area are considered to be DAAs of the ‘combustion’ STU for the data centre.

3.0 DATA CENTRE LOCATION

The Installation is located on Severn Road, Pilning, Bristol, United Kingdom, BS11 0YU. The approximate centre of the site is at a national grid reference (NGR) ST 53743 81814.

The Installation is immediately surrounded by industrial premises and open land. The city of Bristol is approximately 10km to the southeast. There is also a small residential area approximately 160m to the southwest. The Severn Estuary is approximately 870m to the west of the Installation.

The site does not fall within any Air Quality Management Areas.

The immediate environmental site setting is summarised in Table 3-1.

Table 3-1: Surrounding Land Uses

Boundary	Closest Distance (m)	Description
North	Adjacent	Seabank Power Station, open land and Ableton Lane.
East	Adjacent	Viridor EfW, unnamed pond, Ableton Lane, Copart Bristol Car Auction, open land and CarTakeBack.
South	Adjacent	Severn Road, large carpark, Stuppill Rhine, woodland, Hallen Wetlands and open land.
West	Adjacent	Chittening Road, small number of residential properties, open land, Menzies Distribution (Solutions), solar farm and wind farm.



4.0 INSTALLATION OVERVIEW

The Installation will include 32 SBGs with a total generating capacity of 233.28MWth. The SBGs will be fired on diesel or HVO.

The new data centre will repurpose the existing building on site which was previously used as a plastics recycling facility.

Adjacent to the data centre building will be a new three storey plant gantry structure which will house the SBGs, modular electrical switchrooms and cooling plant. Each SBG will be containerised and will sit at ground level of the gantry within the yard area.

Each SBG will sit on top of an individual belly tank. Electrical plant will sit on the first-floor gantry and cooling equipment on the second floor.

Each SBG will have a single flue for the discharge of combustion emissions; these flues will extend beyond the generator containers and run vertically up through the middle of the gantry building, terminating through the gantry roof above roof height.

The locations of the SBGs and emission points are presented on Drawing 002 Site Layout and Emission Points.

4.1 Staffing

The Installation will operate 24 hours 365 days a year. This data centre will have the following employees (these figures are approximate):

- 10-15 full-time jobs.

This would be further supplemented by additional on-site jobs for on-site maintenance.

4.2 SBG Selection and Resilience Configuration

The data centre comprises of one data hall. The data centre has been designed to ensure the maximum number of SBGs are installed to service potential clients and to ensure resilience.

The SBGs have been selected based on the designed customer demand electrical load. This approach ensures that:

- The SBGs will be operated at their optimal design capacity, as operating diesel SBG sets at low loads (i.e. underloading) for extended periods of time can potentially impact uptime and engine life; and
- That only the necessary minimum number of SBGs will be operated to deliver the required electrical load, this allows for the required number of SBGs to be run dependant on the failure/emergency scenario. In the event of a reduction in electrical power delivered from the National Grid and/or Viridor EfW facility, only the minimum number of SBGs would automatically start up that are necessary to service the data hall.

This approach will result in the reduced consumption of liquid fuel and hence generation of less emissions to air from the SBGs.

As part of the annual maintenance programme, testing of the SBGs throughout the year for short periods of time is required. To minimise the mass emission rate to air of combustion emissions and potential adverse impacts on air quality, one SBG at a time will be tested.

The proposed generators to be installed are MTU 20V4000 DS3300 (engine model 20V4000G34F) engines. The manufacturer specification states these engines are optimised for reduced emissions and fuel consumption. An emissions data sheet for the proposed generators is available which presents NO_x emissions at a range of generator loads. BAT



requires new generators to be 2,000mg/m³ NO_x between 67% and 87% of peak loading (i.e. a typical emergency load). Based on the emissions data provided for the MTU engine, the NO_x emissions at 75% are reported at 1,553mg/kg and hence are considered to be BAT compliant. Written confirmation from the generator manufacturer is also available confirming that the generator is 2g TA Luft compliant (refer to the SBG manufacturer specifications and written confirmation from the manufacturer in Appendix B for details on emissions).

The resilience configuration of the SBGs providing for the electrical load demand of a site (i.e. the data centre building and installed IT equipment) is referred to using 'n', where 'n' is the specified MWe rate delivered by a SBG unit. The EA Data Centre FAQ states that 2n is the exemplar (i.e. twice as many SBGs as required are installed). The resilience arrangement at the data centre is summarised below:

- The 32 proposed MTU SBGs for data centre data will have an n+1 arrangement.

The n+1 configuration (i.e. an additional SBG added to support a single SBG failure or required maintenance) allows for a level of redundancy to the SBG system such that, even in a worse case blackout scenario, only the required number of SBGs needed to meet the electrical load demand would be run; the operational capacity of the SBGs at the time of a blackout would be dependent on the extent of blackout. Furthermore, in the event of failure of an SBG, the correct number of remaining SBGs will in an emergency event provide the required load. The n+1 configuration offers resilience and minimises the risk of disruption in service to the data centre's clients.

The SBGs will in an emergency outage situation be automated via the data centre's building management system (BMS). In the event of a reduction in electrical power delivered from the National Grid and/or the EfW facility, the BMS will automatically start-up the required number of SBGs necessary to provide the required electrical load demand; this configuration allows for the required number of SBGs to be run dependant on the failure scenario. This results in the reduced consumption of fuel and hence generation of less emissions to air from the SBGs.

4.3 Reliability Data

The magnitude of risk posed by operation of the SBGs (other than for SBG testing) is strongly linked to the reliability of the provision of electricity from the local transmission network and the EfW facility (in addition to the uninterruptable power supply (UPS) arrangements).

The Avonmouth data centre is designed to provide the maximum reliability of the electrical power supply to the on-site systems that are critical for operation of the site as a data centre. The data centre will be designed to Uptime Institute Tier III standard, ensuring the required level of resilience to ensure maximum uptime for critical IT infrastructure.

The electricity supply arrangements for the site will include:

- One 132kV from the National Grid. This will supply up to 20% of the electrical power for the facility prior to future grid connections, as detailed below.
- A direct feed from the Viridor EfW facility which will supply up to 80% of the electrical power for the facility:
 - Due to delays with the National Grid connections, it is anticipated that the site will not be fully connected to the grid until c. late 2027 / early 2028. Prior to this time, the site will be powered (80% of the electrical demand) by the adjacent Viridor EfW facility. While the data centre is awaiting the final grid connections, the EfW facility will forego any planned maintenance downtime to ensure power and resilience to the data centre is maintained.



- In the event that further resilience is required due to delays with the grid connection, consideration is being given to the installation of solid oxide fuel cells (SOFC), on an area of the site to the north-west of the data centre, for further power supply. The SOFC will only be installed at the facility as a bridging supply, in the event that the required grid connection is delayed.

UPSs are arrays of batteries that can provide power, almost instantaneously, in the event of a loss of electrical input to the data centre. The Avonmouth data centre will have battery arrays which will provide sufficient protection to the supply of electrical power for the critical 'customer load' whilst the SBG(s) are started. These arrays provide almost instantaneous power in the event of a loss of electrical input to them, providing sufficient protection to the supply of electrical power to the 'customer load' whilst the SBGs are started.

The site will operate its electrical supplies on an automatic basis such that in the event of fluctuations in (or loss of) the electrical supply to the site, where such events could negatively impact operation of the site's data centre function, these are detected and the relevant response (e.g. UPS start-up followed by the start-up of SBGs, if required) is automatically deployed by the data centre BMS.

This infrastructure design provides the required reliability for the data centre, and the required resilience for the data centre customers. The electricity supply arrangement for the data centre is not yet available but can be supplied at a later date, if required.

4.4 Other Combustion Plant

The operator is proposing to install a small diesel pump for the firewater sprinkler system on site. While the exact pump has not yet been determined, it is anticipated to be no more than 60 kW in size. A 60kW pump equates to c. 0.182 MWth.

The rated thermal input of the diesel pump has been calculated using Equation 7 taken from the AMPS technical guidance¹. Equation 7 is as follows:

$$P_{th} = P(r) * 100 / \eta_e$$

Where: P_{th} = thermal input power; $P(r)$ = rated power (mechanical or electrical, whichever is available); η_e = effective efficiency (relevant for mechanical or electrical power)

Applying this equation to a 60kW diesel pump, and assuming an efficiency of 33% (as per the AMPs guidance), the calculated rated thermal input is approximately 182 kWth (0.182 MWth) (i.e. $60 * 100 / 33$).

This is below the 1 MWth lower applicability threshold of the MCPD. Consequently, the diesel pump does not meet the definition of a MCP and is outside the scope of MCPD requirements, therefore this pump has not been considered further within this application.

4.5 Solid Oxide Fuel Cells

As stated above, the operator may install a number of SOFC at the facility which will be used for providing additional electrical resilience for the data centre.

The SOFC would be installed on site in modular containerised systems. The SOFC energy servers convert fuel into electricity through an electrochemical process, without combustion and with high efficiencies. The SOFC will be fuelled by natural gas.

A compound in the north-west of the site is proposed for siting of the SOFC.

¹ <https://www.amps.org.uk/wp-content/uploads/2023/06/AMPS-Guidance-for-determination-of-thermal-input-power-of-generators-.pdf>



The SOFC consist of three parts:

- An electrolyte: a ceramic conductor that moves ions from the fuel to the air to create electron flow;
- An anode electrode: made from special inks which coat the electrolyte; and
- A cathode electrode: made from special inks which coat the electrolyte.

An electro-chemical reaction converts fuel and air into electricity without combustion. Warmed ambient air enters the cathode side of the SOFC and steam mixed with natural gas and enters the anode side to produce reformed fuel. As the reformed fuel crosses the anode, it attracts oxygen ions from the cathode. The oxygen ions combine with the reformed fuel to produce electricity, water and small amounts of carbon dioxide (Figure 1).

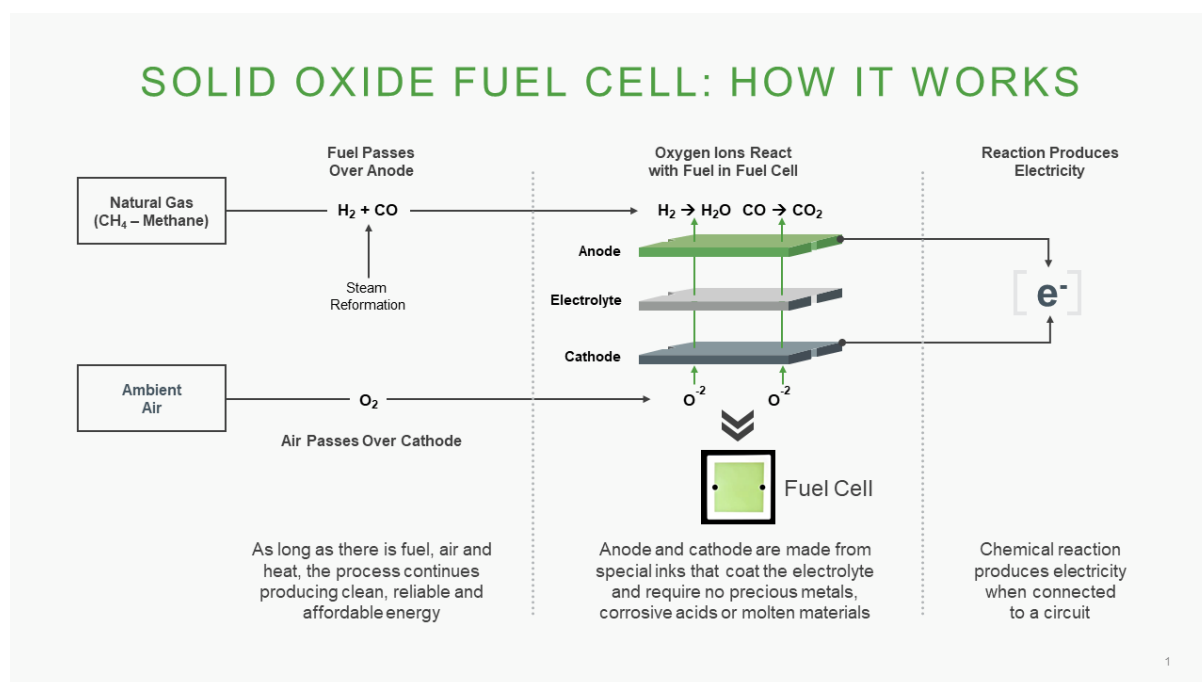


Figure 1 Solid Oxide Fuel Cell Process Flow Diagram

The generated water is recycled within the system to produce the steam needed to reform the fuel. The process also produces the heat to keep the fuel cell warm and drive the reforming reaction process.

Advice obtained from the EA during enhanced pre-application discussions outlined the regulatory position for SOFC:

- A SOFC is not a combustion plant and therefore is not covered by Section 1.1 Part (1) of EPR or the MCPD. This is because 'combustion' is not occurring in a SOFC and therefore it cannot be considered as being a combustion plant. The reaction is an exothermic electrochemical reaction, the primary purpose of which is to produce electricity and not heat.
- The heat generated is a byproduct which can be recycled to enable the reaction, which means the IED definition "Any technical apparatus in which fuels are oxidised in order to use the heat thus generated" is not appropriate.
- The reforming step in which the hydrogen-rich gas is used immediately (i.e. without leaving the SOFC box enclosure) is an internal step and does not constitute an



activity under Section 4.2, Part A(1)(a)(i) production of inorganic chemicals: hydrogen.

As such, the SOFC are not considered to be a permitted regulatory activity and therefore have not been assessed any further within this BATOT assessment.

4.6 Technical Standards

The data centre will be designed and operated in accordance with the relevant sections of the following key guidance:

- Develop a management system: environmental permits guidance, 03 April 2023;
- Emergency backup diesel engines on installations: best available techniques (BAT), 23 August 2023;
- Best Available Techniques: environmental permits, 08 January 2026; and
- Specified generator: comply with permit conditions, 28 December 2022.

In addition, the site is operated in accordance with *Data Centre FAQ, Draft Version 21.0 to TechUK for Discussion 15/11/22* with respect to standby operation. It is noted that this guidance is draft, however, for the purposes of this application, this guidance is considered to represent the current EA position of BAT for data centre back-up generation systems.

Operation of the SBGs (other than for maintenance and testing) will commence in the event that electricity is not available from the local transmission network/EfW facility/SOFC (if installed) (e.g. brown- or black-out), or on internal failure of electrical supply (e.g. transformer failure, UPS problem).

The SBGs on-site will also be operated for maintenance and testing purposes. Each SBG will operate for no more than 50 hours per annum and will not be subject to the emission limit value (ELV) for NO_x (190mg/kg).

4.6.1.1 Emergency Operation

Emergency operations are taken to include unplanned hours required to come off grid to make emergency repair of electrical infrastructure associated within the data centre itself.

Given the short start-up and shutdown times for diesel engines, the SBGs are regarded, for the purposes of determining operating hours, as commencing operation at the first fuel ignition. This is taken to include the shorter periods of plant 'overlap' when engines provided as redundancy are started as a precautionary measure before final customer load is reached with the optimum/minimum number of SBGs.

In the event of emergency operation of the SBGs, the operator will notify the EA in accordance with the requirements as stated in the EP.

5.0 OPERATING REGIME

5.1 SBG Scheduled Operating Regime

During planned maintenance and testing the SBGs will each be typically operated for less than 50 hours per year.

