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Best Available Techniques (BAT) Assessment – Environmental Permit Application Ridgeway Data Centre Emergency Back Up Generation Facility

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Disclaimer

1 Introduction

1.1 Background

This Best Available Technique (BAT) assessment has been prepared in support of the application. to support a new bespoke Environmental Permit application for a proposed emergency back-up power generation facility at a data centre development located at the Ridgeway Trading Estate, Iver, Buckinghamshire centred on Grid Reference TQ 03489 80455 (Figure 1).

Figure 1 - Site Location

The operation of the site's emergency back-up generators is subject to Environmental Agency regulation under the Environmental Permitting Regulations 2016 (as amended). Figure 2 shows the proposed site layout of the overall data centre and the installation boundary covering the back-up emergency generation facilities covered by the permit.

Electricity for operation of the data centre will be provided from connections to the National Grid via the local electricity network; however, given the nature of data centres and their requirement to have an available energy supply at all times, the data centre will incorporate a maximum of 27 gasoil/ hydrogenated vegetable oil (HVO) -fired Emergency Stand-by Generators (ESGs). Of these 27 ESGs, two are secondary back-ups (redundancy). There is also a smaller generator to cover non-critical loads in the event of disruption in the grid power.

The main ESGs will only provide power to the data centre in the event of an emergency situation such as a brown- or blackout of the local electricity transmission network where there are fluctuations or loss of the electrical power provided by the network. During such an event, there is the potential for a delay between fault detection and initial operation of the ESGs; on-site Uninterruptable Power Supplies (UPS) will provide a temporary power supply in order to cover such delays and the potential for a loss/reduction in the power supply to the on-site equipment.

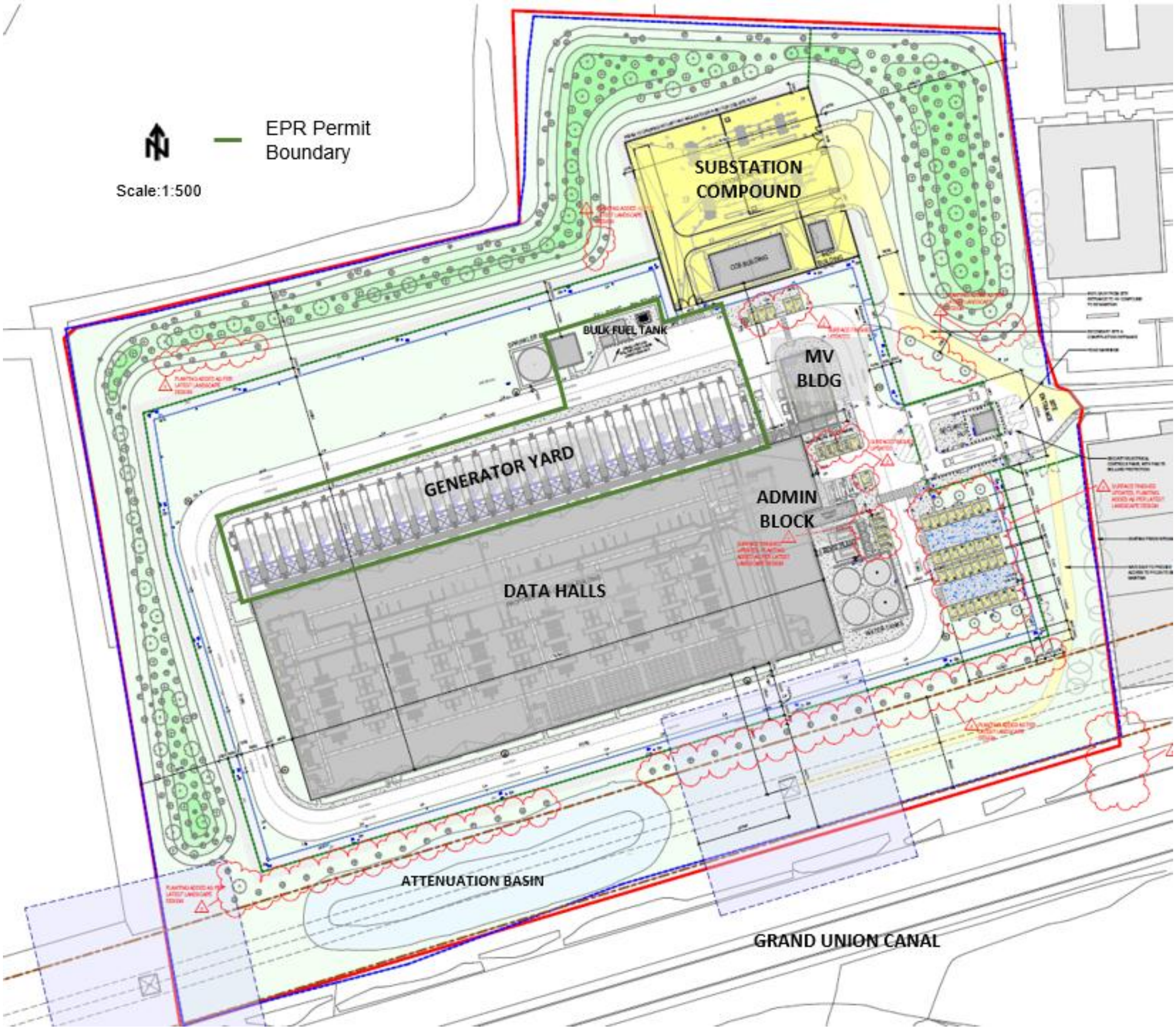

Figure 2 – Proposed Site Layout

Each of the ESGs and house generator will have an individual flue terminating at 25m above ground, the locations of which are provided in the Site Layout and Emissions Point Plan (Appendix 01 – Drawing 2). The generator flues are located close to each other but are separate individual stacks.

Fuel will be stored in a bulk top up fuel tank with a volume of 40,000 litres. This will be used to fill the 'belly tanks' of the generators, each ca. 16,000 litres in volume. All tanks will be above ground and double skinned. The main top-up tank will be contained within a bund with a capacity of 110% of the storage capacity. Each belly tank is containerised and self-bunded to contain 110% of the storage capacity of the tank. The belly tanks will be designed to British Standard BS799 Part 5 2010 (Oil Burning Equipment Carbon steel oil storage tanks. Specification) in accordance with this design standard each tank will be provided with secondary containment (110%). All tanks will comply with the Oil Storage Regulations (SI 2001/2954, The Control of Pollution (Oil Storage) (England) Regulations 2001).

It is proposed that the ESGs will be procured ahead of installation over a single phase however, the exact supplier and model is yet to be determined. Specimen technical data sheets for a typical model are provided at Appendix 02.

The rated generation capacity of each of the main ESGs to be installed is 2.8MWe (8.48MWth input), and the house ESG 1.0 MWe (2.6 MWth input), with a total thermal input of 222.98 MWth. In accordance with the Environmental Permitting (England and Wales) Regulations 2016 (as amended) (the EPR Regulations) the operator is therefore required to apply to the Environment Agency (EA) for an Environmental Permit as the total thermal capacity of the emergency back-up combustion plant exceeds the 50MW threshold stipulated in the regulations.

