Thorney Lane Data Centre Emergency Back-Up Generation Facility

Environmental Permit Application EPR/SP3224LP
Assessment of Best Available Techniques

Amazon Data Services UK Limited

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Glossary

Glossary/ Abbrevation	Term
ACS	Automatic Control System
AQAL	Air Quality Assessment Levels
AQIA	Air Quality Impact Assessment
AQMA	Air Quality Management Area
AQMP	Air Quality Management Plan
AHUs	Air Handling Units
BAT	Best Available Techniques
BREF	Best Available Techniques Reference Document
BS	British Standard
CCA	Climate Change Agreement
CCB	Client Control Building
CCGT	Closed Circuit Gast Turbine
CCTV	Closed-Circuit Television
CO_2	Carbon Dioxide
DAA	Directly Associated Activities
dB	Decibel
EA	Environment Agency
EMS	Environmental Management System
EnMS	Energy Management System
EPMS	Electrical Power Monitoring System
EPR	Environmental Permitting Regulations
ESOS	Energy Savings Opportunity Scheme
ET	Electricity Transmission’s
FAQ	Frequently Asked Questions
FCDM	Frequency Control by Demand Management
FFR	Fast Frequency Response
GHG	Greenhouse Gas
GW	Groundwater
HR	Human Receptor
HV	High Voltage
IED	Industrial Emissions Directive
ISMS	Information Security Management Systems
ISO	International Standards Organisation
IT	Information Technology
kV	Kilo Volt
LA	Local Authority
LAQMZ	Local Air Quality Management Zone
LCP	Large Combustion Plant
LV	Low Voltage
MCP	Medium Combustion Plant
MCPD	Medium Combustion Plant Directive
MW	Mega Watt
MWth	Mega Watt thermal

Glossary/ Abbrevation	Term
MVA	Mega Volt-Amperes
NAQS	National Air Quality Standards
NGET	National Grid Electricity Transmission
NIA	Noise Impact Assessment
NOx	Nitrogen Oxides
NO_2	Nitrogen Dioxide
OCGT	Open Circuit Gas Turbine
OPV	Overfill Protection Valve
PC	Process Contribution
PM	Particular Matter
PPM	Planned Preventative Maintenance
PUE	Power Usage Effectiveness
QMS	Quality Management System
SCR	Selective Catalytic Reduction
SNCR	Selective Non-Catalytic Reduction
SOP	Site Operating Procedures
SOx	Sulphur Oxides
SRP	Spill Response Plan
SSE	Scottish and Southern Energy
STOR	Short-Term Operating Reserve
TA-LUFT	Technische Anleitung zur Reinhaltung der Luft
TWUL	Thames Water Utilities Limited
UK	United Kingdom
UK ETS	UK Emissions Trading System
UPS	Uninterruptible Power Supplies
USEPA	United States Environmental Protection Agency
VSD	Variable Speed Drives
WMP	Waste Management Plan

1. Report Context

1.1 Introduction

AECOM Limited ('AECOM') has been commissioned by Amazon Data Services UK Limited ('the Operator') to prepare a new bespoke application for an Environmental Permit for the emergency back-up generation facility for the proposed data centre emergency back-up facility at Thorney Wood Business Park, Thorney Lane North, Iver in Buckinghamshire. The environmental permit will be for the emergency backup generators and associated fuel storage and handling ('Proposed Installation')

The purpose of this report is to demonstrate that the Proposed Installation will be designed and operated in accordance with the EA indicative best available techniques (BAT) guidance.

1.2 Proposed Installation

The Environmental Permit application will be made for the combustion activities (including fuel storage and handling) associated with emergency backup generators only and not the wider data centre operations. The installation boundary for the Environmental Permit will include the areas covered by these activities only.

The wider data centre development comprises the construction of commercial buildings accommodating data centres, ancillary office space, associated plant and equipment, emergency backup generators with fuel storage infrastructure, landscaping, sustainable drainage systems, and parking facilities.

A bank of emergency backup generators will be provided to support the data centre operation in the event of a power outage. Each individual generator will be classed as medium combustion plant (MCP) with an aggregated thermal input for the site which will exceed 50 megawatts thermal (MWth).

The Proposed Installation will include 36 containerised generators to provide backup power supply for the two main data centre buildings, and a smaller 'house' generator for each building to cover non critical operations in an emergency such as offices, the proposed generator fuel storage and handling areas, and associated emission points only.

1.3 BAT Considerations

The proposed diesel generators are each classed as medium combustion plant (MCP), however the aggregated total rated thermal input of the installation as a whole will be above 50 MWth and therefore it will be regulated under EPR as a Schedule 1, Part 2, Section 1.1 A(1)(a) – burning of any fuel in an appliance with a rated thermal input of 50 or more megawatts.