The planned maintenance and testing regime for the SBGs is scheduled to ensure that the impact on air quality as a result of the fuel combustion emissions is minimised.

The planned operating regime for the 32 SBGs (i.e. testing and maintenance) is presented in Table 5-1.



Table 5-1 Planned SBG Testing Regime

Operational Requirement	Total Hours per SBG Annum
On-load test (100% load): Each SBG tested individually once every 6-months for 6 hours. This equates to 12 hours of testing per SBG per year (2 x 6 hours).	12
Off-load test (0% load): Each SGB tested individually for 15-minutes every month. Testing equates to 3 hours of testing per SBG per year (12 months x 0.25 hours)	3
Total Planned Annual Operational Hours Per SBG	15

The scheduled maintenance and testing regime aligns with the 50-hour testing regime for SBGs which are used purely for a stand-by emergency role, as stated in the EA Data centre FAQ.

5.2 SBG Commissioning

The 32 proposed SBGs will following on-site installation, be subject to a period of commissioning. Each generator will undergo 12 hours of testing individually with load levels being ramped up to 100% load.

6.0 EMISSIONS

6.1 Emissions to Air

The Air Emissions Risk Assessment (AERA) (SLR Ref: 416.066815.00001 AERA) has considered the proposed SBGs at the Installation.

Potential air quality impacts resulting from routine testing and maintenance operations and non-routine emergency outage operation for the site have been considered.

The AERA predicts the following:

- **Planned maintenance and testing:** that there will be no significant adverse impacts on identified local human receptors and designated ecological receptors.
- **Emergency Outage Scenario (hypothetical 72 hour outage):** overall there will be no significant adverse impacts on identified local human receptors and designated ecological receptors. Exceptions to this are as follows:
 - There are potential exceedances of the 1-hour mean (<5% probability) and 10-minute (>5% probability) NO₂ AEGs at some of the modelled human receptor locations.
 - There are potential exceedances of the daily mean NO_x CLe at most of the designated ecological sites when assuming a >24-hour outage duration. This assumes the emergency outage is >24 hours, which is considered an unlikely occurrence.
 - Overall, however the risk of a prolonged emergency outage is considered to be low.



- **Commissioning (Cumulative with Testing and Maintenance):** overall it is considered that there will be no significant adverse impacts on identified local human receptors and designated ecological receptors.

Refer to the Environmental Risk Assessment for further information (document reference 416.066815.00001 ERA).

6.2 Emissions to Sewer and Surface Water

The data centre will be designed with separate foul and surface water drainage systems.

The drainage arrangements at the Installation are illustrated on the drainage plan (reference JDA033-CSP-EX-XX-DR-C-SK100_P02, in Appendix C) and are summarised below.

Foul Water Discharge

There will be no discharges to foul sewer from the permitted activities.

Surface Water Discharge

- **SBG Compound:** The SBGs will be located in a dedicated compound. This compound will have a bund wall on three sides and a ramped entrance designed to contain any rainwater, spills or leaks.

Within this bunded compound will be three floor drainage gullies designed to capture run-off from within this area. Each gully will drain to a manhole each of which will be fitted with a sensor to detect hydrocarbons and ethylene glycol. The sensors will be connected to the BMS; in the event of detection, these will automatically close off the manholes to prevent the discharge of potentially contaminated water from the compound entering the surface water drainage system.

Surface water runoff from within the compound will enter the surface water drainage system for the site, flowing via a full retention separator before discharging from the site at emission point **SW1**. Following discharge from the site, the runoff will enter the wider surface water drainage system for the Viridor facility, which drains via an existing system of swales, then enters a drainage ditch before ultimately discharging to the Bristol Channel.

- **Loading Area:** Two dedicated generator refuelling laybys will be provided for the bulk delivery of diesel or HVO, which will be located on the east and west sides of the generator plant area. The loading areas will be designed to allow bulk tankers to park and connect to the fill point located in the wall of the plant enclosure. The loading area, which will be concrete surfaced with raised kerbing around the perimeter, and will be cambered so that any runoff drains towards a drainage channel on the outermost edge of each of the concrete layby areas. Each of these drains will direct the runoff from the layby area via the surface water drainage system to one of two newly installed full retention Class 1 forecourt petrol interceptors. The interceptors will have high level silt and oil alarms. During tanker offloading operations for diesel or HVO, the interceptor will be isolated via an isolation valve; closure of this valve will be an automated process via the site's BMS. From the interceptors the runoff will enter the site's surface water drainage system and will be directed to the surface water discharge point **SW1**.

6.3 Emissions to Land

There will be no point source emissions to land from the permitted activities.



6.4 Fugitive Emissions

Significant fugitive emissions, odours and noise are not anticipated in respect of the permitted activities.

A summary of the storage arrangements for fuel is provided in Section 10 of this document.

A spill procedure will be developed as part of an environmental management system (EMS), and relevant operating personnel will be provided with spill response training. Additionally, the requirement for maintenance activities and regular inspections of the data centre site will be included in the EMS.

6.5 Noise and Vibration

A Noise Assessment has been undertaken in accordance with British Standard 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*. This is presented in this EP application.

The noise assessment, which assessed the noise impact of the proposed SBGs and associated infrastructure at Avonmouth during normal and emergency operations, concluded that the Avonmouth site will have a low impact in terms of noise emissions.

As per EA Guidance² the assessment only considers emissions from back-up generators and associated infrastructure only. As noise from the data centre itself does not fall under the scope of EA regulation, this has not been considered within the noise assessment.

The assessment has been undertaken in accordance with BS 4142 and EA noise guidance (NVM and MID), and the predictions have been completed using ISO 9613-2, modelling with appropriate worst-case propagation assumptions, during operations involving the SBGs.

Overall, the key findings of the noise assessment are as follows:

- Rating levels from the SBGs during a worst-case emergency operating scenario, in which all SBGs are assumed to be operating simultaneously, would remain at least 10 dB below the representative background sound levels at all NSRs.
- The BS 4142 assessment indicates low impact, at all noise sensitive receptors, which means “no, or barely audible or detectable noise” impacts will be felt at each noise sensitive receptors.
- With regard to routine testing, the SBGs will typically be operated individually and avoid concurrent testing across multiple SBGs where practicable. Therefore, noise impact of a single SBG will be lower than emergency operations and thus considered negligible.

Overall, operation of the SBGs at the Site is not expected to give rise to adverse noise impacts and is therefore considered acceptable in the context of this EP application.

7.0 RESOURCE USE AND EFFICIENCY

7.1 Types and Amounts of Raw Materials

Fuel and oil use is summarised below:

- Diesel/HVO:

² Noise and vibration: environmental permit application guidance (Dec 2025)



- emissions optimised MTU 20V4000 DS3300 (engine model 20V4000G34F) (7.29MWth): each SBG will as a maximum require up to 689 litres of diesel per hour (at 100% of the power rating).

A similar volume will be required if HVO is used as a fuel.

- Lubricating oil: used in the engines and other mechanical equipment. Occasional top up or replacement will be required during scheduled or forced maintenance periods only.
- The lubricating oil for the SBGs will be stored within the engine and will be manually topped up during servicing.

The BAT objective with regard to raw materials is achieved by the appropriate design, operation and maintenance of the SBGs to ensure the lowest possible consumption rate by the selection of the least hazardous materials and by the provision of appropriate storage methods.

The SBGs are designed for the use of diesel or HVO as a fuel. The operator will seek to use HVO as a sustainable alternative fuel to diesel where possible.

A typical composition of diesel fuel is shown in 7-1.

Table 7-1: Typical Diesel Fuel Oil Specification

CHEMICAL	TYPICAL % (MASS BASIS)
Carbon	89.7
Hydrogen	10.2
Sulphur	<0.1

Cogeneration (Combined Heat and Power)

The provision/implementation of combined heat and power (CHP) is not applicable as the SBGs will each operate for substantially less than 500 hours per annum for the provision of emergency power generation; each engine will inherently only operate for a small fraction of the year for planned maintenance and testing.

7.2 Fuel Storage

7.2.1 Generator Belly Tank Diesel Storage

Fuel for the 32 proposed SBGs will be stored in individual belly tanks located beneath each SBG within the container unit. The belly tanks will be designed and constructed in accordance with BS799-5:2010 Oil Burning Equipment Carbon Steel Oil Storage Tanks. The belly tanks will have primary and secondary containment in line with CIRIA 736.

Whilst detailed design is not currently available, it is anticipated that each belly tank for the MTU SBGs will have a capacity of c. 25,000 litres and will be fitted with:

1. Level gauges;
2. High and low level alarms connected to a BMS;
3. A pressure delivery over-fill prevention valve;
4. Leak detection alarms connected to a BMS;



5. Pressure relief valves to prevent over pressurisation of fuel supplied from the belly tanks; and
6. All pipework will be painted or constructed with corrosion resistant material to minimise the risk of corrosion.

Two dedicated SBG refuelling laybys will be provided for the bulk delivery of diesel or HVO, which will be located on the east and west sides of the SBG plant area. The loading areas will be designed to allow bulk tankers to park and connect to the fill points located in the wall of the plant enclosure. The fuel delivery pipework will feed into each individual SBG belly tank. The fuel delivery pipework will run above ground and will be double walled with leak detection based on pressurisation levels in the interstitial space between the pipework walls. Full design details of the fuel delivery system will be provided once available.

7.3 Energy Efficiency

7.3.1 Climate Change Agreement

The Operator is not currently a participant to a Climate Change Agreement. Energy management techniques will be implemented in the EMS to monitor, record and track energy consumption at the Installation.

7.3.2 Energy Efficiency Directive (EED)

The EED exempts “those peak load and back-up electricity generating installations which are planned to operate under 1,500 operating hours per year as a rolling average over a period of five years”.

Based on the planned maintenance and testing schedule, in total the SBGs at the data centre will be operated for less than the 1,500 hour threshold. For the purpose of this EP application, the data centre will therefore be exempt from the EED requirements and an assessment of energy efficiency in accordance with the Reference Document on Best Available Techniques for Energy Efficiency, February 2009 is not required.

7.3.3 Energy Management

The management of energy will be an integral part of the EMS which will be developed for the data centre. Training aimed at minimising energy use and developing good housekeeping techniques will be a part of the staff training programme. Energy use and its minimisation will be managed via the EMS.

7.3.4 Measures for the Improvement of Energy Efficiency

The SBGs will be subject to periodic maintenance and inspections which will include ensuring the SBGs are optimised to minimise the heat rate (energy consumption) whilst maintaining the relevant emissions standards.

Energy recovery is not reasonably practicable for engines with such small anticipated operational hours, however, as part of the EMS, assessment of the site’s energy usage will be undertaken with a view to identifying measures to reduce energy consumption.

7.3.5 Energy Usage

The overall efficiency of the data centre SBGs (32 SBGs) (under the provision of ‘standby’ power), will be approximately 33.3%.

7.4 Water Minimisation

There will be no consumption of water associated with the SBG combustion activities.



7.5 Waste Minimisation

Whilst the site will inherently not produce significant amounts of waste, a waste minimisation audit will be performed periodically throughout the operational lifetime of the data centre in accordance with EP requirements. The aim of this audit will be to minimise the use of all raw materials and thus prevent waste at source.

Waste oils (EWC 13 02) from the SBGs at the data centre will unlikely exceed 5m³/4.5 tonnes per annum. Oily wastes will be stored in suitable containers, such as 205 litre drums, located on bunded stillages whilst awaiting collection for off-site disposal by a licensed waste contractor.

7.6 F Gases

Fluorinated gases (F-gases) will be used at the data centre in the refrigeration systems for cooling systems. The installation will use R1234ze for free air cooled chillers and trim chillers. The chiller units will be subject to regular maintenance and leak testing; these requirements will be included in the site's preventative maintenance system. Maintenance and testing will be undertaken by an approved external specialist contractor; copies of the certificates of the engineers qualified to install, maintain and service refrigeration equipment will be maintained on file by the operator.

The facility will maintain an F-gas register for each asset containing refrigerant; the register will detail the location of the asset, asset model and serial number, refrigerant type and charge, the global warming potential (GWP), carbon dioxide equivalent (CO₂e kg), maintenance/leak test frequency, etc.

Leak detection and maintenance records will be maintained which will include details of the quantity of refrigerant used to recharge the units, date of recharge and leak re-test for those assets where leaks are identified. The operator will appoint a responsible third-party engineer for undertaking maintenance activities.

8.0 MANAGEMENT SYSTEMS

The data storage services at the data centre will be managed in accordance with any appropriate standards, these may include:

- ISO/IEC 27001: Information Security Management System.
- ISO 22301: Business Continuity Management.
- ISO 9001: Quality Management System.
- ISO 42001: Artificial Intelligence Management System (AIMS).
- ISO 14001: Environmental Management System. This standard specifies the requirements for an EMS to enable an organisation to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects.

8.1 Environmental Management System (EMS)

An EMS will be developed in line with the ISO14001 standard. The EMS will include policies, management principles, organisational structure, responsibilities, standards / procedures, process controls and resources which are in place to manage environmental protection across all aspects of the business.

The EMS will place particular importance on:



- Reducing risks to the environment to a level that is as low as reasonably practicable using best available techniques;
- Integrating EMS responsibilities within line management;
- A commitment to personnel environmental awareness and competence;
- The ongoing monitoring and review of environmental performance; and
- A commitment to working to achieve continuous improvement in environmental performance.

Policy

The EMS will include an Environmental Policy which clearly defines the operator's commitment to continual improvement and to developing objectives and targets aimed at preventing pollution and improving environmental performance. The Policy will be reviewed annually by top management and communicated to all employees.

Organisation

The Operator will establish and maintain documented procedures for identifying and recording environmental aspects for all its activities and services. Where significant, the environmental aspects will be considered in the development, implementation and maintenance of the EMS. These will also be considered when introducing new or modified activities and services. The Operator will also document in the EMS the process for the setting, managing and reviewing environmental objectives and targets.

The operator will document in the EMS the structure and responsibility within the organisation. Senior management will have overall responsibility for the provision and maintenance of an effective EMS Policy and improvement programme and will ensure that the requirements of the EMS are addressed in all management and business decisions.

The operator will maintain an internal audit programme for periodic internal audits of environmental documents, procedures, implementation and compliance status to determine whether the EMS conforms to planned arrangements, and to determine whether it has been appropriately implemented and maintained in accordance with its Environmental Policy.

Environmental Aspects Evaluation

The environmental significance of the site activities will be determined by means of environmental aspects evaluation. The Operator will identify the aspects and impacts (direct and indirect) relevant to its activities, highlighting which substances, activities or incidents related to the aspects that could potentially have a harmful effect on the environment. Any substance, activity or incident that has the potential to cause harm, or under the worst-case scenario has a high-risk of potential to harm will be identified as being 'significant'.

The Operator's main activities will be identified and recorded, for example in an aspect and impact register; evaluation of these aspects and impacts and the associated implications will be recorded. Environmental aspects will be considered under the following conditions:

- Normal operation (i.e. standard operating procedures and conditions);
- Abnormal operation (i.e. standard operating procedures but non-standard conditions); and
- Emergency conditions.

Aspects which are identified as being 'significant' will be managed by establishing operational controls, process, procedures, training and monitoring activities such audits. The Operator's management team will be responsible for reviewing aspects and impacts defined



as being significant. All staff will be responsible for working in accordance with procedures relating to environmental compliance.