The data centre is therefore considered to be an "installation" as defined in Paragraph 1, Part 1, Schedule 1 of the EP Regulations as: "a stationary technical unit where one or more activities are carried on." The "activities" that are proposed are defined in Chapter 1, Schedule 1 of the EP Regulations (EPR), under Section 1.1 (Combustion Activities).

1.2 Purpose of This Report

It is a requirement that the operator demonstrates how they comply with the indicative BAT requirements, with assessment to be completed as part of the application for an environmental permit. 'Techniques' include both the technology used and the way the installation is designed, built, maintained, operated and decommissioned.

There is no relevant published BAT reference documents (BREF notes) for Data Centres however, the Environment Agency have produced a working draft BAT guidance document specifically for Data Centres: 'Data Centre FAQ Headline Approach v21' (Nov 2022). This BAT assessment is structured using this guidance document and seeks to provide evidence of BAT or justification where the requirements have not been met.

It should be noted that each individual ESG is significantly below the threshold for large combustion plant. Therefore, the BAT requirements for large combustion plant are not relevant for this installation.

Regulated Activities

The total number of ESGs for the data centre will be 26 Hydrotreated Vegetable Oil (HVO)/diesel-fired ESGs, a further house generator (27 in total). The ESG provision includes for a level of redundancy such that, even in a worst-case blackout scenario, all ESGs would start up and would share the required electricity IT load for the data centre.

The data centre will comprise in total thermal input of 222.98 MWth. This application (including the associated modelling studies and risk assessments) has been prepared on this basis.

The "activities" that are proposed are defined in the EPR:

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

In accordance with the EPR:

"…where two or more appliances with an aggregate 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."

Schedule 1, Part 1 Regulation 2(1) of the EP Regulations provides that a Directly Associated Activity (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 the purpose of the on-site fuel storage is to serve the generators and the Scheduled Activity above, this storage of fuel therefore constitutes a directly associated activity (DAA) of the 'combustion' qualifying activity to be covered in this Permit Application

In the event of a worst-case blackout scenario of the local transmission system, potentially all the ESG in the data centre will be operated to deliver the required IT electrical load. Therefore, the operation (under emergency) of individual ESGs is linked to the 'availability' of other engines and all ESGs in the data centre are considered to be technically connected.

Medium Combustion Plant (MCP) and Specified Generators (SG)

The Medium Combustion Plant Directive (MCPD) was incorporated by the Environmental Permitting (England and Wales) (Amendment) Regulations 2018. In addition to MCPD requirements, these regulations also brought in requirements for Specified Generators (SGs) which are defined as combustion plant that generates electricity. The permit application takes into consideration the MCPD and SG requirements as detailed in the EPR, 2018. This states that an 'excluded generator' includes back-up generators operated for the purpose of testing for no more than 50 hours per year. As the ESGs are operated for emergency back-up purposes only, they will be considered 'excluded generators' in accordance with EPR 2018.

ESGs are not considered to be Industrial Emission Directive (IED) Chapter III large combustion plant as each generator is individually less than 15MWth and are therefore not subject to Chapter III Emission limit values (ELV). Furthermore, the generators are considered to be 'excluded generators' due to being operated for emergency back-up purposes only, and for the purpose of testing are each operated for no more than 50 hours per year and will not be required to meet the ELVs for NOX (190mg/kg).

2 SITE SUMMARY

The overall data centre development Site is subject to a planning application submitted to Slough Borough Council. The redevelopment will initially involve the demolition of the existing buildings that are in place within the site footprint. See Figure 3 below outlining the existing site layout.

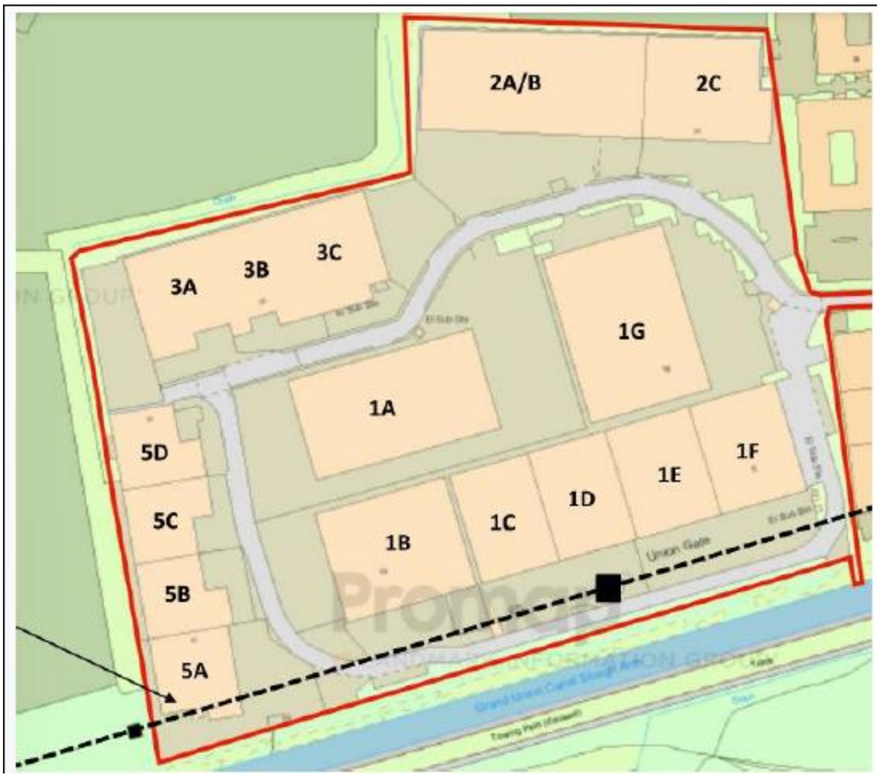

Figure 3 - Existing Site Layout

Following the demolition, construction will begin of an approximately 30,500m^2 data centre building. The development will consist of one data centre building, in which the IT infrastructure will be housed in data halls. The building will also house office accommodation. The construction phase will include the development of associated plant, new vehicular access from Thorney Lane South, parking, a sustainable drainage system, and an external yard in which the 27-HVO/diesel fired ESG and associated fuel storage will be located. The ESG container units at the data centre will be located within the generator compound. The regulated installation boundary to which this EPR applies is shown below (Figure 2).

The generating capacity of the installation is summarised in Table 1 and the location of the flues shown in Figure 4.