The diesel generators proposed will each have a net thermal input significantly below 15 MWth. Therefore, although the total combined thermal input of all engines is greater than 50MWth, the aggregation rules set out within the Industrial Emissions Directive (IED)[1] do not apply and therefore the installation is not classed as a large combustion plant (LCP). Accordingly, the installation does not fall within Chapter III of the IED and instead is a Chapter II combustion plant. The emission limits relevant to LCPs within the relevant BAT Conclusions do not apply.

Although the generators are MCP, as they will be operated for back-up purposes only, the total operating hours for each generator per year will not exceed 500 hours, and as such they will

[1] Article 29 – https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32010L0075&from=EN

not be required to comply with the emission limits set out in Schedule 25A Environmental Permitting Regulations 2016[2], as amended.

At the time of writing there are no relevant published BAT reference documents (BREF notes) for data centres and the previous combustion sector guidance document: ‘Combustion Activities (EPR 1.01)’ was withdrawn in August 2018. The EA has published:

- “Data Centre FAQ Headline Approach v21” (November 2022)[3] as a working draft guidance document detailing the approach to permitting and regulatory obligations for data centres under the Industrial Emissions Directive (IED) and the Environmental Permitting Regulations. The Data Centre FAQ document is not presently an official release but forms the basis for discussion of a common methodology and liaison with individual operators and their industry association and summarises the framework for our approach in applying EPR/IED to data centre
- “Emergency backup diesel engines on installations: best available techniques[4]” for MCP that operate up to 500 hours per annum.
- ‘Develop a management system: Environmental Permits’ guidance[5].

This BAT assessment has therefore been developed using engineering information provided by the Operator, based on the design parameters of the Proposed Installation, available information about the local environment and the applicable standards and guidelines, outlined in the above guidance documents.

[2] The Environmental Permitting (England and Wales) Regulations 2016, as amended.
[3] Data Centre FAQ Headline Approach v21’ (November 2022).
[4] Environment Agency Guidance “*Emergency backup diesel engines on installations: best available techniques*” August 2023
[5] Environment Agency Guidance “*Develop a management system: environmental permits”* April 2023

2. Approach to BAT Appraisal

Article 3 (10) of the Industrial Emissions Directive (IED)[6] defines BAT as "the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where not practicable, generally reduce emission and impact on the environment as a whole".

The Directive continues to provide further definition as follows:

- "available techniques" are those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the cost and advantages, whether or not the techniques are used or produced inside the United Kingdom, as long as they are reasonably accessible to the Operator.
- "best techniques" are the most effective in achieving a high general level of protection of the environment as a whole.
- "techniques" are both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned.

BAT may be demonstrated by either:

- Compliance with the sector-level, indicative BAT performance such as Sector Guidance Notes provided by the Environment Agency or in the European Commission 'Reference Documents on BAT' (BREFs) and their associated BAT conclusions; or
- By conducting an installation-specific, options appraisal of candidate techniques.

The indicative BAT provided in the European BREF/BAT Conclusion documents is based on an analysis of the costs and typical benefits for typical, or representative, plants within that sector. When assessing the applicability of the sectoral, indicative BAT standards at the installation level, departures may be justified on the grounds of the technical characteristics of the installation concerned, its geographical location and the local environment.

[6] European Parliament and Council of European Union, November 2010, Directive 2010/75/EU on Industrial Emissions (Integrated Pollution Prevention Control)

3. Technology Selection

The following section presents a Best Available Techniques (BAT) assessment, detailing the consideration of alternative technologies and the rationale for selecting diesel generation as the most suitable option.

At present, neither the Environment Agency or the European Commission has published any BAT reference documents or BREF notes specifically addressing the provision of backup power within the data centre sector. As a result, an alternative approach is being proposed, informed by the Environment Agency's guidance outlined in the "Data Centre FAQ Headline Approach v21[3]."

The selection of BAT to meet the backup power requirements is guided by operational performance and environmental risk. These criteria have been defined in alignment with the principal risks associated with backup power provision and are consistent with the risk assessment guidance applicable to bespoke environmental permits.

Operational performance criteria used for BAT selection to meet the backup power requirements are detailed in Table 1.