Environmental Risk Assessment

Environmental risk assessments, together with the environmental aspect evaluation, will inform routine management system procedures for the management of risks under normal circumstances, and emergency plans to mitigate impacts under abnormal circumstances. Such assessments will cover the implications of material storage, fuel transfer, drainage and site security.

Environmental risk assessments will be carried out:

- Under normal operating conditions;
- Under potential abnormal/emergency conditions;
- For existing equipment;
- For existing material storage;
- Before a new substance is introduced;
- Before the installation of new plant on-site; and
- Before existing plant is modified.

All significant risks will be recorded, for example in an aspect and impact register.

The Operator will require and will encourage full and open reporting of all environmental incidents, including near misses. Staff will be encouraged to report environmental incidents and problems which may result from the following factors:

- Pollution incidents;
- Potential incidents;
- Breaches of legislation;
- Supplier non-compliances;
- Contractor non-compliances;
- Non-compliances identified during audits; and
- Management system non-compliances.

Additionally, contractor personnel will be informed of the need to report incidents.

Monitoring, Control and Change Management

The primary mechanism that will ensure operational control to minimise adverse environmental risks will be the aspect and impacts register. Processes and procedures will address each significant aspect and generate the information and data necessary to monitor adequately the environmental performance of the data centre and develop an understanding of performance so as to identify faults, opportunities for improvement and to optimise maintenance routines.

The EMS will provide for the controlled implementation of changes which may have environmental implications, to ensure any environmental risks posed by a proposed change will be adequately managed.

Change control will include consideration of the proposed change requirement, identification of the potential environmental implications, measures required to minimise the potential



environmental impacts and the responsibility for resolution and a timescale. Change control will include consideration of (inter alia):

- Legal obligations;
- Results of routine monitoring activities;
- Changing commercial circumstances;
- Improvement targets;
- Review of the environmental aspects, which will include risks from climate change;
- Complaints or suggestions from the public;
- Staff suggestions; and
- Non-compliances.

Accident Prevention and Management

The Operator will develop systems for managing accidents or incidents. Risks as a result of activities undertaken, or proposed to be undertaken, at the data centre will be considered and documented, for example in an environmental aspect and impact register and via risk assessments. The environmental aspect and impact register will be updated to include requirements of the EP.

The following will also be developed:

- A Disaster Recovery Plan to counteract potential interruptions to its business activities and to protect critical business processes from the effects of major failures of information systems or disasters. Risk assessments will be undertaken to ensure that the Disaster Recovery Plan has appropriate controls in place; and
- A Business Continuity Plan (BCP), which will detail emergency/accident procedures and incident management responsibilities, including management of significant pollution incidents and fire. The plan will include contact numbers for key company personnel and emergency services.

Training

Environmental training will be provided; this will be for both general awareness and job-specific training.

The site will be managed by a sufficient number of staff who have the competencies to operate the site. In accordance with the EMS:

- All staff will have clearly defined roles and responsibilities;
- Records will be maintained of the knowledge and skills required for each post;
- Records will be maintained of the training undertaken and relevant qualifications obtained by staff to meet the competence requirement of each post; and
- Operations will be governed by standard operating instructions.

Each individual's knowledge and skills will be assessed and matched against the needs of the job position. Additional experience and/or training requirements necessary to enable an individual to undertake their assigned role will be identified, prioritised and planned.

Training records will be maintained and training needs regularly reviewed.

All contractors will be given appropriate training prior to the commencement of any works or services.



Review and Audit

The Operator recognises that continuous improvement requires the ongoing appraisal of EMS and Environmental Policy in order to ensure that they remain effective, in line with developing best practice and relevant to the business as a whole. An annual management review of the EMS will be undertaken to ensure that it remains appropriate and effective at controlling environmental performance and to identify any areas where opportunities exist for improvement.

The EMS and site activities will be internally audited at least annually, either by site staff with suitable audit experience and / or training or by a suitably qualified and experienced third party.

Where corrective action is identified as being required, through audit (or otherwise), which for example involves modifications to plant and equipment, the implementation of such changes will be managed via the EMS change management process.

8.1.1 Climate Change Risk Assessment and Adaptation Plan

A Climate Change Risk Assessment (CCRA) and Climate Change Adaptation Plan (CCAP) will be developed in accordance with EA guidance³. This will be included within the EMS.

9.0 MONITORING

9.1 Emission Limits

The proposed 32 SBGs at the Installation will each be operated for less than 500 hours per annum and will therefore not be subject to emissions limit values (ELV) for the substances listed in Annex V of Directive 2010/75/EU on industrial emissions (Industrial Emissions Directive, IED).

As the SBGs will not be used for the elective generation of electricity they will not be considered 'specified SBGs' in accordance with EPR 2018 and hence will not be subject to the ELV for NO_x (190mg/kg (within 10 minutes of the specified SBG commencing operation)).

The operator will record:

- the operating hours of each engine for planned maintenance;
- the operating hours of each engine for emergency operation; and
- the amount of fuel used on an annual basis.

For the purposes of determining operating hours, the SBGs are regarded as having minimal start-up or shut-down times. Operational hours will be counted from the first fuel ignition. This will include the shorter periods of plant 'overlap' when redundant plant is started as a precautionary measure before final load is reached with the optimum/minimum number of SBGs.

9.2 Point Source Emissions to Atmosphere

Point source emissions to air are from the SBGs as a result of diesel combustion. Air emissions modelling has been completed for the proposed SBGs. Based on the findings of the AERA (416.066815.00001 AERA) the products of combustion which are released to air

³ Climate change: risk assessment and adaptation planning in your management system - GOV.UK (www.gov.uk)



as a result of planned maintenance and testing and commissioning (cumulative with testing and maintenance) the SBGs will not result in an adverse impact on the environment.

For operation of all SBGs under an emergency (brown- or black-out) scenario (72 hours modelled), overall there will be no significant adverse impacts on identified local human receptors and designated ecological receptors. Exceptions to this include potential exceedances of the 1-hour mean (<5% probability) and 10-minute (>5% probability) NO₂ AEGs at some of the modelled human receptor locations and potential exceedances of the daily mean NO_x CLe at most of the designated ecological sites when assuming a >24-hour outage duration, as detailed in Section 6.1 of this BATOT. This assumes the emergency outage is >24 hours, which is considered an unlikely occurrence. Overall, the risk of a prolonged emergency outage is considered to be low

9.3 Point Source Emissions to Sewer

There are no discharges to sewer at the Installation.

9.4 Point Source Emissions to Water

There is one point source emission to surface water proposed from the installation. The point source emission (SW1) will consist of surface water run-off only and will discharge to an existing swale adjacent to the facility. This swale is part of a series of connected swales and drainage ditches within the Avonmouth area, which collect surface water run-off before ultimately discharging to the Bristol Channel.

10.0 BEST AVAILABLE TECHNIQUES

The assessment for the implementation for Best Available Techniques (BAT) at the data centres is based on the following:

- the latest version of the '*Data Centre FAQ, Draft Version 21.0 to TechUK for Discussion 15/11/22*' – Release To Industry', provided by the EA; and
- with respect to technology selection, Department of Energy & Climate Change, Developing Best Available Techniques for Combustion Plants Operating in the Balancing Market, Final Report, June 2016.

10.1 Data Centre BAT - Operating Regime

10.1.1 Planned Maintenance and Testing

During operation for planned testing/maintenance at the data centre, the SBGs will each operate typically for 15 hours per year; this is notably below the 50 hour per annum data centre BAT requirement.

In the event that electricity is not available from the local transmission network/EfW facility/SOFC (e.g. brown- or black-out) the SBGs will be operated to deliver the required data centre customer load.

Whilst emergency operation (if required) would increase the total operational hours of each SBG, it is extremely unlikely that operation of any single SBG would exceed 500 hours per annum (this being the definition of an 'emergency' unit).

The SBG provision includes for a level of redundancy to the SBG system such that, even in a worse case blackout scenario, whilst all SBGs would start up they would not operate at full capacity; the operational capacity of the SBGs at the time of a blackout would be dependent on extent of the facility's IT load at the time. Should an SBG fail the engine will be covered by the remaining engines, which will operate to share the required IT load at that time.



Emergency operations are taken to include unplanned hours required to come off grid to make emergency repair of electrical infrastructure within the data centre.

The operator will notify the EA:

- In advance of planned outage/maintenance of the local transmission system that is expected to exceed 18 continuous hours; and
- Upon an incident of unplanned continuous outage that exceeds 18 hours.

10.1.2 Elective Electricity Generation

The SBGs at the data centre will not be operated for elective electricity generation.

10.1.3 Operating Regime Time Limit

The air emissions modelling (416.066815.00001 AERA) has predicted that operation of the SBGs for the planned maintenance and testing regime of 15 hours per SBG per year, as detailed in Table 5-1, will not result in adverse impacts on air quality. The operator will therefore not operate the SBGs for more than these hours per year for the purpose of planned maintenance and testing.

10.2 Data Centre BAT: Engine Selection

Diesel-fired (also suitable for HVO fuel) SBGs have been chosen for the provision of emergency back-up energy in the event of a black- or brown out at the facility. A BAT assessment has been undertaken which compares diesel SBGs to other available technologies to support the chosen technology.

The following key requirements for the SBGs to provide emergency back-up electricity have been considered for the selected technologies:

- Start-up time;
- Reliability;
- Independence of off-system services; and
- Causing the least environmental impact.

A comparison of these technology types is presented in Table 10-1. Start up, efficiency and emissions data as stated has been obtained from a report prepared by DECC (Department of Energy & Climate Change, Developing Best Available Techniques for Combustion Plants Operating in the Balancing Market, Final Report, June 2016) unless otherwise stated. Figures are reported at oxygen reference values of 15%.



Table 10-1: Comparison of Technologies

	Combined Cycle Gas Turbines (CCGT)	Open Cycle Gas Turbines (OCGT)	Aero Derivative Gas Turbines ⁴	Gas Engines	Diesel Engines
Process Description	<p>CCGT technology uses a primary gas turbine coupled to a secondary steam turbine. Air is compressed through a rotating compressor, then mixed with fuel and combusted before being expanded through a gas turbine, converting the thermal energy into rotation of the turbine blades. Some of the mechanical energy powers the compressor, with the majority turning a SBG which converts the mechanical energy to electricity.</p> <p>The hot turbine exhaust gases then pass through a boiler to generate steam. The steam is fed to a steam turbine which powers a second SBG, producing further electricity.</p>	<p>OCGT consist of a compressor, combustion chamber and gas turbine. They differ from CCGTs in that they operate without the secondary component to recover heat.</p> <p>Air is fed into the compressor, pressurised and then passed to the combustion chamber where fuel is added and combusted. The hot exhaust gas turns the turbine blades and energy is converted to electricity.</p> <p>OCGTs can provide STOR and peaking services but not fast reserve services as during start-up thermal stresses need to be managed through a slow heating up process.</p>	<p>Aero Derivative Gas Turbines are similar to open cycle gas turbines but have been derived from turbines used for aeronautical applications.</p> <p>As a result of the different requirements for use of gas turbines in aircraft, they are more flexible than OCGT plant, and are able to operate under wider ranges of load and start up and shut down quicker than other turbines.</p>	<p>A gas engine consists of a bank of fixed cylinders inside which pistons move, injecting air and fuel, compressing the mixture, igniting the mixture and then expanding the hot gas produced converting the thermal energy into rotation of a crank shaft.</p> <p>The engine load is adjusted by controlling the amount of gas and air injected into the cylinder, which is controlled by an automated system.</p> <p>A SBG connected to the crank shaft of the engine converts the mechanical energy into electricity.</p>	<p>Diesel engines work in a similar fashion to gas engines with the key difference being that diesel fuel is injected into the cylinder after compression of the air has taken place, and automatically ignites as a result of the high temperature of the compressed air.</p> <p>Engines are generally rated for a continuous power output but can exceed this by stated amounts for shorter periods of time in modes named Standby (1hr maximum) and Prime (12hr maximum). These higher power outputs come at the cost of higher emissions and greater equipment stress.</p>
Start-Up Time⁵	1 – >3.5 hours	15 -30 minutes	As low as 1 minute	1-10 minutes	<10 minutes



	Combined Cycle Gas Turbines (CCGT)	Open Cycle Gas Turbines (OCGT)	Aero Derivative Gas Turbines ⁴	Gas Engines	Diesel Engines
Thermal Efficiency (LHV%)	58.8-60.7	38.3-39.9	35-39	35.0-45.0	35.0-37.0
Notes	The secondary steam turbine increases the start-up time of the facility, as it requires slow warming. The complexity and footprint of a combined cycle, combined with the efficiency of steam cycles only being high at relatively large capacities means that CCGT systems are only suitable for large facilities (c.100MW+)	The significant amount of heat lost in the exhaust gas makes open cycle gas turbines significantly less efficient than combined cycle systems.	As with the open-cycle gas turbine, heat loss in exhaust gases means these systems are not as efficient as other options. Certain enhancements can be added, e.g. steam injection, but these are relatively novel and difficult to apply in a non-continuous scenario.	Gas engines are proven, reliable technology and are known to perform well and emit relatively low amounts of NO _x , SO _x and particulates when compared to diesel fired engines.	Diesel engines, unabated, emit relatively high amounts of SO ₂ and particulate matter as well as NO _x . The use of low sulphur fuel, catalysts and particle filters can reduce this but diesel engine emissions are considerably higher than other options.

⁴ GE Power Systems, Aero Derivative Gas Turbines – Design and Operating Features

⁵ Note that this is based on typical industrial facilities.



10.2.1 Technology Selection

Gas Turbines

As per Table 10-1, CCGTs are not considered BAT for the provision of emergency/standby power. This is due to their lengthy start up times and their size limitations; the efficiency of steam cycles being relatively low at small capacity and the overall system complexity being more appropriate to larger size installations.

OCGTs have relatively high capital investment, operating and maintenance costs and lower thermal efficiencies than can be achieved by CCGTs and gas engines.

Aero derivative gas turbines can achieve suitably short start-up times of as low as one minute, however they suffer from relatively low efficiencies compared to engines and the enhancements which have recently become available to improve these are relatively novel and unproven. This is especially applicable for non-continuous operation, where steam or water injection may become a problem as a result of potential condensation within turbine sections.

Reciprocating Engines

Reciprocating engines perform well in terms of their thermal efficiencies. At the upper end of their efficiency range, gas engines have higher thermal efficiencies than diesel engines and OCGTs.

Reciprocating engines also have shorter start up times and are thus more suitable for the provision of emergency/standby power. Under standby conditions, higher emissions are produced, including NO_x, SO₂ and Particulate Matter as soot.

Gas engines benefit from lower NO_x emissions than diesel engines and can utilise gas delivered by the national gas grid, avoiding the additional transport and fuel storage issues associated with diesel systems.

Reciprocating engines fired on diesel fuel oil have a high response (i.e. low start-up duration) and good independent performance reliability due to the on-site storage of diesel fuel in sufficient quantities, which will be managed and controlled by the facility, with the option for fuel oil to be sourced from more than one supplier for delivery to the site. Diesel-fired engines do have a large number of moving parts which can be subject to failure and require regular ongoing maintenance to ensure reliability, however these moving parts can be readily obtained and replaced and are typically included as part of the service agreement with the generator vendor. Due to the number of moving parts, diesel generators when operated can be noisy and generate vibration.

When compared to gas-fired generators diesel engines produce polluting emissions to air, most notably NO_x and particulate matter, which can impact local air quality if operated for prolonged periods of time.