Table 1 Generator Capacity

Release Point Reference	Generator Ref	ESG Model	Thermal Rated input MWth
A1	Emergency Standby Generator (redundancy 1)	CAT C175-20 EM1365 *	8.48
A2	Emergency Standby Generator (redundancy 2)	As above	As above
A3	Main Emergency Standby Generator 1	As above	As above
A4	Main Emergency Standby Generator 2	As above	As above
A5	Main Emergency Standby Generator 3	As above	As above
A6	Main Emergency Standby Generator 4	As above	As above
A7	Main Emergency Standby Generator 5	As above	As above
A8	Main Emergency Standby Generator 6	As above	As above
A9	Main Emergency Standby Generator 7	As above	As above
A10	Main Emergency Standby Generator 8	As above	As above
A11	Main Emergency Standby Generator 9	As above	As above
A12	Main Emergency Standby Generator 10	As above	As above
A13	Main Emergency Standby Generator 11	As above	As above
A14	Main Emergency Standby Generator 12	As above	As above
A15	Main Emergency Standby Generator 13	As above	As above
A16	Main Emergency Standby Generator 14	As above	As above
A17	Main Emergency Standby Generator 15	As above	As above
A18	Main Emergency Standby Generator 16	As above	As above
A19	Main Emergency Standby Generator 17	As above	As above
A20	Main Emergency Standby Generator 18	As above	As above
A21	Main Emergency Standby Generator 19	As above	As above
A22	Main Emergency Standby Generator 20	As above	As above
A23	Main Emergency Standby Generator 21	As above	As above
A24	Main Emergency Standby Generator 22	As above	As above
A25	Main Emergency Standby Generator 23	As above	As above
A26	Main Emergency Standby Generator 24	As above	As above
A27	House Generator	CAT C32 EM0777*	2.65
		Total	222.98

* Example specification only

The data centre will be staffed on a 24-hour basis. Staff will be present during normal office hours and a team of key engineering staff and security will also be onsite 24 hours a day.

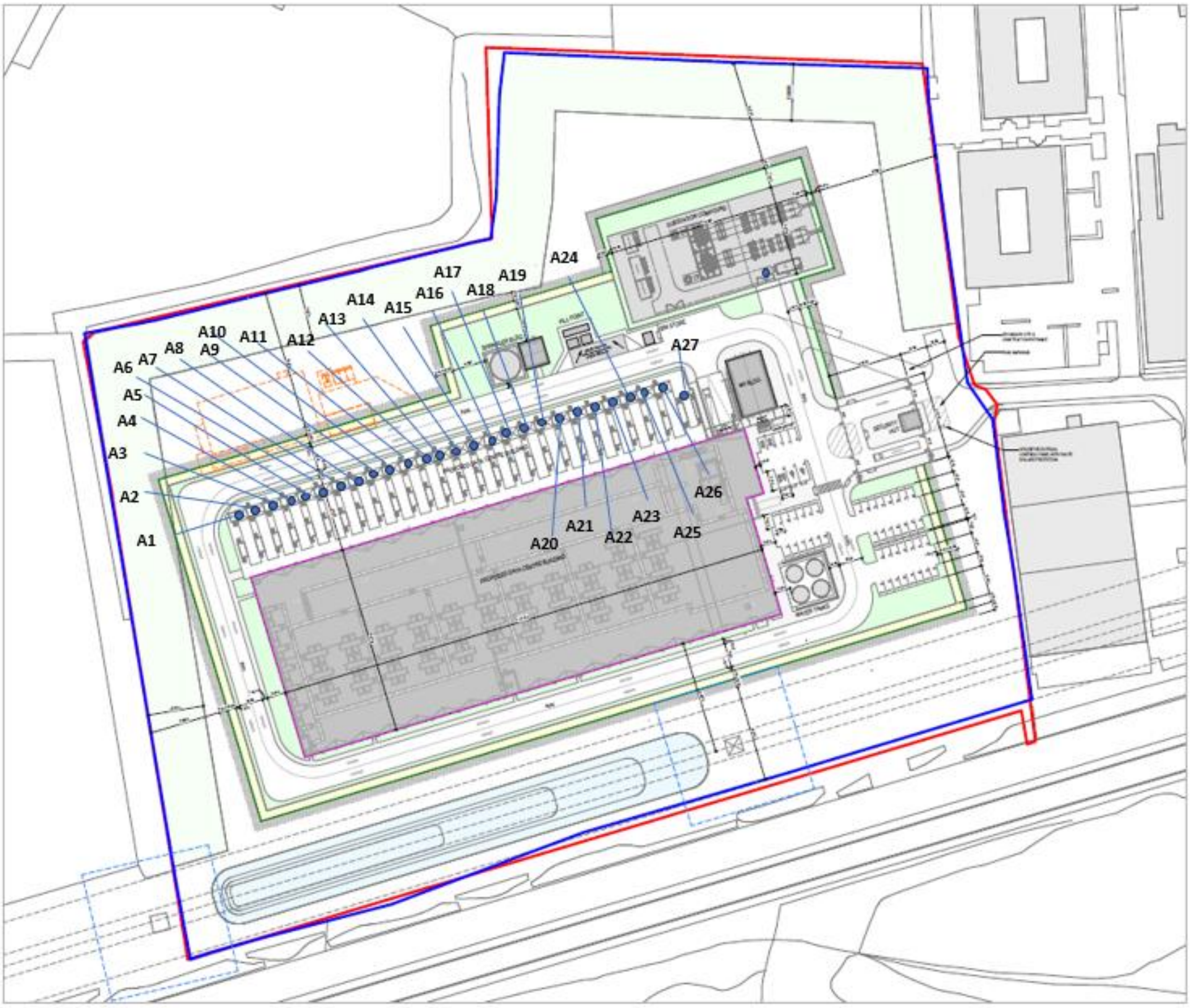

Figure 4 Emission Points to Atmosphere – Generator Stacks

3 DATA CENTRE DESIGN

3.1 Overview of Electrical Infrastructure

The on-site power distribution system, extending from the high-voltage (HV) intake substations through to the low-voltage (LV) distribution network, has been designed to be safe, reliable, robust, and efficient, with inherent redundancy at all critical stages.

The primary source of electrical power for the site is the National Grid, provided via two independent 33kV high-voltage connections. These dual feeds are configured such that each is capable of supporting 100% of the site load. Under normal operating conditions, demand is shared approximately equally across both supplies; however, in the event of a fault or loss of one feed, the remaining supply can seamlessly support the full site demand, thereby ensuring continuity of service.

Each incoming supply terminates at a dedicated, physically separate substation. From these substations, power is distributed via independent 20kV switchboards designed to maintain supply during maintenance, repair, or fault conditions. This arrangement ensures that no single point of failure can disrupt the overall electrical supply to the data centre.

3.2 Distribution Network Design

Power is distributed across the site via a number of ring main network supplying downstream distribution transformers. This ring configuration enables load balancing and enhances resilience by allowing sections of the network to be isolated in the event of a fault, while maintaining supply to unaffected areas.

In the event of a fault in a ring main unit or associated cabling, upstream protection systems operate to isolate the affected section. The impacted low-voltage systems are temporarily supported by Emergency Standby Generators (ESGs) while the fault is identified, isolated, and resolved. Once rectified, the network is reconfigured and the ring re-energised, restoring normal operation.

A bus-coupling arrangement is incorporated within the switchgear, allowing rapid switching between independent supply routes. This enables the site to transfer load to an unaffected electrical path in the event of disruption, thereby minimising reliance on backup generation and reducing transition times.

3.3 Uninterruptible Power Supply (UPS) and Backup Generation

Data centres require a continuous and stable electricity supply to support critical IT infrastructure. Even brief interruptions or voltage fluctuations can result in service disruption, data loss, and significant financial and reputational impacts.