Final Choice of Engine

From the above options, and considering all the aspects required of the plant to provide emergency/standby power for the data centre, diesel engines have been determined as BAT on the basis that:

- These engines provide a fast response speed to the required load; as stated previously, fast start-up of standby generators for data centre is fundamental as an almost instantaneous supply of electricity is required in the event of power loss to the site.



- Diesel engines have low maintenance costs and replacement parts are readily available.
- The need for a reliable supply of fuel (diesel) is essential to ensure reliance, the on-site storage of sufficient quantities of diesel fuel provides the required level of independent performance reliability.

In addition, the diesel engines will allow for the use of HVO as an alternative fuel without having any detrimental impact on the engine.

The storage of gas on-site as a fuel source will not be possible due to restraints on available space, additionally there are significant health and safety risks associated with such storage. As such, there will be reliance on an off-site supply of gas, which would have to be provided to the site via a pipeline which would be operated and maintained by others. Should this supply of gas be interrupted there will be no emergency back-up generation for the data centre, and as such would not meet the resilience requirements of the facility.

10.3 Data Centre BAT: Emissions

The '*Data Centre FAQ Headline Approach*' specifies the BAT emissions specification for new diesel-fired reciprocating engines as 2g TA-Luft or US EPA Tier II (or equivalent standard).

The proposed generators to be installed are MTU 20V4000 DS3300 (engine model 20V4000G34F) engines. The manufacturer specification states these engines are optimised for reduced emissions and fuel consumption. An emissions data sheet for the proposed generators is available which presents NO_x emissions at a range of generator loads. BAT requires new generators to be 2,000mg/m³ NO_x between 67% and 87% of peak loading (i.e. a typical emergency load). Based on the emissions data provided for the MTU engine, the NO_x emissions at 75% are reported at 1,553mg/kg and hence are considered to be BAT compliant. Written confirmation from the generator manufacturer is also available confirming that the generator is 2g TA Luft compliant (refer to the SBG manufacturer specifications and written confirmation from the manufacturer in Appendix B for details on emissions).

The operator will report the following to the EA (annually):

- the operating hours of each SBG for planned maintenance and testing;
- the total operating hours of all SBGs for emergency use and the number of emergency occurrences; and
- the annual amount of fuel used.

Given the short start-up and shutdown times for diesel engines, the SBGs are regarded, for the purposes of determining operating hours, as commencing operation at the first fuel ignition. This is taken to include the shorter periods of plant 'overlap' when engines provided as redundancy are started as a precautionary measure before final load is reached with the optimum/minimum number of SBGs.

10.4 Data Centre BAT: Stacks

Data Centre FAQ Headline Approach states that data centres usually have very low-profile sites and as such can have short, below roof level emission stacks which can impact on the efficiency of dispersion of emissions. BAT is that release stacks are vertical to aid the dispersion of emissions from the SBGs.

By elevating stack heights it is possible to increase the dispersion of exhaust gases as a result of mixing with the surrounding air once the plume of exhaust gases leaves the stack. Whilst this will not reduce the concentration of pollutants leaving the stack, it will result in a lower concentration at ground level – i.e. a lesser impact on the receptor. Increasing the



stack height also avoids the effects of building wake and entrainment of the emissions in the locality of the emission source. The use of taller stacks does have an impact on the operation of the engine(s) as it will marginally increase the back pressure on the engine.

By bringing together the exhaust streams for multiple engines, it is possible to improve the mixing of flue gases with the surrounding air. This aggregation does not decrease the absolute quantities of NO_x emitted but does lead to a lower concentration at ground level – i.e. a lesser impact on the receptor.

The reduction in ground level concentration is achieved through improved mixing with the surrounding air once the plume of exhaust gases leaves the stack. A higher mass flowrate of gases will result in a greater momentum that increases the final height of the plume after it has left the aggregated stack. This increased mixing leads to a lower concentration of pollutants at receptors.

Each SBG will have a dedicated stack to aid the dispersion of the engine flue gases (for further details, please see the Air Emissions Risk Assessment (416.066815.00001 AERA)):

- The stack release heights for the proposed SBGs at the data centre will be 26m above ground level (agl).

The stacks will be vertical; each stack will be 26m in height to the top of the proposed risers.

The AERA has taken into account the profiles and heights of all the stacks and building downwash impacts at the data centre and has concluded that:

- For planned maintenance and testing and commissioning (cumulative with testing and maintenance) significant impacts are not predicted on air quality;
- Commissioning of the 32 proposed SGBs will not result in adverse impacts on air quality; and
- For operation of the SBGs under an emergency (brown- or black-out) scenario modelled at 72 hours, on identified local human receptors and designated ecological receptors. Exceptions to this include potential exceedances of the 1-hour mean (<5% probability) and 10-minute (>5% probability) NO₂ AEGLs at some of the modelled human receptor locations and potential exceedances of the daily mean NO_x CLe at most of the designated ecological sites when assuming a >24-hour outage duration
- This assumes the emergency outage is >24 hours which as previously stated, it is recognised that such a prolonged emergency scenario is highly unlikely.

Further air emissions controls are not considered necessary as, given the very low probability of emergency operation at the site, the overall environmental risk is not considered to be significant⁶.

10.5 Data Centre BAT: Electrical System Reliability

Section 4.3 provides a description of the on-site electricity supply system for the data centre which has been implemented to service the 'customer load' that, in addition to the SBGs, incorporates physical connections to the local transmission network/EfW facility/potentially SOFC (to allow for the failure of any single connection).

The electrical system for the data centre will provide significant protection against the failure of (or fluctuation in) the electrical supply to the site before it would become necessary to start the SBGs.

⁶ Refer to Air Emissions Risk Assessment (SLR Ref: 416.066815.00001 AERA) and Environmental Risk Assessment (SLR Ref: 416.066815.00001 ERA)



The operator will ensure information security at the data centre is managed in accordance with ISO 27001:2013 standard.

Operation of the SBGs will in the main be limited to maintenance and testing. The operator will implement a programme of planned maintenance and testing of the SBGs, in accordance with manufacturer requirements, to limit unplanned maintenance/testing of the generators and thus avoiding the unnecessary use of diesel and the generation of emissions to air.

10.6 Data Centre BAT: Air Quality Action Plan

The operator will develop Air Quality Action Plan (AQAP).

The AQAP will detail the management actions to be taken in the event of an emergency outage of the national electricity transmission system that could result in the prolonged usage of the SBGs which could potentially result in adverse impacts on local air quality.

The operator will liaise with the Local Authority and the Environment Agency to agree actions to be taken in the event of a prolonged outage situation (>18 hours) and a finalised plan will be incorporated into the site's EMS.

The operator will maintain open lines of communication with the Local Authority, particularly to manage any risks that may be identified in the future as becoming significant threats to the local air quality, for example identification of new emissions sources (cumulative impacts) or potential for future site expansion.

10.7 Data Centre BAT: Fuel Storage

Fuel will be stored in belly tanks within the container units for each of the 32 new SBGs. There will be no bulk storage of fuel at the data centre.

The SBG plant area and the two SBG refuelling laybys will be hard surfaced with concrete, this minimises the risk of percolation of any unplanned fuel releases to the underlying soil and groundwater.

To minimise the risk of unauthorised access, the data centre will have a 24/7 security team on site as well as a site access control system including card readers and biometric readers at the entrance. There will be site perimeter security measures including razor wire, anti-dig perimeter fencing and man trap entry. There will also be CCTV surveillance.

The perimeter will be surrounded by a continuous 3m high galvanised steel palisade fence, separating it from the adjoining Viridor facility and the public realm, with guard houses and bi-folding speed gates at each of the two entrances.

10.7.1 SBG Belly Tanks

The SBGs (each with a capacity of c. 25,000 litres) will be housed within modular container units.

A belly tank will be located beneath each SBG within the container unit, which will automatically supply fuel to the SBG. Whilst detailed design is not currently available, the belly tanks will be designed and constructed in accordance with BS799-5:2010 Oil Burning Equipment Carbon Steel Oil Storage Tanks. The belly tanks will have primary and secondary containment in line with CIRIA 736.

Each belly tank for the MTU SBGs will be fitted with:

1. Level gauges.
2. High and low level alarms connected to a BMS.
3. A pressure delivery over-fill prevention valve.



4. Leak detection alarms connected to a BMS.
5. Pressure relief valves to prevent over pressurisation of diesel supplied from the belly tanks.
6. All pipework will be painted or constructed with corrosion resistant material to minimise the risk of corrosion.

In addition to the above protection measures, in terms of fire protection measures the SBG container units will have a fire cut off cable that switches the SBG off in the event of fire and a flame detection which will be connected to the data centre's control room via the BMS.

10.7.2 Bulk Tanks

There will be no bulk storage of fuel at the data centre.

10.7.3 Fuel Delivery

Diesel will be delivered by bulk fuel tanker by an approved third party supplier.

Two dedicated SBG refuelling laybys will be provided for the bulk delivery of diesel or HVO, located on the east and west sides of the SBG plant area. Bulk tankers will be required to park and connect to fill points, located in lockable cabinets with drip trays, in the wall of the plant enclosure. The fuel delivery pipework will feed into each individual SBG belly tank. The fuel delivery pipework will run above ground and will be double walled with leak detection based on pressurisation levels in the interstitial space between the pipework walls. Full design details of the fuel delivery system will be provided once available.

A fuel delivery procedure will be developed and included within the EMS.

10.7.4 Tertiary Containment

The SBG compound will be surfaced with concrete and be contained by a bund wall (c. 150mm in height) on three sides and a ramped entrance. Within this bunded compound will be three floor drainage gullies which will capture run-off from within this area, each draining to a manhole which will be fitted with a sensor to detect hydrocarbons and ethylene glycol. The sensors, which will be connected to the BMS, will in the event of detection, automatically close off the manholes to prevent the discharge of potentially contaminated water from the compound entering the surface water drainage system.

The refuelling laybys will be concrete surfaced with raised kerbing around the perimeter and will be cambered so that any runoff drains towards a drainage channel on the outermost edge of each of the concrete layby areas. Each of these drains will direct the runoff from the layby area via the surface water drainage system to one of two newly installed full retention Class 1 forecourt petrol interceptors.

Any unplanned release of diesel or HVO would be prevented from percolating into the ground by the surface hard standing. Should such a release enter the on-site surface water drainage system it would be captured by the alarmed manholes and/or interceptors. The alarms will be connected to the BMS and will notify key data centre staff. In such an event, spillage procedures would be implemented.

Further details of the surface water drainage system and interceptors are provided in section 6.2 Emissions to Water.

10.7.5 Preventative and Predictive Maintenance (PPM)

The operator will have a planned preventative maintenance (PPM) system in place. PPM will be managed and completed by facilities management personnel and appointed approved



third-party specialists, as required. The PPM system will be used to inform facility management personnel of plant status and any system issues.

The PPM system will include the requirement for regular inspection, maintenance and testing of containment on the fuel storage tanks, along with regular checks of the condition of tertiary containment at the site.

Regular visual inspections will be carried out in accordance with the PPM to confirm the integrity of storage tanks/bunds, spill prevention and protection equipment, and to identify any unsafe conditions.

The facility will be manned 24 hours a day by data centre personnel with a minimum of 1 employee on site at all times.

It is considered that fuel delivery and storage arrangements are BAT.

11.0 CONCLUSION

Based on the above discussions, it is considered that the SBGs and associated fuel storage arrangements at the data centre will be operated and maintained in accordance with all relevant BAT.





Appendix A EA Enhanced Pre-application Advice

Environmental Permit Application

Best Available Techniques and Operating Techniques

Avonmouth Data Centre Limited

SLR Project No.: 416.066815.00001

Guidance on Air Dispersion Modelling for Back-up Engine Arrays at Data Centres (IED Chapter II)

1. Introduction

- 1.1 This pre-application guidance sets out the Environment Agency's approach to air dispersion modelling for arrays of back-up engines at Data Centres regulated under Chapter II of the Industrial Emissions Directive (IED).
- 1.2 It is intended to support Applicants and their consultants in preparing air dispersion modelling assessments for environmental permit applications and variations, and to promote consistency in the assessment of impacts from routine testing and emergency operation of back-up engines.
- 1.3 The focus of this document is back-up engines for Data Centres, however the principles and approaches outlined here are also applicable to any other installation with an array of back-up gas oil engines.
- 1.4 This document does not replace existing guidance but aims to consolidate and clarify key requirements. It should be read in conjunction with current guidance, including:
- [Emergency backup diesel engines on installations: best available techniques \(BAT\) - GOV.UK](#),
 - [Air emissions risk assessment for your environmental permit - GOV.UK](#),
 - [Environmental permitting: air dispersion modelling reports - GOV.UK](#),
 - The supplementary combustion sector (Part A installations) basic pre-application advice
- 1.5 In the event of any contradictions, the published GOV.UK guidance takes precedence.

2. Operational Scenarios – routine testing, emergency, and commissioning

2.1.1 Your modelling must include both testing and emergency use operating scenarios. Modelled scenarios must represent a reasonable 'worst-case' arrangement of plant, taking account of the location of engines in relation to sensitive offsite receptors.

2.2 Routine testing

2.2.1 Routine testing represents operation of the back-up engines during regular testing and maintenance procedures. Back-up engines are limited to a maximum of 50 operating hours for their routine testing per engine per year. Testing should be minimised where practicable, and it is expected that sites will operate well within

Appendix A to the Supplementary Combustion Sector (Part A Installations) Basic Pre-Application Advice Document

this threshold. BAT is to minimise how much you test the engines and to only test one engine at a time. See Section 5.3

2.2.2 You must complete a table for **each** testing scenario (provided in Annex 1 of this document) and provide the following:

- Total number and identification of the specific engines operated during each test.
- Frequency and duration of the test.
- Engine loading.
- Confirmation of whether engines are tested together or individually.
- Confirmation of the maximum number of engines which could reasonably operate within the relevant pollutant averaging periods (i.e. 1-hour or 24-hour).
- Where Selective Catalytic Reduction (SCR) is installed, explain whether the engines are being tested with or without active SCR and the duration of the SCR cold-start period (see Section 5.4).

2.2.3 The routine tests you identify in your permit application must be clearly reflected by your air dispersion modelling scenarios. You should only model the testing you propose to undertake.

2.2.4 You must identify any potential overlap of routine tests within the relevant pollutant averaging periods (such as the 1-hour or 24-hour periods), as overlapping tests may combine to produce higher short-term emissions. Any overlap must be fully accounted for in your modelling.

2.3 Emergency/Loss of Off-Site Power (LOOP)

2.3.1 An emergency or 'Loss of Off-Site Power' (LOOP) operational scenario must also be considered within your modelling. In line with our guidance ([Air emissions risk assessment for your environmental permit - GOV.UK](#)), you must include a worst-case modelling scenario based on a full-load response lasting for 72-hours. The 72-hour duration is derived from national 'black start' contingency planning for a major power failure.

2.3.2 Emergency operation modelling should be representative of a realistic loss of off-site power scenario at your installation. Where your modelling assumes either fewer than all permitted engines operating, or operation at less than 100% load, you must provide a clear justification for this in your assessment report.

2.3.3 The total capacity of fuel storage tanks cannot be used to justify a shorter duration emergency scenario.

2.3.4 Your report must also include an assessment of grid reliability to demonstrate the likelihood of a power outage. This may include:

Appendix A to the Supplementary Combustion Sector (Part A Installations) Basic Pre-Application Advice Document

- Historical performance data for the local electricity network, including frequency and duration of outages.
- Any relevant national or local reliability standards or published metrics.
- How many engines will operate with the loss of each separate grid connection.

2.4 Commissioning

- 2.4.1 In the case of new engines, commissioning tests must also be considered within your air quality assessment. Where it can be demonstrated that the operational scenarios modelled for routine testing are equivalent to or worse than commissioning, commissioning does not need to be modelled separately.
- 2.4.2 If commissioning details are not included in the application, Applicants will be required to provide a commissioning schedule and/or risk assessment as a pre-operational condition.

3. Pollutants

- 3.1.1 The greatest air quality risks from arrays of back-up engines typically arise during short-term operation, although annual impacts must also be assessed.

3.2 Main pollutants

- 3.2.1 In the case of engines running on gas oil or agreed substitute fuels such as Hydrotreated Vegetable Oil (HVO), Applicants should consider emissions of oxides of nitrogen (NO_x and NO_2) in their air quality assessments.
- 3.2.2 If your back-up engines aggregate to 50MWth or more, you must also assess against the short-term nitrogen monoxide (NO) EAL (1-hour 100th percentile).
- 3.2.3 If SCR is proposed, then we also expect you to consider annual and 1-hour ammonia (NH_3), to account for ammonia 'slip'. You must justify the NH_3 emission concentration used in your assessment.
- 3.2.4 Consideration of other pollutants (e.g. sulphur dioxide, particulate matter), is only necessary if there is a relevant short-term air quality management area (AQMA) for the pollutant of concern within 2km of the installation.

3.3 Acute Exposure

- 3.3.1 The operation of arrays of standby engines can lead to very high peak concentrations at sensitive human health receptors. You will need to provide an assessment against the US EPA Acute Exposure Guideline Levels (AEGLs) to determine if acute concentrations of NO_2 may be high enough to cause health effects and associated risks to members of the public.
- 3.3.2 AEGLs provide scientifically derived thresholds for various exposure durations, including very short periods such as 10 minutes, which are particularly relevant

Appendix A to the Supplementary Combustion Sector (Part A Installations) Basic Pre-Application Advice Document

when evaluating peak emissions from back-up engine operation. Although AEGLs are not a regulatory requirement in England, they are widely recognised as indicative benchmarks for assessing short-term health impacts during emergency or incident response.

- 3.3.3 Your acute exposure risk assessment should compare the 100th percentile predicted environmental concentrations (PECs) of NO₂ against the AEGLs. See Table 1 and [Air emissions risk assessment for your environmental permit - GOV.UK](#).

3.4 Ecological receptor assessments

- 3.4.1 You must assess against the relevant long- and short-term critical levels and the nutrient nitrogen and acid deposition critical loads for any relevant ecological designation, for both routine testing and emergency. For reference, critical levels are presented in Table 1 (and [Air emissions risk assessment for your environmental permit - GOV.UK](#)). Critical loads are habitat-specific; refer to www.apis.ac.uk for relevant values.
- 3.4.2 If you are proposing to use your own critical loads or levels, you must provide sufficient evidence to support this.
- 3.4.3 The greatest ecological risks from back-up engines typically relate to the 24-hour NO_x critical level. You should apply the critical level of 75 ug/m³, recommended in Chapter 11 of the WHO Air Quality Guidelines for Europe¹, in the first instance for all detailed modelling assessments.
- 3.4.4 If you predict exceedances of the critical level of 75 µg/m³, you can then assess against the higher daily NO_x critical level of 200 ug/m³, provided ozone (O₃) is below the AOT40 (accumulated ozone exposure above a threshold concentration of 40 ppb) of 6,000 ug/m³, calculated from 1-hour concentrations over the defined growing season, and SO₂ is below the lower critical level of 10 ug/m³ at the ecological receptor of relevance.

¹ World Health Organisation (WHO). 2000. Air Quality Guidelines for Europe. <https://iris.who.int/handle/10665/107335>

Appendix A to the Supplementary Combustion Sector (Part A Installations) Basic Pre-Application Advice Document

Table 1: Averaging periods and relevant standards for Data Centres								
Pollutant	Averaging period	Relevant standards ($\mu\text{g}/\text{m}^3$)						
		10 min	30 min	1-hr	4-hr	8-hr	24-hr	Annual
Human health								
NO₂	Annual							40
	1-hour (99.79 th percentile)			200				
	AEGL-1 ^{Note 1}	940	940	940	940	940		
	AEGL-2 ^{Note 1}	38,000	28000	23,000	15,000	13,000		
	AEGL-3 ^{Note 1}	64,000	47,000	38,000	38,000	21,000		
NO	Annual							310
	1-hour (100 th percentile)			4,400				
NH₃	Annual							180
	1-hour (100 th percentile)			2,500				
Ecological								
NO_x	Annual							30
	24-hour (100 th percentile)						75 or 200 ^{Note 2}	
NH₃	Annual							1 or 3 ^{Note 3}
Nutrient nitrogen deposition	Annual							Note 4
Acid deposition	Annual							Note 4
<p>Note 1: some calculations may convert ppm to $\mu\text{g}/\text{m}^3$ under different temperature assumptions so published AEGL values may differ. The values in this table are used by the Environment Agency.</p> <p>Note 2: see paragraph 3.4.4 above.</p> <p>Note 3: 1 $\mu\text{g}/\text{m}^3$ should be selected when lichens and bryophytes are present. In other cases, use 3 $\mu\text{g}/\text{m}^3$. Refer to www.apis.ac.uk for relevant critical levels.</p> <p>Note 4: Nutrient nitrogen and acid deposition critical loads are habitat-specific; refer to www.apis.ac.uk for relevant values.</p>								

4. Alternative fuels

4.1.1 HVO is an increasingly common alternative fuel to gas oil. If you propose to operate on HVO, you should use gas oil as the basis for your risk assessment. This will provide a reasonable worst-case, as HVO is expected to produce lower NO_x emissions. Your permit will not prohibit the use of gas oil and there is no guarantee of availability of supply of HVO in the event of an outage, therefore this approach also maintains operational fuel flexibility.

4.1.2 Other substitute or ‘drop-in’ fuels for gas oil will generally be treated in the same way as HVO for modelling and risk assessment purposes. Agreement for the use of alternative fuels must be sought, on a case-by-case basis, from the

Appendix A to the Supplementary Combustion Sector (Part A Installations) Basic Pre-Application Advice Document

Environment Agency in writing. To avoid delays with determining your application, this should ideally be done via enhanced pre-application advice.

5. Best Available Techniques (BAT)

5.1 Build Standards – emissions optimisation

5.1.1 For installations subject to IED Chapter II (aggregated capacity >50 MWth), new Medium Combustion Plant (MCP) engines without abatement must be emissions-optimised to TA Luft 2g or Tier II US EPA or equivalent standards or better.

Indicative emission concentrations are:

- NO_x: 2,000 mg/Nm³ at 5% O₂ (equivalent to 750 mg/Nm³ at 15% O₂) at a typical emergency load (usually greater than 67% of standby power rating).

See [Emergency backup diesel engines on installations: best available techniques \(BAT\) - GOV.UK](#)

5.1.2 You must send copies of your engine specification sheets when you apply for your permit or variation, as these will provide evidence of these requirements and proof of BAT.

5.1.3 Please note, installing more polluting engines (e.g. 3g or 4g equivalent) and installing SCR to abate emissions is not BAT and will not be accepted.

5.2 Build standards - stacks

5.2.1 The BAT guidance also specifies that stack design should ensure effective flue gas dispersion. Stacks should be vertical and unobstructed by caps or cowls.

5.2.2 Existing engines may have horizontal stacks, which limit effective dispersion and can result in higher ground-level pollutant concentrations. Where this is the case, the assessment must clearly explain how these have been accounted for in the modelling.

5.3 Operational controls

5.3.1 When using back-up engines, you must manage the impacts on air quality to minimise harm to human health and the environment. BAT is to minimise how much you test the engines and to only test one engine at a time; see [Emergency backup diesel engines on installations: best available techniques \(BAT\) - GOV.UK](#)

5.3.2 You must fully justify any deviation from BAT, including any operational requirements to test engines concurrently.

5.4 Selective Catalytic Reduction (SCR)

5.4.1 Where SCR is proposed, the NO_x emission concentrations from the back-up engines will be lower. You must set out the achievable ELV in your application. Although there is no fixed ELV, an indicative benchmark of 190 mg/Nm³ (at 15%

O₂) is often applied; concentrations as low as 35 mg/Nm³ may be achievable in some cases.

- 5.4.2 Where catalysts are not pre-warmed, the SCR ‘cold-start’ period must be accounted for in your emission assumptions. This typically lasts 5–10 minutes at the start of operation, during which NO_x emissions will be higher.

6. Post-processing modelling outputs

- 6.1.1 All assumptions and calculations used in post-processing should be clearly documented and justified.
- 6.1.2 If you have run your model for a full year of continuous operation, when processing your 24-hour process contributions you should:
- Avoid factoring your 24-hour 100th percentile process contributions (PCs) by the number of hours of operation in a 24-hour period, as this may underpredict concentrations.
 - Where the daily operation is confirmed to be 10 hours or fewer, the 1-hour 100th percentile can be used as a proxy and factored by the number of hours of operation in 24 hours.

6.2 Time-varying emissions file use

- 6.2.1 Where operation is known to occur only during specific hours, time-varying emission factors can be applied to restrict the modelled hours of operation, potentially limiting the hours of exceedance.
- 6.2.2 A time-varying emissions file can account for operational variability throughout the year, but this approach relies on the emissions profile being representative of reality and reflecting a realistic worst-case assumption. Any use of a time-varying file must be fully evidenced and justified in your report.

6.3 Statistical Analysis

- 6.3.1 If your initial modelling indicates that short-term NO₂ concentrations may exceed the air quality standard, you should use a suitable statistical analysis method to estimate the probability of exceedances.
- 6.3.2 Statistical analysis should only be applied where there are a maximum number of permissible exceedance hours (i.e. the NO₂ short-term air quality standard, with 18 permissible exceedance hours (99.79th percentile)) and should not be applied to the NO₂ AEGL or 24-hour NO_x assessments.
- 6.3.3 Statistical methods such as Hypergeometric Probability Distribution Analysis or a Monte Carlo Simulation may be used to calculate the probability of the NO₂ short-term air quality standard being exceeded, accounting for the number of operating hours and permissible hours of exceedance.

Appendix A to the Supplementary Combustion Sector (Part A Installations) Basic Pre-Application Advice Document

- 6.3.4 The web guidance [Specified generators: dispersion modelling assessment - GOV.UK \(www.gov.uk\)](http://www.gov.uk) provides a methodology to assess the operating envelope and operational hours using hypergeometric probability distribution analysis to support assessment of compliance, particularly where engine operation is limited to a small number of hours each year. The guidance highlights that, in such cases, it is appropriate to use statistical methods to assess the likelihood of exceeding the permitted number of exceedance hours and provides advice on selecting and applying these techniques.
- 6.3.5 The short-term Environmental Standard for NO₂ permits up to 18 hours of exceedance per year (99.79th percentile). If all testing occurs for a total of 18 hours or less annually, it is not possible to breach this standard, so no statistical analysis is needed. Be aware that some tests may not exceed this threshold when modelled in isolation but may exceed when multiple tests are considered (e.g. 22 hours of exceedance with 9 hours of exceedance from Test 1 and 13 hours of exceedance from Test 2). All test scenarios must be included when calculating the total number of potential exceedance hours in your modelling.

6.4 Probability outcomes

- 6.4.1 Statistical analysis results should be interpreted as follows:
- 1% or less: Exceedances are considered highly unlikely.
 - Less than 5%: Exceedances are unlikely, assuming plant operational lifetime of no more than 20 years.
 - More than or equal to 5%: There is potential for exceedances, and the Environment Agency will consider the acceptability of this risk on a case-by-case basis.

7. Modelling outcome

- 7.1.1 If you predict short-term exceedances of the 1- hour NO₂ (99.79th percentile) air quality standard, you should undertake statistical analysis (Section 6.3).

7.2 Routine testing

- 7.2.1 Routine testing scenarios will not be permitted if modelling and statistical analysis (where required) indicates an exceedance of the environmental standards. Exceedances of the AEGLs may be acceptable; however, substantial exceedances are unlikely to be allowed where the Environment Agency considers that reasonable additional measures could be applied to reduce impacts.
- 7.2.2 If your modelling, or our subsequent audit, predicts that exceedances are likely for testing, you will need to propose additional measures to reduce emissions. This may include, but not be limited to:

Appendix A to the Supplementary Combustion Sector (Part A Installations) Basic Pre-Application Advice Document

- Revising testing regimes to align with BAT (reducing the number of engines operating in groups, and/or their operating duration - see Section 5).
- Increasing stack heights.
- Replacing any horizontal stacks with vertical stacks.
- Including SCR (of limited effectiveness for short-term tests unless catalysts are pre-warmed).

7.2.3 You will need to resubmit your air quality modelling assessment to demonstrate that exceedances no longer occur.

7.3 Emergency

7.3.1 Some exceedances of the environmental standards may be permissible for the emergency scenario. Substantial exceedances will not be acceptable, however, particularly where the Environment Agency considers that reasonable additional measures could be applied to reduce impacts.

7.3.2 If modelling predicts exceedances for emergency use, the grid reliability likelihood assessment in section 2.3.4 should be followed.

7.3.3 All Data Centre installations are required, via an improvement condition, to develop a site-specific Air Quality Management Plan (AQMP) that identifies the emergency operating conditions under which local air quality may be adversely affected and the measures that will be taken to minimise impacts at sensitive receptors.

8. Ecological receptors

8.1.1 You must consider the impact of your site on protected conservation areas in your assessment. These include European designated sites (Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Ramsar sites), Sites of Special Scientific Interest (SSSI), and local nature sites (ancient woodland, local wildlife sites, and national or local nature reserves).

8.1.2 See [Air emissions risk assessment for your environmental permit - GOV.UK](#) for the relevant screening distance for air emissions on protected conservation areas.

8.1.3 The Environment Agency can provide free basic advice before you apply for an environmental permit, this includes information on whether your activity may have an impact on nature conservation sites, or protected species and habitats. We can also give you enhanced advice for more complex requests – this is a service you pay for. [Get advice before you apply for an environmental permit - GOV.UK](#).

Annex 1 - Testing regime template tables

You must complete a separate table for **each** test scenario and submit these with your application.