To mitigate these risks, the facility is equipped with Uninterruptible Power Supply (UPS) systems comprising battery arrays that provide near-instantaneous power in the event of a loss or fluctuation in incoming supply. These systems ensure continuity of power to critical loads during the short period required for backup generators to start and stabilise.

Emergency standby generators (ESGs), powered by HVO/diesel fuel, provide longer-duration backup in the event of a sustained grid outage. The transition from grid supply to generator operation is fully automated and controlled by the site’s generator control systems, ensuring rapid and reliable response without manual intervention.

3.4 Reliability and Redundancy Strategy

The electrical infrastructure is designed in accordance with an N+2C redundancy philosophy. This approach ensures that critical components required for operation (N), at least one independent backup component is provided. As a result, any single component or distribution path can be taken out of service—for maintenance or due to fault—without affecting overall operations.

3.5 Grid Reliability and Performance

Electricity is supplied by the National Grid, which operates in accordance with the Security and Quality of Supply Standards under its transmission licence. These standards require a high degree of inherent redundancy within the national transmission network.

Published data indicates that the electricity transmission system in England maintains exceptionally high reliability. For the 2024/25 reporting period, National Grid achieved an average reliability of approximately 99.9998%, corresponding to extremely low levels of supply interruption. This level of performance demonstrates the robustness of the upstream network supporting the data centre.

Uptime is typically expressed as a percentage of total operational time over a year. For example:

- 99% (“two nines”) equates to approximately 7 hours 18 minutes of downtime per month
- 99.9% (“three nines”) equates to approximately 43 minutes per month
- 99.999% (“five nines”) equates to approximately 5 minutes per year

The combination of highly reliable grid supply and robust on-site infrastructure significantly reduces the likelihood of power disruption events.

3.6 Monitoring, Maintenance, and Operational Control

The site will be supported by a comprehensive programme of inspection, preventative maintenance, and testing to ensure ongoing performance and reliability of all electrical systems.

In addition, the facility will incorporate:

- A Building Management System (BMS) to monitor and control physical assets
- An Electrical Power Monitoring System (EPMS) to provide real-time visibility of electrical performance and system status

These systems enable proactive identification and resolution of potential issues, further reducing the likelihood of unplanned outages.

The integrated design of dual high-voltage grid connections, resilient distribution infrastructure, UPS systems, and standby generation ensures a highly reliable and uninterruptible power supply to the data centre.

This layered resilience approach minimises the need for emergency generator operation and reduces overall environmental impact, while maintaining the high levels of uptime required for critical digital infrastructure.

3.7 Technical Standards

The data centre installation comprises the combustion plant and storage of diesel/HVO fuel oil. For the purposes of this application, the following regulations and guidance are relevant and have been taken into consideration in developing the approach to the assessment. The combination of these publications are considered to represent the current EA position on BAT for data centre back-up generation systems:

- The Environmental Permitting (England and Wales) Regulations 2016, SI2016/1154.
- EU, 2010 Directive 2010/75/EU of the European Parliament and the Council on industrial emissions.
- EU, 2015. Directive (EU) 2015/2193 on the limitation of emissions of certain pollutants into the air from medium combustion plant.
- The Control of Pollution (Oil Storage) (England) Regulations 2001
- Best available techniques: environmental permits - https://www.gov.uk/guidance/best-available-techniques-environmental-permits
- Risk assessments for specific activities: environmental permits - https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit
- Environment Agency a working draft BAT guidance document: 'Data Centre FAQ Headline Approach v21' (Nov 2022) - https://www.techuk.org/asset/BB871EF0-8316-4127-89DC63C6B3B7CD04/ .

The site will be designed and operated in accordance with the relevant sections of this guidance.

Operation of the ESGs (other than for maintenance and testing) will commence in the event that electricity is not available from the local transmission network or on internal failure of electrical supply (e.g. transformer failure, UPS problem). The ESGs on-site will also be operated for maintenance and testing purposes.

3.8 Emergency Operation

Emergency operations are taken to include unplanned hours required to come off grid to make emergency repair of electrical infrastructure within the data centre itself. Given the short start-up and shutdown times for HVO/diesel engines, the ESG are regarded, for the purposes of determining operating hours, as commencing operation at the first fuel ignition.

The generators will start and should run until mains power is restored. After power is restored for 15 minutes, the load will be transferred back to utility. After the outage has occurred, the generators will automatically return to mains power as a primary source.

3.9 Commissioning

The data centre is yet to be constructed. The ESGs, once installed, will be subject to commissioning prior to operation.

3.10 Technology selected to provide emergency power

ESGs have been selected to provide emergency power to the installation in the event of grid failure. A BAT assessment considering alternative technologies and why ESGs are considered BAT is presented below.

There are currently no BAT reference documents or BREF notes that have been made available by the European Commission that reference the specific provision of backup power in the Data Centre industry. The selection of technology is based on the guidance in the EAs "Data Centre FAQ Headline Approach v21".

The emergency back-up generators are to be installed to provide power to the data centre in the unlikely event of a power outage of mains electricity supplies. To meet the requirements of a Tier III concurrently maintainable data centre, emergency back-up generators must:

- Start and take full electrical load in less than 2 minutes to minimise the quantity of batteries deployed in the Uninterruptable Power Supply (UPS) whilst the generators start, synchronise and accept the load.
- Have sufficient fuel stored on site to enable generator running at full load for 72 hours of continuous running.
- Be deployed in a resilient configuration such that if a generator is out of service (under maintenance or unavailable) the remaining generators can support the full facility electric load (i.e. N+1 as a minimum).
- Must be tested regularly to ensure that they will operate in the unlikely event of a mains power outage.
- Must be able to operate at low loads, during early deployments as the IT demand grows and when external ambient conditions dictate very small cooling demand in the facility.
- Must be modular to allow for expansion as the data centre load grows.

As the emergency back-up generators are an intermittent source of power and the data centres use ambient conditions for "free cooling" there is no opportunity for using heat recovery systems on the generators to improve overall operating efficiencies.

In addition, the electric loads in the facility can change very quickly in response to changes in IT processing demands and/or external ambient conditions. The emergency back-up generators must therefore be able to respond quickly to changes in load condition.

The available engine technologies to provide this level of duty are, HVO/diesel engines, gas spark ignition engines, gas turbines and fast start aero engine derivatives. A high-level comparison of the attributes associated with these four technologies, bearing in mind the specific data centre requirements, is presented in Table 2.

The high-level comparison between the technologies demonstrates that the benefits of fast start, reaction to load changes, simpler and safer fuel supply, storage and handling systems associated with a HVO/diesel combustion engine outweigh the benefits of the of the other technologies, particularly given the low anticipated run hours each year for the emergency back-up generators deployed.