Name of test: <i>[e.g. Building 1 test]</i>							
Number and location of engines: <i>[e.g. 8 engines located at Data Hall 1 (DH1), emission points A1-A8]</i>							
Frequency	Duration	Engine loading	Tested concurrently or consecutively?	Maximum number of engines operated in any:		Where Selective Catalytic Reduction (SCR) is installed/proposed:	
				1hr	24hr	SCR operational during test?	SCR warm-up time
<i>[e.g. monthly – first Wednesday of the month]</i>	<i>[e.g. 10 minutes per engine]</i>	<i>[e.g. 50% load]</i>	<i>[e.g. each engine tested individually (consecutive operation)]</i>	<i>[e.g. 6 engines]</i>	<i>[e.g. 8 engines]</i>	<i>[e.g. No – SCR installed but not utilised for this test due to warm-up times]</i>	<i>[e.g. N/A – SCR installed but not utilised for this test]</i>

Name of test: <i>[e.g. Annual Black Building Test]</i>							
Number and location of engines: <i>[e.g. all 32 standby engines, across 4 data halls (DH1–DH4), emission points A1-A32]</i>							
Frequency	Duration	Engine loading	Tested concurrently or consecutively?	Maximum number of engines operated in any:		Where Selective Catalytic Reduction (SCR) is installed/proposed:	
				1hr	24hr	SCR operational during test?	SCR warm-up time
<i>[e.g. Annual – during 1st week of June – no more than two data halls per day.]</i>	<i>[e.g. 30 minutes per data hall]</i>	<i>[e.g. 100% load]</i>	<i>[e.g. All engines run concurrently for 30 minutes. Limited to two data halls per day. Data halls not tested simultaneously.]</i>	<i>[e.g. 8 engines]</i>	<i>[e.g. 16 engines]</i>	<i>[e.g. Yes – SCR operational where installed (data halls 1, 2, and 3 only, emission points A1-A24)]</i>	<i>[e.g. 10 minutes]</i>

Maria Francis

Date: 24/03/2026

Avonmouth Data Centre Limited

By email

Dear Maria

Pre application advice – Enhanced service

Pre-application reference EPR/ZP3925MP/P001

Site: Avonmouth Data Centre

Thank you for your pre application enquiry on 13/02/2026.

I am pleased to provide you with your pre-application advice. This advice is based on the information provided on your pre application advice request form and our meeting on 23/03/2026.

Our advice is provided in the right-hand column in the table below (reproduced from the agenda):

Item	Description	Advice
1	Permit application overview	-
2	EA to confirm regulatory permitting approach for the solid oxide fuel cells to be installed at the facility.	Based on the information provided, these would not be permitted, either as an EPR activity or as a directly associated activity to the combustion activity.
3	<p>EA to confirm the scope of the application contents. SLR understand this to be at this stage:</p> <ul style="list-style-type: none"> • Application Forms (Parts A, B2, part B2.5, B3, F1 and MCP Spreadsheet) • Non-Technical Summary • Drawings • Environmental Risk Assessment • Air Emissions Risk Assessment • Noise Assessment • Best Available Techniques and Operating Techniques; and • Site Condition Report. <p>Please confirm any additional supporting documents / assessments required.</p>	<p>These are the correct forms and documents which should be submitted.</p> <p>The Part B2.5 form is not required as it is for stand-alone MCP applications.</p> <p>If the Noise Impact Assessment outcome shows that a Noise Management Plan (NMP) is required, then this should be provided,</p>
4	Discussion regarding site condition report and operator timelines for undertaking soil and groundwater investigations.	<p>There was a consultation on revised H5 guidance - now closed and the responses are being considered. This should be published in next few months.</p> <p>If a final baseline is not submitted with the application, then a pre-operational condition</p>

Item	Description	Advice
		will be added to the permit for this to be provided.
5	<p>EA to confirm application fee</p> <ul style="list-style-type: none"> We anticipate that the application will be classed as a new application and subject to a fee of £19,103 in accordance with Table 1.10, reference 1.10.1 of the EA Charging Scheme. There may be an additional fee for a Habitats Assessment of £779. 	<p>If the application is made after 1st April, then the application fees will increase by 3.8%. If before, then the fees quoted are correct.</p> <p>If a NMP is required, then an additional fee for the plan assessment will be required based on charge table reference 1.19.7 £1,246 (plus 3.8% if after 1st April)</p>
6	<p>EA to confirm key technical standards to follow (including those listed below) and please confirm if the data centre FAQ's as per the below is the most up to date version.</p> <ul style="list-style-type: none"> Data Centre FAQ Headline Approach, DRAFT version 21.0 H.Tee 15/1/22. Data Centre Air Quality Appendix to Combustion Pre App v1.1_external circulation 	<p>In addition, the BAT assessment should include details of the back-up engine standards which is referenced in the pre-app guidance: Emergency backup diesel engines on installations: best available techniques (BAT) - GOV.UK</p> <p>A statement to say what standard is being met will be required.</p> <p>The FAQ v 21 is the latest version, although it is dated 15/11/2022.</p> <p>The Data Centre specific pre-application guidance sets out what we expect to be included in the Air Quality assessment together with other guidance on what should be included in a data centre application. This guidance should be followed when preparing an application.</p>
7	<p>EA to confirm timescales for determining the environmental permit application</p>	<p>Within 2 to 4 weeks of receipt, an application is allocated to an officer for validation (duly making). That officer also arranges external consultation on the application and adds the AQ and Noise assessments to our specialist team's queue for audit.</p> <p>Once it is duly made, the application is returned to our work queue. Currently applications are allocated for determination within 1 to 2 months.</p> <p>The determination time depends on the quality of the application and how many requests for further information or revised modelling are required. Our AQ audit queue is currently about 3 to 4 months, but the determination officer will assess the other aspects of the application while they wait for the AQ assessment to be audited.</p>

Item	Description	Advice
		Overall, an applicant can expect that an application takes about 8 months to be determined from when it was received.
8	AOB	As the permit boundary for the data centre would include an area subject to a part surrender on the EfW permit, it would make sense to link the two applications together. If the covering email for each application referred to the other, the officers checking the applications can make a note on each application record on our systems that the two applications should be considered together. However, this could only occur if the applications were made at a similar time.

What this enhanced pre application advice covers

As part of this service, we have provided you with the above information together with a conservation screening report which is attached.

After you apply

The information that you need to submit with your application is explained in the application form and its guidance. The Environment Agency will check that you have submitted this information and the correct application charges. This is to ensure we have enough information to start to determine your permit application.

We will contact you if information is missing and can feasibly be provided within 10 working days. If we consider information cannot be provided within this time frame we will return your application with a list of what is missing.

We'll retain 20% of the correct application charge to cover our costs in reviewing your application and requesting information. This maximum amount we'll retain is capped at £1,613. This is explained in the environmental permitting charges guidance.

We will not charge this if we return an application after having done very little work – for example, because it contained obvious errors or omissions.

Once we have duly made an application we will start to determine it.

Once an application is validated and duly made, it is ready to be allocated for determination. Determination is when we do our technical checks. We may need to ask you for further information or additional documents during determination and it is important you send anything requested as quickly as possible.

The time it takes us to allocate an application depends on a number of factors, including the complexity of the specific application and the availability of a member of our team with the right skills to assess it.

The amount of time taken to determine your application will vary. It will be impacted by factors such as:

- The quality of the application

- The complexity of the application
- Whether an application is of high public interest
- Whether the application includes novel technologies or techniques
- Whether the determination requires input from others, both internal and external to the Environment Agency
- Whether modelling and/or monitoring and assessment is required, for example Air Quality modelling and assessment or water discharge or groundwater activity specific substances assessment.

The Permitting Officer determining your application will be able to keep you updated with the progress of your application.

What happens next?

If you submit an environmental permit application then please quote this pre-application reference number: **EPR/ZP3925MP/P001**.

Please send your completed application documents via email to:

psc@environment-agency.gov.uk

Please email applications where possible. If email is not possible you can submit by post to:

Environment Agency, Permitting Support Centre, Quadrant 2, 99 Parkway Avenue,
Sheffield, S9 4WF

Scope of this advice

We have only provided the specific advice you requested based on the information provided. We cannot provide advice on all aspects of your application, so it is important you read all available online guidance and the application forms to ensure anything not covered within this advice is considered as part of your application.

It is important to remember:

- this is advice, we are not agreeing anything at this stage
- we have provided this advice based on the limited information we have about your proposals at this time
- we have only provided the advice you specifically requested
- we may need to request additional information when we have a full application

Disclaimer

The advice given is based on the information you have provided, and does not constitute a formal response or decision of the Environment Agency with regard to future permit applications. Any views or opinions expressed are without prejudice to the Environment Agency's formal consideration of any application. Please note that any application is subject to duly making and then full technical checks during determination, and additional information may be required based on your detailed submission and site specific requirements and the advice given is to address the specific pre-application request.

This advice covers installations only.

Other permissions from the Environment Agency and/or other bodies may be required for associated or other activities.

Enhanced pre application cost estimate

At this stage the pre-application advice is expected to cost up to £500 plus VAT. An invoice will be sent separately. This will include a link to pay online. You can also pay your application charges online but this is a different link so please ensure you are using the correct one when you apply.

This pre-application request is now closed

We consider this pre application request is now closed. However, if you have any questions regarding this letter please contact PreApplicationService@environment-agency.gov.uk.

If you require additional enhanced pre-application advice please complete our [online form](#).

Yours sincerely

Miriam

Miriam Townshend
Senior Permitting Officer

Nature and Heritage Conservation

Screening Report: Bespoke installation – IR EPR emissions to air

Reference	EPR/ZP3925MP/P001
NGR	ST 53736 81797
Buffer (m)	100
Date report produced	23/03/26
Number of maps enclosed	1

This nature and heritage conservation report

The nature and heritage conservation sites, protected species and habitats, and other features identified in the table below **must be considered in your application**.

In the further information column, there are links which give more information about the site or feature type and indicate where you are able to self-serve to get the most accurate site boundaries or feature locations.

Most designated site boundaries are available on [Magic map](#). Using Magic map allows you to zoom in and see the site boundary or feature location in detail, Magic map also allows you to measure the distance from these sites and features to your proposed boundary. [Help videos](#) are available on Magic map to guide you through.

Where information is not publicly available, or is only available to those with GIS access, we have provided a map at the end of this report.

Sites and Features within screening distance

Screening distance (km) Further Information

Special Areas of Conservation (cSAC or SAC)

10

[Joint Nature Conservation Committee](#) and [Magic map](#)

Severn Estuary

Avon Gorge Woodlands

River Wye

Special Protection Area (pSPA or SPA)	10	Joint Nature Conservation Committee and Magic map
Severn Estuary		
Ramsar	10	Joint Nature Conservation Committee and Magic map
Severn Estuary		
Sites of Special Scientific Interest (SSSI)	2	Natural England and Magic map
Severn Estuary		
Local Wildlife Sites (LWS) (see map below)	2	Appropriate Local Record Centre (LRC) Appropriate Wildlife Trust
Moorhouse Farm and Stuppill Rhines		
Severn Estuary		
Severn Estuary SSSI (part of) - New Passage to Chittening Warth		
Hallen Marsh Junction		
Salt Rhine and Moorhouse Rhine		
Lawrence Weston Road Rhines		
Avonmouth Sewage Works and Hoar Gout		
Impool, Middle Compton and Upper Compton Rhines		

Where protected species are present, a licence may be required from [Natural England](#) to handle the species or undertake the proposed works.

The relevant Local Records Centre must be contacted for information on the features within local wildlife sites. A small administration charge may also be incurred for this service.

The following nature and heritage conservation sites, protected species and habitats, and other features have been checked for, where they are relevant for the permit type requested, but have not been found within screening distance of your site unless included in the list above.


Special Areas of Conservation (cSAC or SAC), Special Protection Area (pSPA or SPA), Marine Conservation Zone (MCZ), Ramsar, Sites of Special Scientific Interest (SSSI), National Nature Reserve (NNR), Local Nature Reserve (LNR), Local Wildlife Sites (LWS), Ancient Woodland, relevant species and habitats.

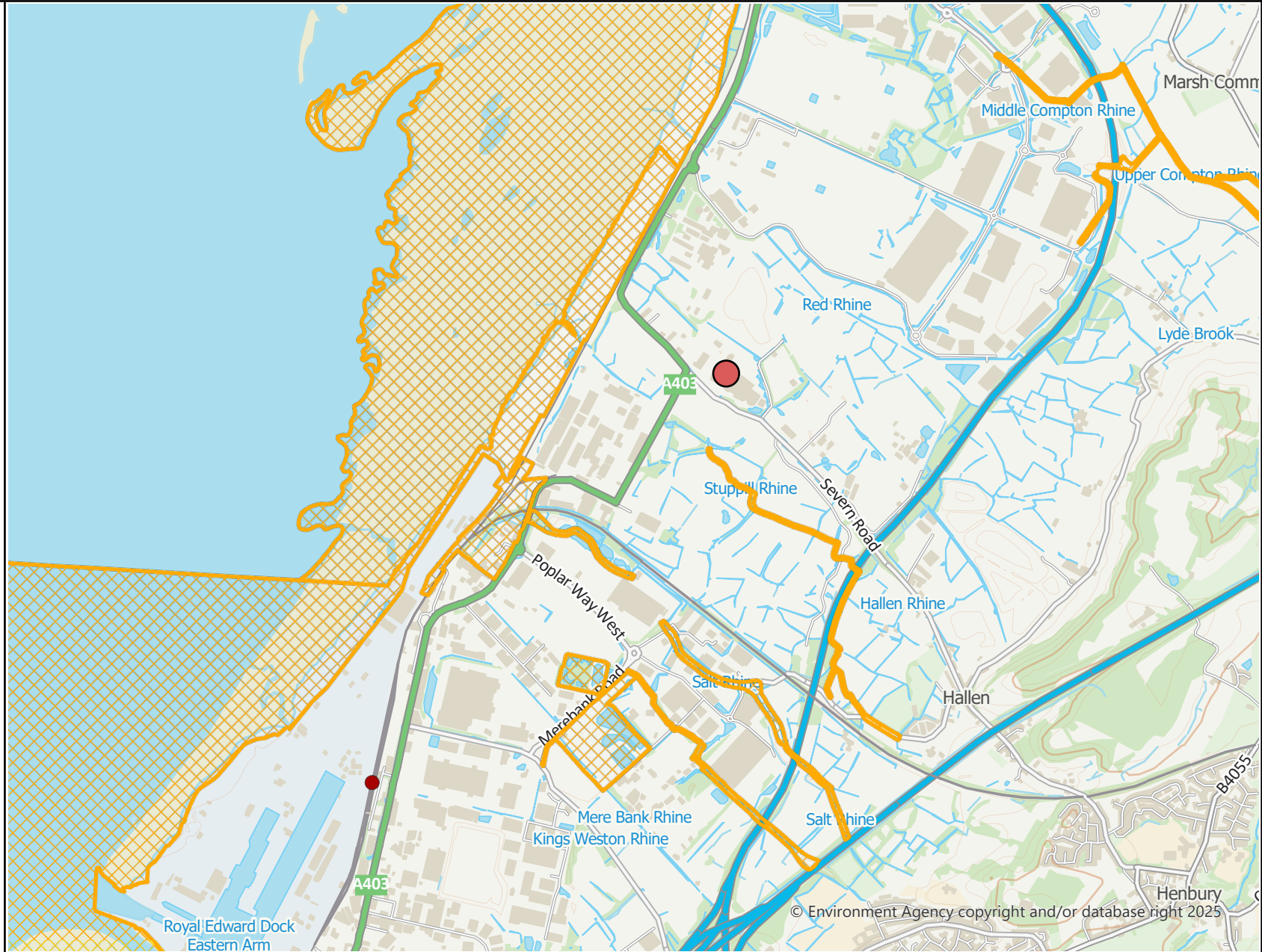
Please note we have screened this application for features for which we have information. It is however your responsibility to comply with all environmental and planning legislation, this information does not imply that no other checks or permissions will be required.

The nature and heritage screening we have conducted as part of this report is subject to change as it is based on data we hold at the time it is generated. We cannot guarantee there will be no changes to our screening data between the date of this report and the submission of the permit application, which could result in the return of an application or requesting further information.