Table 2 – High Level Comparison of Alternative Engine/Fuel Technologies

Attributes	Engine/Fuel Technologies (no heat recovery)			
	HVO/diesel Engine	Gas Engine	Gas Turbine	Aero-Derivative
Start Time to Full Load	<2mins	7-10mins	10-15mins	2-5mins
Reaction to Load Changes	Immediate	Slow	Slow	Slow
Fuel Volatility and Storage Safety Risk	Low	High	High	High
Fuel Supply	Diesel/HVO	Gas, requires a grid connection	Gas, requires a grid connection	Gas, requires a grid connection
Fuel Storage	Simple tanks and gravity connections	Complex, gas compression, pumps and storage	Complex, gas compression, pumps and storage	Complex, gas compression, pumps and storage
Engine Maintenance	Low Frequency, Standard diesel engine technology	High frequency, Standard Gas engine technology	High frequency, Specialist engineering support	High frequency, Specialist engineering support
Cost per MW installed	Lowest cost	10-20% more costly than diesel engines	20-30% more costly than diesel engines	30-40% more costly than diesel engines

This approach requires the installation of a number of small-scale HVO/diesel ESGs at the data centre rather than the installation of a smaller number of larger ESGs. The following points are noted:

- A larger number of smaller generators allows for flexibility in achieving the required electrical output in the event of an emergency situation, whereby whilst all the generators will be started, they will be operated to share the required electrical load. This will result in the reduced consumption of HVO/diesel fuel per generator and hence generation of less emissions to air from the generators.
- The generators have been selected based on the required electrical load for the data centre suite. This ensures that the generators are operated at their optimal design capacity; operating HVO/diesel generator sets at low loads (i.e. underloading) for extended periods of time can potentially impact uptime and engine life.

The level of redundancy will ensure that in the event of failure of a generator at the data centre the correct number of remaining generators will provide the required load in an emergency event, thus avoiding any disruption in service to the data centre customer. In the event of a deficiency of the mains supply from the National Grid, the generator automatic controller would automatically start-up all the ESGs to meet the require electrical load to service the data centre suites. The BMS will monitor all relevant and critical aspects of the mechanical and electrical systems.

To achieve the required level of redundancy with large generators, the overall capacity of the generators would be higher, additionally the level of reliability would be reduced somewhat if a smaller number of larger generators were in place.

As part of the annual maintenance programme, testing of the generators 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, a small number of generators will be tested together in a phased manner. The ability for a phased approach to maintenance and testing would be reduced somewhat if a smaller number of larger generators were in place, with potentially a greater mass emission rate of combustion pollutants to air at any one time from larger generators during testing and maintenance.

All main ESGs will be the same model. There can therefore be no preference to prioritise the use of less polluting engines over more polluting engines. In the event of a reduction in electrical power delivered from the National Grid, the generator automatic controller would automatically start-up the generators needed to meet the require electrical load to service the data centre.

A larger number of smaller ESGs offers the flexibility and reliability of electrical supply in the event of an emergency, a critical factor in the operation of the data centre; a level of flexibility that cannot be achieved using a smaller number of larger generators. This approach also minimises the potential for adverse impacts on air quality as a result of the planned phased maintenance and testing of the generators.

The above points demonstrate that plant sizing, number, configuration along with routine maintenance and testing of emergency back-up generation have been considered and are aligned with the principles of the BAT process delivering optimised efficiency (fuel consumption) and emissions.

All main ESG engines are emissions optimised and are capable of being operated with Hydrotreated Vegetable Oil (HVO) in addition to diesel.

3.11 Generator emissions performance

The ESGs that will be selected to support the operation of the installation will be emissions optimised, and will achieve NOx emissions equivalent to the TA-Luft 2g' (2,000mg/Nm3 @ 5%O2 @100% load) as well as the Tier II US EPA standard. The generator engine and emissions datasheets of example type of engines under consideration by the operator (Appendix 02) were used to inform the Air Quality Dispersion Modelling Assessment. (Appendix 04).

3.12 Generator noise attenuation

The main generators are located within individual generator enclosures which provide added noise attenuation to achieve an acoustic pressure level of 75dB(A) (100% load) @ 1m around the perimeter of the container under standard test conditions.

Attenuation is achieved by lining the sheet steel roof and walls with soundproofing panels a 50mm thick layer of high-density mineral wool sandwiched between a steel sheet outer skin and a perforated steel inner skin. Additional heavy mass layers will be added as required to achieve the required level of sound attenuation.

For more information on noise impacts, please refer to the noise impact assessment submitted with the application ('Noise Impact Assessment' -Appendix 05).

3.13 Generator flue design

Dispersion of pollutants has been considered when designing the flues for the generator emissions. As a result, the flues are unimpeded by flaps/cowls and has been orientated vertically, exiting above the height of the building. The discharge from all main generators is at an elevation of 25m.

During the design process consideration was given to implementing a common windshield to group stacks as this is understood to improve dispersion however, significant impacts are considered unlikely from any of the modelled events at sensitive human or ecological receptors.

The design of the flues is therefore considered to be BAT.

Flue gas monitoring

The guidance specifies the BAT is also the provision of flue gases sampling ports to allow for monitoring of NOx and Carbon Monoxide in line with web guidance 'Monitoring stack emissions: low risk MCPs and specified generators'. Sampling ports will be installed within each of the flues which comply with the EA's MCERTS (monitoring certification scheme). Monitoring will be undertaken in accordance with the permit.

3.14 Fuel Storage and Management

The ESGs are capable of operating on diesel or biodiesel such as 'HVO' or Hydrogenated Vegetable Oil. Fuel for the ESGs is held in a bulk tank and the various belly tanks across the site (see Appendix 03 for i) Fuel storage schematic and ii Fuel distribution schematic).

The sites ESGs required adequate fuel storage to allow the generators to operate during a grid failure. The generators are fed from belly tanks, which are in turn fed from a single bulk tank. Details of the tanks and fuel related activities are covered in the following sections.

Management systems will be in place at the facility to ensure that the risk from fugitive emissions are minimised, for example through regular inspection and maintenance of plant. Protection systems will include automatically triggered safe plant emergency shutdown in the event of major faults in equipment. Scheduled maintenance of fuel tanks will be incorporated into the Environmental Management System (EMS), to minimise the risk of fugitive emissions.

The standby generation fuel storage, fuel delivery and engine lubrication oil systems have been designed to consider the potential impact of leaks / spillages on the site with the design of the oil storage and associated infrastructure in alignment with the Control of Pollution (Oil Storage) (England) Regulations 2001 and Best Available Technique (BAT) Reference (BREF) document 'Emissions from storage' for sites regulated under the IED has also been considered as part of the design.

Onsite storage capacity

The site stores sufficient fuel to operate in the event of grid failure. This is based on a conservative worst-case scenario where the data halls are at capacity requiring the generators to run at 100% load.

The fuel storage and management is as follows:

- A road tanker will fill up the fuel bulk top-up tank at the fill point with drip tray in a lockable cabinet with no exposed pipe open to the atmosphere post filling. The tanker will be parked on an area of slab with slotted drain that falls towards a blind sump drain which is connected to an oil separator, and in turn is connected to the foul water drain network that can be manually isolated in the event of a major incident.

- The main bulk top-up tank is located above ground within a bunded area capable of retaining 110% of the 40,000 litre tank volume in the event of spillage of fuel. This volume of fuel is required to meet the requirement to be able to provide uninterrupted power for 72 hours without any external assistance. The tank has integral level alarms remotely monitored allowing instant accurate assessment of the filling level. The tank has been designed to British Standard BS799 Type J and will be made of carbon steel following EN 10025 standards

- The top-up fuel tank bund has a sump-pump located within it to collect any surface water, which connects to an oil interceptor before discharging non-oily rainwater to the foul sewer network. This top-up fuel tank is connected via a short underground twin walled pipe (pipe-in-pipe) rated for carrying fuel which is connected to the main bunded generator enclosure area (110% capacity). The fuel is distributed to the individual generator 16,000 litre belly tanks via a single pipe network within the bunded area.

- The short underground twin-layered pipe between the top-up tank and main generator bunded area is essential to remove the potential for risk of collision and rupture of an above ground fuel pipe during fuel delivery or other maintenance activities.

- The underground pipe contains a leak detection system along the length, which uses a vacuum between the inner and outer pipe linked to an additional alarm panel. In the event of loss of vacuum, an alarm will activate and again be remotely monitored via the generator control system.

- The tanker offloading system is self-sealing (non-return valve) that only opens when fully connected to the tanker that has itself an electric fill valve and mechanical overfill protection.

- The fuelling area is monitored at all times via CCTV with high-level switch with audible/visual alarm and emergency isolation in the event of incident.

See the Fuel Distribution schematics (Appendix 03) are provided for further details.

The ESG will be housed within proprietary steel container units. Beneath the floor of the container unit for each ESG will be a belly tank, this being integral to the ESG container unit; this will automatically supply fuel to the ESG. Each of the belly tanks has a usable capacity of 16,000 litres and will be bunded to 110% of their capacity. There are two supply lines directed towards the ESG containers, one being pumped from the above ground bulk tank and a second more immediate coming directly after the filtration process. The objective of this approach is to ensure that the ESGs are fuelled and ready for start-up in case of Grid failure.

All tanks, pipes and valves are designed to appropriate industry standards and flanged connections between pipes are kept to a minimum by the proximity of the tanker fill point. When the twin-walled pipe appears aboveground next to the generator compound, the fuel is briefly in a single-walled pipe before entering the main bunded generator area from distribution to the individual belly tanks. These fuel pipes are situated over hardstanding with drainage which passes to an oil interceptor to minimise the impact of any leaks. Visual inspections will also take place daily to identify any leaks, with spill kits being on hand at multiple locations. In the event of any leaks at this location, the single-walled pipe would be isolated to minimise the quantity of fuel potentially released. The belly tanks can also be filled directly from within the bunded area, meaning operations can continue whilst any maintenance is undertaken with minimal disruption and environmental impact.

The generator belly tanks will be designed to British Standard BS799 Part 5 2010 (Oil Burning Equipment. Carbon steel oil storage tanks specification), which stipulates a requirement for 110% containment. The belly tanks are therefore considered to comply with the Oil Storage Regulations.

The belly tanks will also be provided with alarms in the event of pressure loss/significant leakage into the bund, as well as having alarms which alert at high and low fluid levels, both during filling and operation. These alarms will be remotely monitored via the generator control system. The operator will also carry out daily checks for signs of smaller leakage not notified by the alarm system.

Fuel tank filing will be carried out by trained fuel tanker drivers. This reduces any significant risk of spillages and leaks. Spill kits will also be available to deal with any leaks. Relevant spill response equipment will be situated at various locations around the site, designed for the particular hazard characteristics of the materials (fuel) present.

All spillages will be logged, investigated and corrective action will be taken.

Fuel integrity is maintained with each generator housing a fuel polishing unit to constantly circulate and filter the fuel. Blockage alarms will also be installed as an additional risk reduction measure, which will be remotely monitored.

In summary the bulk storage tank will have the following protection measures:

- Bunded to 110% of its capacity

- Level Sensor connected to the BMS.
- Tank Gauge Alarm set at 85% capacity connected to the BMS.
- Level Alarm to control panel at 90% capacity connected to the BMS.
- Mechanical Overflow Prevention Valve at 95% capacity
- Leak Detection Probes connected to the BMS.

The belly tanks will have the following protection measures:

- Bund designed to provide 110% containment.
- Tank level gauge.
- High and low level alarms connected to the BMS.
- A pressure delivery over-fill prevention valve.
- Leak detection alarms connected to the BMS.
- The generator sets will have pressure relief valves to prevent over pressurisation of fuel supplied from the belly tanks.
- An Engine Control Unit will provide instantaneous fuel consumption data which will be automatically collated to calculate total fuel consumption over time.
- To minimise the risk or corrosion all pipework will be painted or constructed of corrosion resistant material.

In addition to the above protection measures, each ESG container unit will have a fire detector which is connected to the datacentre's control room via the BMS and the fire sprinkler system (water).

Tertiary Containment

Tertiary containment will be provided by the contoured hardstanding of the area where the ESG and the fuel road tanker off-loading area will be located, additionally raised kerbing will be present along the site perimeter. These tertiary containment measures along with the oil interceptors as described above have been designed to provide adequate containment volume in the event of incident. The risk of a leak/spill from more than one belly tank at a time is considered to be low; the tertiary containment will therefore provide more than adequate capacity to contain a leak/spill of fuel from a belly tank.

Any unplanned release of fuel would be prevented from percolating into the ground by the hardstanding; should such a release enter the local drainage system it would be captured by the alarmed interceptor which will have an manual shut off device that can be activated on detection of fuel in the interceptor preventing the release of fuel to surface water.

In such an event, spillage procedures would be implemented.

Preventative and Predictive Maintenance (PPM)

The operator will develop a preventative maintenance system. PPM will be managed and completed by the 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.

The Data Centre will be staffed 365 days a year with monitoring by security staff located within a security office, using an extensive CCTV and alarm system. Entry and exit to the site are tightly controlled via a security gate and turnstiles. The site is bounded by a palisade security fence that acts as an impenetrable perimeter to prevent unauthorised access to the site.

It is anticipated that fugitive emissions of odour will not be significant for the facility. Fuel will be contained within vented tanks and therefore would only be a potential source of odour if a spill were to occur. Procedures will be incorporated within the EMS to ensure the potential for spills is minimised and they are dealt with swiftly should they occur.

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

4 OPERATING TECHNIQUES

4.1 Generator operation

The generators are to be used purely as standby plant to provide emergency standby power in the event of grid failure. There is no capacity agreement in place or elective operation of the plant for generating revenue (e.g. STOR, Triad avoidance, Demand Side Response, Peak Demand etc.). As such operation of the generators is likely to be limited to maintenance and testing of approx. 24.5 hours/year/generator.

4.2 Scheduled Maintenance & Testing

The maintenance schedule for the generators is based on manufacturer guidelines. These guidelines help to prolong the life of the equipment, reduce the use of raw materials (e.g. replacement parts, oil changes) and ensure the engines perform efficiently to prevent increases in pollutant levels.