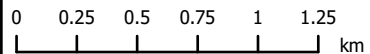
Local Wildlife Sites



Local Wildlife Sites
 Local Wildlife Sites



Scale: 1:31,305





Appendix B Engine Manufacturer Specifications

Environmental Permit Application

Best Available Techniques and Operating Techniques

Avonmouth Data Centre Limited

SLR Project No.: 416.066815.00001



Rolls-Royce Solutions UK

Unit 29, The Birches Industrial Estate,
East Grinstead, West Sussex, RH19 1XZ
United Kingdom
T +44 132 335451

AVK-SEG Limited
Power Systems House
Malvern Road
Maidenhead
Berkshire
SL6 7RE

27th June 2025

Hi George,

I can confirm that the Rolls-Royce mtu DS3300 3F NOx optimised genset will comply to 2g TA-Luft or <2000mg Nox NTE (not to exceed) as required by the UK Environment Agency.

A handwritten signature in blue ink, appearing to read 'Luke McDougall'.

Luke McDougall
Key Account Manager – PowerGen
Rolls Royce Solutions UK

A handwritten signature in black ink, appearing to read 'Ben Howkins'.

Ben Howkins
Sales Manager - PowerGen
Rolls Royce Solutions UK



Contents

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G34F				
Fuel type	EN590				
Rated power [kW]	2590				
Rated speed [rpm]	1500				
Application Group	3B 3E 3F 3G				
Legislative body	NOx emission optimized				
Test cycle	D2 +110%				
Data Set No.	XZ54954100501				
Data Set Basis	NOx emission optimized				
Fuel sulphur content [ppm]	5				

Content	Page
Disclaimer	2
Emission data sheet (EDS)	3
Not to exceed emission values	5

Description of Revision		Frequency	All industrial property rights reserved. Disclosure, reproduction or use for any other purpose is prohibited unless our express permission has been given. Any infringement results in liability to pay damages.		PDF Name Project no. Order no. EDS-ID Title Emission data sheet	Size A4
Data generated by EDS Creator version 1.0 and unipilot. Ref.-dataset: BR4000_20V4000G03_G63L - TTME.nc for 1384 in EDS platform.			Approver1 Approver2 Approver3 Approver4 User	Theiss, Sandro (TVMG) Kneifel, Alexander (TSL) Koliwer, Michael (TV) FN2\1382678	4590-09.06.2025	
Configuration-ID 1384	Documentation	Emissionstage NOx emission optimized	Engine model 20V4000G34F	Emissionstage basis NOx emission optimized	Sheet 1 of 6	



General Disclaimers (valid for Measured and NTE values)

Please note that these data are physical and/or technical values only referring to and representing a normative defined operating condition. Any change in operating time and conditions will have impact on physical values and engine behavior, which must be considered and assessed within the complete propulsion system especially in regard to emission compliance and product safety. Measurements listed in this EDS are representative of the listed engine rating at the time of testing. These measurements and results can change according to instrumentation, boundary condition, and engine to engine variability. In addition - changes to the engine family hard or software may occur which could result in changes to some of the listed values. Emissions data measurement procedures are conducted according to applicable rules and standards as per "Emission Stage/Optimization". Potential deviations from these procedures are documented internally. The listed emission values relate to the corresponding certification data. Seller doesn't take any responsibility or liability neither out or in connection with the contract nor on any other basis - beyond these specified operating conditions of the engine - and for any installation/modification of the entire propulsion system by the customer itself or any third party and the customer will indemnify RRPS on first demand for any third party claim out or in connection with this. Seller reserves the right to amend specifications and information without notice and without obligation or liability. No liability for any errors, facts or opinions is accepted. Customers must satisfy themselves as to the suitability of this product for their application. No responsibility for any loss as a result of any person placing reliance on any material contained in this data sheet will be accepted. Seller reserves all rights in the information contained in this data sheet. It shall not be reproduced, made available to a third party or otherwise used in any way whatsoever. When applicable, emission values are measured after combined exhaust streams. Measured Emissions data is based on single operating points and thus cannot be used to compare to regulations which use values based on a weighted cycle. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures, and instrumentation. Over time deterioration may occur which may have an impact on emission levels. The SO2 emission rates comprehend exclusively the SO2 content as found in the fuel source, oil consumption effects are not included. Variation of sulfur content in the fuel changes only the stated SO2 emissions, cross sensitivity to other emissions (e.g. particulates) is not possible. All values based on metric units, inaccuracies for non metric values can occur, values are not binding. Specific to gas engines: The listed emission values are based on gas composition at the time of certification measurement. Gas composition is as displayed in the EDS-document. Carbon dioxide and methane concentrations have direct influence on the corresponding displayed carbon dioxide and methane emissions.

Additional Information:

All data in this data sheet that does not relate to exhaust gas emissions serves solely to explain the boundary conditions of the respective underlying emissions measurement. They are in no way suitable for the design of the systems in which the corresponding engine is intended to be used. This particularly applies to exhaust gas temperatures, exhaust gas mass- and volume flows, exhaust back pressure, intake depression, fuel consumption, ambient air temperature and ambient air humidity.

Design data of this type can be found in the TEN data.

EAT Specific Disclaimers (valid for EDS values)

NH3 emissions levels measured with AVL SESAM i60/ 4 FT Multi Component Exhaust Measurement System (FTIR) including EPA 40 CFR 1065 legislation compliant automated checks for linearity.

Generators or engines with exhaust after-treatment systems require a stabilization period of approximately 1 hour to ensure stable temperatures across SCR prior to performing an emissions test. Performing emissions measurements before a stable temperature has been achieved can result in inconsistent emission values. NOx Values only applicable if temperatures across SCR reached for DEF Dosing.

NTE Disclaimers (valid for NTE calculated values)

Calculated not to exceed values (NTE) are not proven by tests and therefore the accuracy is not guaranteed.

All emission data shown in chapters Emission Data Sheet, Not to Exceed Values, and Type Approval were gathered from a corresponding certification engine under test conditions shown above and complying to corresponding TEN data.

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Configuration-ID		Documentation		Approver1	Kneifel, Alexander (TSL)	EDS-ID	
1384				Approver2	Kolliwer, Michael (TV)	4590-09.06.2025	
			Approver3			Title	Emission data sheet
			Approver4				
			User	FN2\1382678			
			Engine model	20V4000G34F			
			Emissionstage	NOx emission optimized			Sheet
			Emissionstage basis	NOx emission optimized			2
							of
							6



Engine data

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G34F				
Fuel type	EN590				
Application Group	3B 3E 3F 3G				
Legislative body	NOx emission optimized				
Test cycle	D2 +110%				
Fuel sulphur content [ppm]	5				
mg/mN ³ values base on residual oxygen value of [%]	5				

Engine raw emissions*

Cycle point	[-]	n1	n2	n3	n4	n5	n6
Power	kW	2857	2589	1942	1295	647	259
Power relative	[-]	1.1	1	0.75	0.5	0.25	0.1
Engine speed	1/min	1500	1500	1500	1500	1500	1500
Engine speed relative	[-]	1	1	1	1	1	1
Exhaust back pressure after ETC (static)	mbar	24.8	25.1	12.4	4.8	0.8	-0.2
Exhaust temperature after ETC	grdC	528	524	492	470	358	226
Exhaust mass flow wet	kg/h	16254	16385	12575	8698	5920	4999
NO _x -Emissions specific	g/kWh	5.67	4.87	4.84	5.3	7.06	12.03
CO-Emissions specific	g/kWh	0.76	0.65	0.56	0.46	1.26	3.47

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Data generated by EDS Creator version 1.0 and unipilot. Ref.-dataset: BR4000_20V4000G03_G63L - TTME.nc for 1384 in EDS platform.		Emissionstage NOx emission optimized		Configurator	Theiss, Sandro (TVMG)	Order no.	A4
				Approver1	Kneifel, Alexander (TSL)	EDS-ID	
				Approver2	Kolwer, Michael (TV)	4590-09.06.2025	
				Approver3			
Approver4				User	FN2\1382678	Title	Emission data sheet
Configuration-ID 1384	Documentation		Emissionstage basis NOx emission optimized	Engine model 20V4000G34F			Sheet 3 of 6



CO ₂ -Emissions specific	g/kWh	661.1	700.9	678	672.9	710.6	907.5
HC ₁ -Emissions specific	g/kWh	0.12	0.14	0.15	0.25	0.54	1.89
PM-Emissions specific (Meas.)	g/kWh	0.047	0.05	0.042	0.036	0.156	0.609
NO _x -Emissions (based on 5% O ₂)	mg/m ³ N	1921	1553	1596	1758	2199	2860
CO-Emissions (based on 5% O ₂)	mg/m ³ N	259	208	185	153	392	825
CO ₂ -Emissions (based on 5% O ₂)	mg/m ³ N	224119	223673	223409	223143	221138	215724
HC ₁ -Emissions (based on 5% O ₂)	mg/m ³ N	42	46	48	82	169	449
PM-Emissions (based on 5% O ₂)	mg/m ³ N	16.1	16	13.7	12	48.6	144.8
Dust (meas. O ₂)	mg/m ³ N	21.9	23.5	21.7	24	33	51.6

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				Approver1	Kneifel, Alexander (TSL)	EDS-ID	
				Approver2	Kolwer, Michael (TV)	4590-09.06.2025	
				Approver3		Title Emission data sheet	
				Approver4			
			User	FN2\1382678			
Configuration-ID 1384	Documentation	Emissionstage basis NOx emission optimized	Engine model 20V4000G34F			Sheet 4 of 6	



Engine data

	Genset	Marine	O & G	Rail	C & I
Application	X				
Engine model	20V4000G34F				
Fuel type	EN590				
Application Group	3B 3E 3F 3G				
Legislative body	NOx emission optimized				
Test cycle	D2 +110%				
Fuel sulphur content [ppm]	5				
mg/mN ³ values base on residual oxygen value of [%]	5				

Not to exceed emission values*

Cycle point	[-]	n1	n2	n3	n4	n5	n6
Power	kW	2857	2589	1942	1295	647	259
Power relative	[-]	1.1	1	0.75	0.5	0.25	0.1
Engine speed	1/min	1500	1500	1500	1500	1500	1500
Engine speed relative	[-]	1	1	1	1	1	1
NO _x +HC ₁ mass flow	kg/h		17.01	12.71	9.53	7.56	
NO _x -Emissions specific	g/kWh		6.33	6.3	6.89	10.59	
CO-Emissions specific	g/kWh		1.11	0.95	0.88	2.52	
HC ₁ -Emissions specific	g/kWh		0.24	0.25	0.47	1.09	
NO _x +HC ₁ -Emissions specific	g/kWh		6.57	6.54	7.36	11.68	
PM-Emissions specific (Meas.)	g/kWh		0.075	0.067	0.054	0.234	

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			Configurator	Theiss, Sandro (TVMG)	Order no.	
<p>Data generated by EDS Creator version 1.0 and unipLOT. Ref.-dataset: BR4000_20V4000G03_G63L - TTME.nc for 1384 in EDS platform.</p>	<p>Emissionstage NOx emission optimized</p>	<p>Emissionstage basis NOx emission optimized</p>	Approver1	Kneifel, Alexander (TSL)	EDS-ID	<p>Title Emission data sheet</p>
			Approver2	Kolwer, Michael (TV)	4590-09.06.2025	
			Approver3			
			Approver4			
Configuration-ID 1384	Documentation		User	FN2\1382678		Sheet 5 of 6
			Engine model	20V4000G34F		



NO _x -Emissions (based on 5% O ₂)	mg/m ³ N		2019	2075	2286	3298	
CO-Emissions (based on 5% O ₂)	mg/m ³ N		354	315	291	783	
HC ₁ -Emissions (based on 5% O ₂)	mg/m ³ N		78	82	156	339	
NO _x +HC ₁ -Emissions (based on 5% O ₂)	mg/m ³ N		2097	2157	2442	3637	
PM-Emissions (based on 5% O ₂)	mg/m ³ N		24	22	18.1	73	

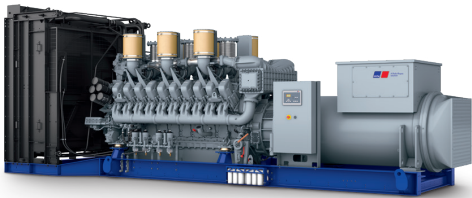
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				Approver2	Koliwer, Michael (TV)	4590-09.06.2025	
				Approver3			
				Approver4			
Configuration-ID 1384	Documentation			User	FN2\1382678	Title	Emission data sheet
			Emissionstage NOx emission optimized	Engine model 20V4000G34F			Sheet 6
			Emissionstage basis NOx emission optimized			of 6	



Diesel Generator Set

mtu 20V4000 DS3300

380V – 11 kV/50 Hz/data center continuous power/
NOx emission optimized/20V4000G34F/water charge air cooling



Optional equipment and finishing shown. Standard may vary.

Product highlights

Benefits

- Approved for renewable fuels (e.g. HVO)
- Low fuel consumption
- Optimized system integration ability
- High reliability
- High availability of power
- Long maintenance intervals

Support

- Global product support offered

Standards

- Engine-generator set is designed and manufactured in facilities certified to standards ISO 2008:9001 and ISO 2004:14001
- Generator set complies to ISO 8528
- Generator meets EC 60034-1, ISO 8528-3; IEC 60044-1; Declaration of conformity; EN55011, group 1, cl. B
- NFPA 110*

Power rating

- System ratings: 3110 kVA - 3130 kVA
- Accepts rated load in one step per NFPA 110*
- Generator set complies to G3 according to ISO 8528-5
- Generator set exceeds load steps according to ISO 8528-5*

Performance assurance certification (PAC)

- Engine-generator set tested to ISO 8528-5 for transient response
- 100% load factor
- Verified product design, quality and performance integrity
- All engine systems are prototype and factory tested

Complete range of accessories available

- Control panel
- Power panel
- Circuit breaker/power distribution
- Fuel system
- Fuel connections with shut-off valve mounted to base frame
- Starting/charging system
- Exhaust system
- Mechanical and electrical driven radiators
- Medium and oversized voltage alternators

Emissions

- NOx emission optimized

Certifications

- CE certification option
- Unit certificate acc. to VDE-AR-N 4110

* Changes to the standard parameter sets (alternator-regulator and genset-controller) are necessary



A Rolls-Royce solution

Application data ¹⁾

Engine			Liquid capacity (lubrication)	
Manufacturer		mtu	Total oil system capacity: l	390
Model	20V4000G34F		Engine jacket water capacity: l	205
Type	4-cycle		Intercooler coolant capacity: l	50
Arrangement	20V		Combustion air requirements	
Displacement: l	95.4		Combustion air volume: m ³ /s	3.7
Bore: mm	170		Max. air intake restriction: mbar	50
Stroke: mm	210		Cooling/radiator system	
Compression ratio	16.4		Coolant flow rate (HT circuit): m ³ /hr	80
Rated speed: rpm	1500		Coolant flow rate (LT circuit): m ³ /hr	32.5
Engine governor	ECU 9		Heat rejection to coolant: kW	1100
Max power: kWm	2590		Heat radiated to charge air cooling: kW	660
Air cleaner	dry		Heat radiated to ambient: kW	105
Fuel system			Fan power for electr. radiator (40°C): kW	70
Fuel specification	EN 590, Grade No.1-D/2-D (ASTM D975-00), EN 15940 (e.g. HVO)		Exhaust system	
Maximum fuel lift: m		5	Exhaust gas temp. (after turbocharger): °C	535
Total fuel flow: l/min		27	Exhaust gas volume: m ³ /s	10.3
Fuel consumption ²⁾			Maximum allowable back pressure: mbar	85
	l/hr	g/kwh	Minimum allowable back pressure: mbar	30
At 100% of power rating:	689.6	221		
At 75% of power rating:	510.2	218		
At 50% of power rating:	335.5	215		

Standard and optional features

System ratings (kW/kVA)

Generator model	Voltage	NOx emission optimized					
		without radiator			with mechanical radiator		
		kWel	kVA*	AMPS	kWel	kVA*	AMPS
Leroy Somer LSA53.2 M12 (Low voltage Leroy Somer standard)	380 V	2488	3110	4725	2424	3030	4604
	400 V	2488	3110	4489	2424	3030	4373
	415 V	2488	3110	4327	2424	3030	4215
Leroy Somer LSA54.2 L14 (Low voltage)	380 V	2488	3110	4725	2424	3030	4604
	400 V	2488	3110	4489	2424	3030	4373
	415 V	2488	3110	4327	2424	3030	4215
Leroy Somer LSA54.2 XL11 (Med. volt. Leroy Somer)	11 kV	2504	3130	164	2424	3030	159

* cos phi = 0.8

1 All data refers only to the engine and is based on ISO standard conditions (25°C and 100m above sea level).

2 Values referenced are in accordance with ISO 3046-1. Conversion calculated with fuel density of 0.83 g/ml. All fuel consumption values refer to rated engine power.

Standard and optional features

Engine

- 4-cycle
- Standard single stage air filter
- Oil drain extension & shut-off valve
- Closed crankcase ventilation improved oil separator
- Governor-electronic isochronous
- Common rail fuel injection
- NOx emission optimized engine
- Centrifugal oil filter

Generator

- 4 pole three-phase synchronous generator
- Brushless, self-excited, self-regulating, self-ventilated
- Digital voltage regulator
- Anti condensation heater
- Stator winding Y-connected, accessible neutral (brought out)
- Protection IP23
- Insulation class H, utilization acc. to H
- Radio suppression EN 55011, group 1, cl. B
- Short circuit capability 3xIn for 10sec
- Winding and bearing RTDs (without monitoring)
- Excitation by AREP
- Mounting of CT's: 2 core CT's
- Winding pitch: 2/3 winding
- Voltage setpoint adjustment ± 10%
- Meets NEMA MG-1, BS 5000, IEC 60034-1, VDE 0530, DIN EN 12601, AS 1359 and ISO 8528-3 requirements
- Leroy Somer low voltage generator
- Oversized generator
- Medium voltage generator
- Excitation by PMG, subtransient reactance X"d: Saturated <12%

Oil system

- Automatic oil refilling system
- Extended test run kit (including pre-lubrication pump)

Cooling system

- Jacket water pump
- Thermostat(s)
- Water charge air cooling
- Mechanical radiator
- Electrical driven front-end cooler
- Jacket water heater
- Jacket water heater with plate heat exchanger
- Pulley for fan drive

Control panel

- Unit cabling with coded plugs for easy connection of customer-specific controls (V0)
- Pre-wired control cabinet for easy application of customized controller (V1+)
- Island operation (V2)
- Automatic mains failure operation with ATS (V3a)
- Automatic mains failure operation incl. control of generator and mains breaker (V3b)
- Island parallel operation of multiple gensets (V4)
- Automatic mains failure operation with short (< 10s) mains parallel overlap synchronization (V5)
- Mains parallel operation of a single genset (V6)
- Mains parallel operation of multiple gensets (V7)
- Basler controller
- Deif controller
- Complete system metering
- Digital metering
- Engine parameters
- Generator protection functions
- Engine protection
- SAE J1939 engine ECU communications
- Parametrization software
- Multilingual capability
- Multiple programmable contact inputs
- Multiple contact outputs
- Event recording
- IP 54 front panel rating with integrated gasket
- Different expansion modules
- Remote annunciator
- Daytank control
- Generator winding temperature monitoring
- Generator bearing temperature monitoring
- Modbus TCP-IP

- Represents standard features
- Represents optional features

Standard and optional features

Connectivity

The engine system automatically collects and transfers engine data to the manufacturer from time to time. The data is used by the

manufacturer for the purposes of product development and improvement as well as service optimization.

Users can log in or register via <https://mtu-go.com> and also gain insight into the data.

Power panel

- Supply electrical driven radiator from 45kW – 75kW

Circuit breaker/power distribution

- 3-pole circuit breaker
- 4-pole circuit breaker
- Electrical-actuated circuit breaker
- Base frame mounted GCB, pre-wired with generator, ready for commissioning

Fuel system

- Flexible fuel connectors mounted to base frame
- Fuel filter with water separator
- Fuel filter with water separator heavy-duty
- Switchable fuel filter with water separator
- Switchable fuel filter with water separator heavy-duty
- Separate fuel cooler
- Fuel cooler integrated into cooling equipment

Starting/charging system

- 24V starter
- Redundant starting system
- Starter batteries, cables, rack, disconnect switch (lockable)
- Battery charger
- Alternator

Mounting system

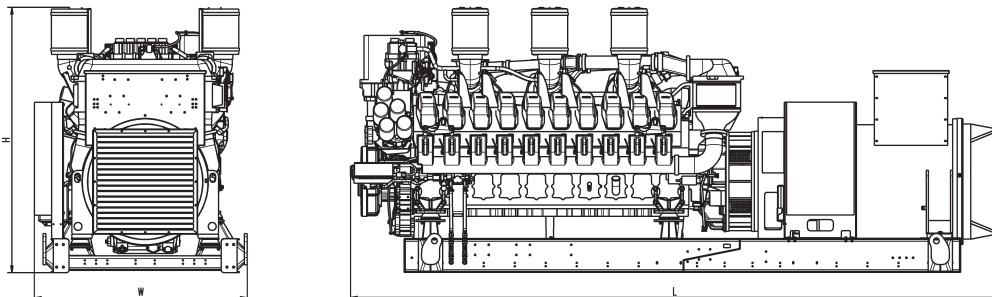
- Welded base frame
- Resilient engine and generator mounting
- Modular base frame design
- Base frame mounting on foundation/base plate with using clamping brackets
- Spring mounts with 95% degree of isolation

Exhaust system

- Exhaust bellows with connection flange
- Exhaust silencer with 10 dB(A) sound attenuation
- Exhaust silencer with 30 dB(A) sound attenuation
- Exhaust silencer with 40 dB(A) sound attenuation
- Y-connection-pipe

- Represents standard features
- Represents optional features

Weights and dimensions



Drawing above for illustration purposes only, based on a standard open power 400 Volt engine-generator set. Lengths may vary with other voltages. Do not use for installation design. See website for unit specific template drawings.

System	Dimensions (LxWxH)	Weight (dry/less tank)
Open power unit (OPU)	5760 x 1887 x 2332 mm	15819 kg

Weights and dimensions are based on open power units and are estimates only. Consult the factory for accurate weights and dimensions for your specific engine-generator set.

Sound data

– Consult your local **mtu** distributor for sound data.

Emissions data

– Consult your local **mtu** distributor for emissions data.

Rating definitions and conditions

- Data center continuous power ratings (DCP) apply to data center installations where a reliable utility power is available and comply with Uptime Institute Tier III and IV requirements. At constant or varying load, the number of generator set operating hours is unlimited. A 10% overload capacity is available for one hour in twelve. Ratings are in accordance with ISO 8528-1, ISO 3046-1, BS 5514 and AS 2789. Average load factor: $\leq 100\%$.
- Consult your local **mtu** distributor for derating information.



Appendix C Drainage Plan

Environmental Permit Application

Best Available Techniques and Operating Techniques

Avonmouth Data Centre Limited

SLR Project No.: 416.066815.00001

Surface Water Flow Rates				
Existing Storm Event	Flow Rate Litres/sec	Proposed Storm Event	Flow Rate Litres/sec	Reduction %
1 Year	50.10	1 Year	43.00	14.17
30 Year	250.90	30 Year	127.70	49.10
100 Year	309.00	100 Year	198.70	35.70
100 Year +40% cc	412.00	100 Year +40%cc	290.90	29.39

- A. DO NOT SCALE FROM THIS DRAWING.
- B. THIS DRAWING IS BASED ON THE FOLLOWING OVERLAYS/BACKGROUNDS:-
- HYPHEN ARCHITECTURAL SITE PLAN 9955 A-010_P09, DATED 06.03.2026
 - LANDSCAPE TOPOGRAPHICAL SURVEY 3538-TS01-P01-T01_D01 to T04_D01, DATED 27.11.2025
 - TOTAL DRAINAGE SERVICES DRAINAGE CCTV SURVEY 15513_R0, DATED 20.02.2026
 - SLR EXISTING DRAINAGE NETWORK VDR-SLR-HGN-SWI-DR-100-001, DATED JUNE 2023
- C. ALL REPAIR WORKS TO EXISTING UNDERGROUND DRAINAGE SYSTEM TO BE IN LINE WITH TOTAL DRAINAGE SERVICES REPORT, 15513 Severn Road, Avonmouth Report, DATED 16.02.2026.

- Notes
- All setting out to be in accordance with the Architects drawings. Any discrepancies between the Engineers and the Architects drawings to be referred to the Architect before proceeding. Dimensions must not be scaled.
 - All drainage to be installed in accordance with relevant Building Regulations documents and Current Sewers for Adoption where applicable.
 - Connections to Public sewers to be agreed and inspected by Water Authority.
 - Invert level, size and cover levels to existing manholes and sewers to be checked prior to any construction. Any discrepancies to be reported immediately.
 - Invert to base of soil stack bends to be 450mm below lowest branch connection.
 - All RWP and Foul Water drain point setting out is to be confirmed by Architect.
 - All below ground connections to match above ground outlet size, Min 100/110mm diameter.
 - Foul drains to project 100mm above finished floor level.
 - All pipework to be 100/110 UNO. Refer to note 7 connection sizes.
 - All foul and surface water drainage stacks to have above ground rodding access, refer to above ground drainage layout by others.
 - This drawing has been produced in colour and should be reproduced in colour for clarity.
 - A CCTV Survey and report in WINCAN format for all new drainage will be required before the "As Built" drawings will be issued.
 - All excavations to be carried out in accordance with HSE Guidance, including temporary support, loose material, edge protection, protection of nearby structures underground/ overhead services, groundwater control and damage to trees. www.hse.gov.uk/construction/safety/topics/excavations

WARNING
PROPOSED DRAINAGE LAYOUT SHOWN IS INDICATIVE AND IS SUBJECT TO SVP & RWP PIP UP REQUIREMENTS FROM ARCHITECT & MEP CONSULTANT.

Rev	Description	By	Check	Date
P02	DRAINAGE STRATEGY REPORT ISSUE	GT	DH	20-03-26
P01	PRELIMINARY ISSUE FOR COMMENTS	GT	DH	12-03-26



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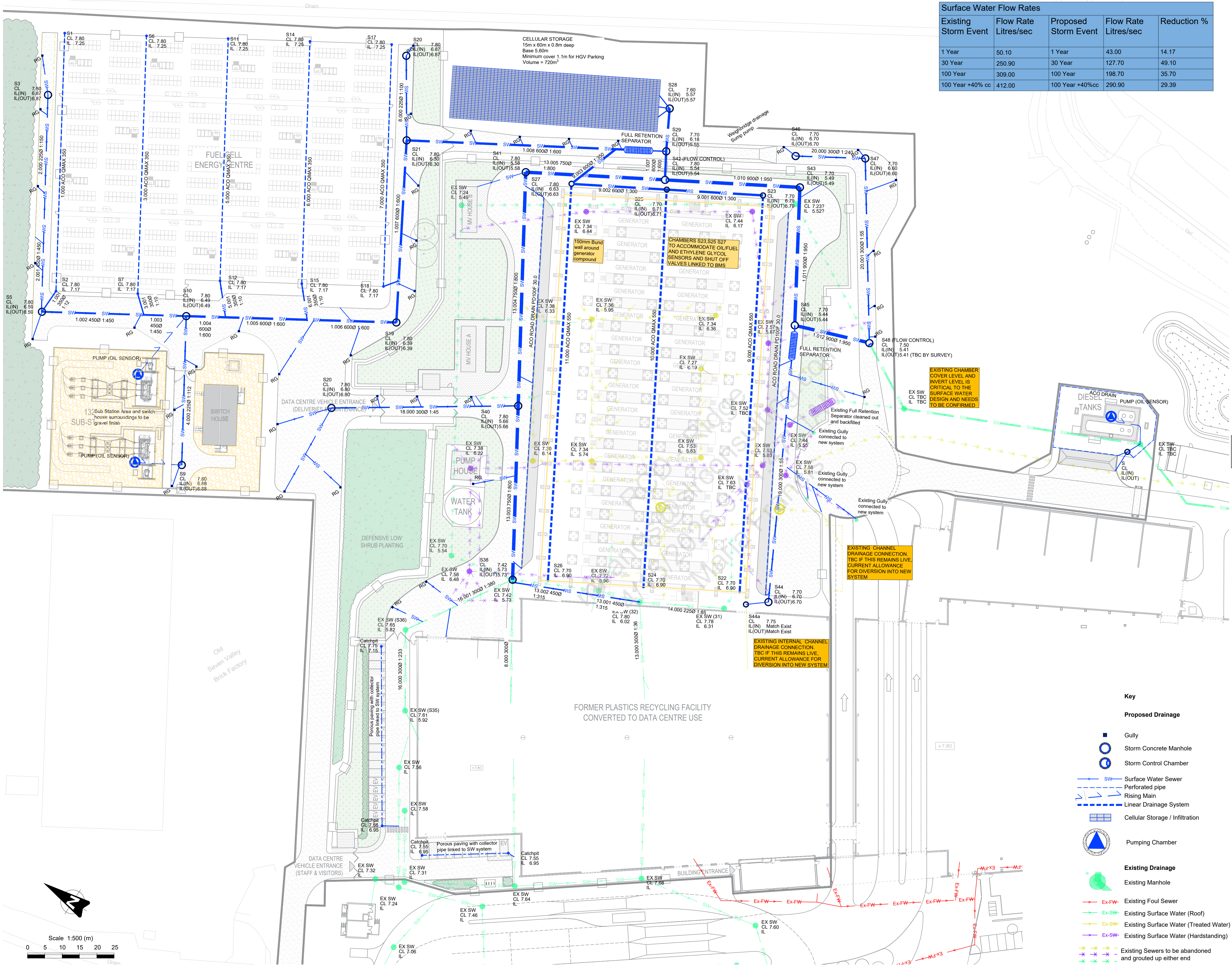
Project
Avonmouth Data Centre

Drawing
PRELIMINARY SURFACE WATER UNDERGROUND DRAINAGE PROPOSAL

Scale	Date	Author	Checked
1:500 @ A1	March 2026	GT	DH

Workstage	Status	Revision
1	PRELIMINARY	

Project / Drawing No
JDA033-CSP-EX-XX-DR-C-SK100



Key

Proposed Drainage

- Gully
- Storm Concrete Manhole
- Storm Control Chamber
- SW Surface Water Sewer
- Perforated pipe
- Rising Main
- Linear Drainage System
- Cellular Storage / Infiltration
- Pumping Chamber

Existing Drainage

- Existing Manhole
- Ex-FW Existing Foul Sewer
- Ex-SW Existing Surface Water (Roof)
- Ex-SW Existing Surface Water (Treated Water)
- Ex-SW Existing Surface Water (Hardstanding)
- Existing Sewers to be abandoned and grouted up either end

Scale 1:500 (m)