The planned maintenance and testing regime for the ESGs is then 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 ESGs (i.e. testing and maintenance) will operate in accordance with a regular planned schedule. This will include the following events (timeframes quoted below are maximum figures whereas actual planned testing and maintenance hours will be less):

Event 1: Biweekly - Each of the 27 generators will be tested, one at a time (daytime only) for a maximum of 15-minutes every fortnight. Generators will be tested at 10% load (6.5hrs per generator))

Event 2: Biannual - Each of the 27 generators to be tested, one at a time (daytime only) for four hours twice annually. Generators will be tested at 100% load (8hrs per generator)); and,

Event 3: Maintenance - Each of the 27 generators to be tested, one at a time(daytime only) for ten cumulative hours over a year. Generators will be tested at 100% load (10hrs per generator)).

Emergency: During a blackout there the potential for all 27 generators to operate. These are configured so all generators would operate at 100% load.

Based on the hours above, the overall operational hours for planned maintenance and testing per year for all 27 ESGs will be 661.5 hours (based on 24.5 hours per ESG). The scheduled maintenance and testing regime for each ESG will be significantly below the 50-hour testing regime for ESGs which are used purely for a stand-by emergency role as stated in the EA Data centre FAQ.

Routine testing and maintenance of the generators will be completed by suitably experienced and trained data centre facilities management staff and an appointed subcontractor, if required. During maintenance and testing data centre facilities management staff and the subcontractor and will be completed in accordance with manufacturer requirements to ensure optimal performance and efficient combustion). The routine testing and maintenance regime ensures that a limited number of generators are subject to planned maintenance and testing at any one time. The testing and maintenance regime at the data centre will be managed via the PPM system.

This approach minimises both fuel consumption by the generators and generation of combustion emissions to air.

The air quality assessment has not identified significant impacts to air from the proposed test regime. Each generator is expected to run for 24.5 hours per annum and is considered to be BAT

5 EMISSIONS

5.1 Point Source Emissions to Atmosphere

Emissions to air will occur from the operation of the generators as a result of diesel/HVO combustion. Due to the Data Centre's high levels of resiliency, it is expected that operation will be limited to maintenance and testing only, with no elective operation as detailed earlier.

In order to estimate the total annual emissions of NOx to air from the site, emissions factors have been developed (Table 3) from the suppliers data sheets at peak fuel consumption rate and the resultant 'worst case' emissions discussed in the Air Quality Assessment (report ref 6973r2 dated January 2024– Appendix 04).

The Air Quality Assessment accompanying the EP Application (see Appendix 04) concludes that for each of the modelling scenarios the predicted pollutant concentrations are below the relevant Environmental Quality Standards (EQS) and not considered significant at all human and ecological receptors over both the short and long term.

The model accounted for a 72-hour grid failure event, with all generators running concurrently at site load. In a typical outage, only generators required to carry the building load would operate, meaning this scenario is conservative. Whilst this scenario is not regarded to be representative of typical site operations, the predicted impacts of operations were not considered significant.

The ESG will each operate for less than 500 hours per annum and will not be subject to ELV for the substances listed in Annex V of the IED. As the ESGs will not be used for the elective generation of electricity they will not be considered 'specified generators' will not be subject to the ELV for NOx (190mg/kg (within 10 minutes of the ESG commencing operation)).

5.1.1 Air Quality Management Plan

BAT is to develop an Air Quality Management Plan (AQMP) to be implemented in the event of a prolonged outage. An AQMP will be drafted as a basis for identifying which receptors may be affected and if notification is required. The plan is to be further developed in conjunction with the regulatory stakeholders. Once the AQMP is finalised, it shall be submitted to the EA for final approval.

5.2 Point Source Emissions to Sewer / Surface Water

The installation is connected to a newly installed drainage system that will serve the wider site that is split into separate foul and surface water networks as shown within the surface and foul water drainage plans (Appendix 1).

Detailed schematics of the diesel storage and distribution design (Appendix 3) provide details of the containment of run-off from the installation including fuel delivery, fuel storage, fuel conveying system and fuel polishing systems. These assets and the generator yard will discharge from the installation to sewer via an oil interceptor (3200 litre liquid capacity, 1000 litre sediment storage capacity Class 1 full retention interceptor). The interceptor will be fitted with an automatic closure device which will activate on detection of fuel; this device will be activated by its integral detection mechanism. The system will also be fitted with a wired interface to the building's BMS. An audible alarm system for oil levels will be also installed which will connect to the data centre BMS. In the event of an unplanned release of fuel, the closure device will automatically isolate the interceptor preventing the discharge of fuel contaminated runoff to sewer and the alarm will notify key data centre staff of the issue, via the BMS.

The wider drainage system at the site will accept rainwater runoff from the building roof area and other hard surfaced areas of the installation and the overall site. This will pass through an interceptor to the attenuation ponds which are designed with a hydrobrake and penstock to control the outfall release of surface water runoff to The Grand Union Canal.

Procedures will be developed and included within the site's Environmental Management System (EMS) for the management of surface water runoff and for the management and maintenance of the interceptor; relevant staff will be suitably trained in these procedures. All interceptors will be emptied at least annually and be subject to regular inspection and integrity testing.

5.3 Emissions to Land

The data centre will have no point source emissions to land.

5.4 Fugitive Emissions

Significant fugitive emissions, odours and noise are not anticipated in respect of operation of the data centre ESGs either during testing or during full emergency operation.

A summary of the storage arrangements for fuel is provided in above.

The data centre operator will maintain procedures for fuel delivery and for spill response, and relevant operating personnel will be provided with spill response training. Additionally, the requirement for regular inspections of the data centre site will be included in the site's EMS and maintenance procedures.

5.5 Noise Emissions

A noise impact assessment was completed in support of the application for an environmental permit. This report is presented in Appendix 05. This report identifies sensitive receptors and potential sources of noise from the installation. The primary noise sources are the EGS's which would only operate one at a time during testing/maintenance.

The impact assessment concluded that "noise levels are predicted to achieve the noise limits at the nearest noise sensitive properties and therefore noise impacts are not considered to be significant.". Further information can be seen in the 'Noise Impact Assessment' submitted as part of this application.

As the ESGs will be operated intermittently for maintenance and testing purposes only, and for emergency backup purposes in the unlikely event of brown or black out scenarios, it is considered that there would be low impact as a result of operation of the ESGs at the proposed data centre. ESG routine testing and maintenance will only take place during normal routine working hours.

6 ENERGY EFFICIENCY

6.1 General energy management

The Energy Efficiency Directive 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*". As the total installed planned maintenance and testing schedule falls below the 1500 hour the data centre is therefore exempt from the EED requirements and an assessment of energy efficiency is not required.

The back-up generators are designed for use in the event of an emergency. The provision/implementation of combined heat and power is not applicable as the back-up generators will each operate for substantially less than 500 hours per annum for the provision of emergency power generation.

Energy recovery is not reasonably practicable for engines of this emergency nature with such small anticipated operational hours. However, as part of the operator's EMS, energy use will form one of the key environmental indicator and regular assessments of the site's energy usage will be undertaken with a view to identifying measures to improve energy efficiency, where possible.

6.2 UK ETS

The installation's combustion plant capacity is in excess of 20MWth and the operator will therefore participate in the UK ETS scheme. The operator will submit a Greenhouse Gas Permit application. Participating in the scheme requires the site to record and maintain detailed records of generator operational hours and fuel consumption to determine annual CO_2 emissions.

6.3 CCA

The operator will not be a participant to a Climate Change Agreement (CAA). Energy management techniques will be implemented via the operator's EMS. Energy management techniques are employed to monitor, record and track power usage effectiveness (PUE) within the Data Centre.

6.4 Measures to Improve Energy Efficiency

The electricity efficiency of the generators ranges from 30-40%. Heat recovery on generators is not a viable option since the generators are backup plant that operate infrequently. To ensure the generators operate as efficiently as possible, the site follow a PPM regime. This involves regular checks of the generators to help ensure each generator is operating efficiently.

7 EFFICIENT USE OF RAW MATERIALS

The BAT objective with regard to raw materials is achieved by the appropriate design, operation and maintenance of the ESGs to ensure the lowest possible consumption rate of fuel; by the selection of least hazardous materials; and by the provision of appropriate storage methods. The main raw materials that will be used within the permitted installation are as follows.

7.1 Diesel / HVO

The installation will store enough diesel/Hydrogenated Vegetable Oil (HVO) to provide the site with up to 72 hours' worth of electricity when running at 100% continuous rated load. Due to the highly reliable grid supply, it is unlikely that large volumes of fuel will be consumed by this installation. Fuel use will mostly be limited to maintenance running of the generators. The PPM regime in place will help seek efficient fuel use by the generators.

7.2 Ancillary Materials - Lubrication oils and Antifreeze

The engines require lubrication oil to reduce wear and tear through friction. Periodic replacement of this oil and antifreeze is required during scheduled or forced maintenance periods only. Waste oils are to be stored and disposed of responsibly and in accordance with applicable legislation. No lubricating oil/anti-freeze or transformer oil will be stored on site by the operator; all oils will be brought to site and topped up/replaced during planned or forced maintenance periods only. The lubricating and transformer oils may have alternatives, however the type of oils used are limited to those recommended/specified by the engine manufacturers and site engineers.

The engines will utilise a closed-circuit cooling water system which will utilise a water / glycol mix. The cooling system, including coolers and circulating pumps will be fully within the container for each engine. There will be no need to routinely top up coolant and any spillages or leaks will be quickly identified and dealt with.

No process waters will be generated by the plant, hence there will be no associated process water releases to surface water or sewer from the installation. The area containing the coolers and Closed Cycle Cooling Water (CCCW) circulating pumps will be within the engine containers so the risk of accidental discharge of process waters is minimised.

8 AVOIDANCE, RECOVERY AND DISPOSAL OF WASTES

8.1 Waste

Waste streams arise as a result of operation and maintenance of the combustion plant. Maintenance extends the life of the plant and resolves issues in a timely manner, reducing waste associated oils, lubricants & replacement parts. The installation does not produce significant amounts of waste due to the standby nature of the generators.

Waste streams arising from this installation can include but are not limited to small volumes of lubrication oils used in maintenance and servicing, air and fuel filters in addition to ad hoc disposals of items such as fuel that has reached end of life, used spill kits, and decommissioned plant for disposal at the end of life only. Any waste oil generated during testing/ maintenance will be removed from site by the appointed third-party contractor and managed by a suitably regulated waste management contractor.

The operator will minimise waste generation through efficient use of raw materials including fuel polishing to avoid the need to dispose of out of specification fuel.

9 GENERAL MANAGEMENT

9.1 Management Standards

In addition, to an EMS, as detailed below, the following management standards will be implemented:

- ISO/IEC 27001:2013 – specifies the requirements for establishing, implementing, maintaining, and continually improving an information security management system within the context of the organisation. It also includes requirements for the assessment and treatment of information security risks tailored to the needs of the organisation.
- ISO9001:2015 – specifies the requirements for establishing, implementing, monitoring, managing, and improving quality throughout the organisation.

9.1.1 Environmental Management System (EMS)

The operator has corporate standards that require an effective Environmental Management System (EMS) that follows the principles of the internationally recognised ISO 14001:2015 standard. The EMS places specific focus on the following:

- 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
- A commitment to working to achieve continuous improvement in environmental performance.

In summary:

- 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.
- The operator will establish and maintain documented procedures for identifying and recording environmental aspects for all its activities, products and services in addition to climate related risks. EMS will encompass the process for the setting, managing and reviewing environmental objectives and targets and set out 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 system will include 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 risk assessments, together with the environmental aspect evaluation, will allow routine management system procedures to manage risks under normal circumstances, and emergency plans to mitigate impacts under abnormal circumstances. Such assessments will cover the implications of material storage, oil transfer, drainage and site security.
- The operator will require the reporting of all environmental incidents, including near misses. Staff will be encouraged to report environmental incidents and problems which may result from pollution incidents and near misses and non conformances.
- 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 Standard Operating Procedures that are pertinent to the application for an environmental permit include spills response, refuelling and grid failure procedure (Air Quality Management Plan).
- 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.
- 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. A Business Continuity Plan, 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.
- 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.
- 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. 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.

10 MONITORING

10.1 Generator operation

Generator operational hours and fuel consumption for maintenance, testing and during an outage will be monitored and reported to the EA annually. In addition to the annual report, outages are to be notified to the EA within 24 hours of emergency operation commencing. 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 ESG are regarded as having minimal start-up or shutdown times. Operational hours will be counted from the first fuel ignition.

10.2 Emissions limits & Flue Gas Monitoring

The generators are classed as Medium Combustion Plant (MCP). Operational hours are unlikely to exceed 50 hours per year and thus the plant is classed as 'excluded MCP which are exempt from meeting the new plant BAT emissions limit values (ELVs).

Monitoring of flue gas emissions is to be completed in accordance with EA permitting requirements. Flue gas sampling ports, designed to meet BS EN 15259, will be installed on the flues. This will allow for NOx and CO monitoring as required by the permit. Any testing is to be undertaken by an MCERTS accredited supplier.

11 CONCLUSION

The proposed design and operating techniques for this installation and these are considered to meet the EA's BAT requirements for this Data Centre.

12 APPENDICES

Appendix 01: Site Drawings:

i. Environmental Permit Installation Boundary

ii. Air Emissions Point Schematic

iii. Site Drainage Plan – Surface Water (Drawing Ref CSC-00-XX-DR-C-1100)

iv. Site Drainage Plan – Foul Water (Drawing Ref CSC-00-XX-DR-C-1200)

Appendix 02: Engine Manufacturer Example Specifications (MTU engines)

Appendix 03: Fuel Schematic

i. Diesel Fuel Tank and Pipeline Specification

ii. Fuel Storage Schematic (Drawing Ref ETH-01-XX-DR-M-1031)

iii. Fuel Distribution Schematic (Drawing Ref ETH-01-XX-DR-M-1030)

Appendix 04: Air Quality Assessment Report (Redmore Environmental Ltd Report ref 6973r2 dated 27th May 2026)

Appendix 5 The Ridgeway DC - Iver - Env Permit Noise Report - June 2026

Appendix 06: 3rd Party Site Reports

i. Phase I Desktop Reports Argyll Site Solutions Combined Search & TerraSearch Ground Report

ii. Ground Investigation Reporting 2021

iii. Phase II Investigation Reports Concept: 21/3593- FR01 27/08/2021