Table 1. Operational performance criteria

Criteria	Considerations	Weighting
Cost benefit analysis	The upfront capital investment for the proposed technology, along with the potential costs of any required mitigation measures, must be carefully evaluated to ensure they are proportionate to the anticipated environmental benefits. Excessive costs could undermine the operator's competitiveness in the market.	High - impacts competitiveness
Proven as a reliable technology	Data centres demand high levels of resilience, making proven reliability the primary operational criterion for any backup power technology. Reliability can be assessed by examining how frequently and successfully the technology has been deployed across the industry - indicating whether it is well - established or still emerging. Additionally, the selected technology must align with the prevailing operational models and standards commonly adopted within the data centre sector.	High - if technology is not proven it presents a risk to the operator
Cold start capability	The selected technology must be capable of rapid activation in response to an unexpected power outage. A warm start configuration would require generators to run continuously, leading to increased fuel consumption and associated environmental impacts. Conversely, a slow-start system would demand supplementary energy storage - such as batteries or flywheels, resulting in higher costs and greater spatial requirements.	High - the ability to provide instant power is critical to business functions
Space requirements	Space requirements are an important environmental consideration, as technologies demanding substantial physical footprint - such as generator units, energy storage systems (UPS), and fuel storage - can limit the available area for hosting IT equipment within the data centre. This constraint may lead to the need for a larger site or the development of additional facilities to maintain the intended level of service.	High / Medium – space limitations often dictate the technologies that can be considered
Fuel suitability	The chosen fuel must be suitable for safe storage and transportation to and within the site, posing minimal operational risks - such as a low likelihood of combustion or other hazardous incidents.	Medium – low volatility and low risk is vital
Lifetime of stored fuel	Given the infrequency of mains failure events, the fuel may need to be stored onsite for extended periods, as generators are typically only operated during maintenance and testing. Therefore, the fuel must be of a type that remains stable and usable over time, avoiding degradation that could render it a waste product requiring disposal.	Medium to low – whilst an added cost it is not top priority

Environmental risks considered in the BAT selection for meeting backup power requirements are detailed in Table 2.

Table 2. Environmental risks

Criteria	Considerations	Weighting
Air quality impact	Impacts on local air quality resulting from the emission of combustion gases during operation of the technology, in conjunction with the type of fuel used.	High - internal combustion engines perform poorly but they are run infrequently
Noise / odour	The technology should not generate frequent odour or noise disturbances that lead to complaints from nearby sensitive receptors, such as residential properties.	Low - complaints are unlikely due to infrequent operation
Global warming impact	The fuel's contribution to global warming should be proportionate to, and justified by, the electrical output delivered by the technology.	Medium - impact is high, but combustion of fuel is infrequent
Release to water (fuel spillage)	The likelihood of fuel leakage into the surrounding environment - such as nearby watercourses or soil - should be minimal.	Low - fuel use is low due to infrequent operation
Fugitive emissions (leak of gaseous fuel)	The potential for fuel to escape into the atmosphere, such as through gaseous emissions, should be minimal.	Low - fuel use is low due to infrequent operation

3.1.1 Infrastructure selection

A comparison of technology types is presented in Table 3 on the following page.

Table 3. Technology Selection

Technology	Start-Up time	Thermal Efficiency (LHV %)	Advantage	Disadvantage	BAT for Site
Combined Cycle Gas Turbines (CCGT)	1 to 3.5 hours	58.8 -60.7	High efficiency (higher than OCGT turbines or diesel gensets). Lower emissions – Natural gas produces less CO_2, NO_x, SO_x and particulates compared with coal or oil-based backup plants. Fuel availability – If connected to a secure gas grid, they have a reliable, continuous fuel source. Scalability – Can be designed for large-scale power backup (hundreds of MW), supporting grid-level emergencies. Modern technology – Widely used, proven, and commercially mature, with strong operational track records	Slow start-up time – too slow for most emergency backup needs (where seconds to minutes are required). High capital cost – More expensive to build and maintain than diesel or open-cycle gas turbines for standby duty. Complexity – Requires sophisticated systems, skilled operators, and continuous maintenance, even if rarely used. Dependence on gas supply – Vulnerable to interruptions in natural gas infrastructure during emergencies. Not suited for small-scale – Oversized for local facilities (hospitals, data centres), where fast-starting diesel or battery systems are more practical.	Not considered BAT for the provision of emergency/standby power due to: • lengthy start up times • size limitations; • efficiency of steam cycles is relatively low at small capacity • overall system complexity being more appropriate to larger size installations. • Vulnerable to interruptions in natural gas infrastructure.
Open Cycle Gas Turbines (OCGT)	15 to 30 mins	38.3 – 39.9	Fast start-up – much faster than CCGT, suitable for emergency or peak demand backup. Lower capital cost – Simpler design and cheaper to build compared with CCGTs. Flexible operation – Can be switched on and off quickly, ideal for standby/peaking duty. High reliability – Proven technology widely used for grid support and backup. Scalability – Can provide large-scale emergency power (tens to hundreds of MW).	Lower efficiency than CCGT, so fuel consumption is higher. High operating cost – Expensive to run compared to baseload or continuous generation. Emissions – Higher CO_2 and NO_x per MWh compared with CCGT. Noise & heat – Louder operation and higher exhaust temperatures can be problematic near urban sites. Still slower than diesel/battery – For critical facilities needing instant backup (e.g., hospitals, data centres), diesel gensets or batteries are faster (seconds vs. minutes).	Not considered BAT as OCGTs have: • relatively high capital investment, • high operating and maintenance costs • lower thermal efficiencies than can be achieved by CCGTs and gas engines. • Vulnerable to interruptions in natural gas infrastructure.
Aero Derivative Gas Turbines	As low as 1 min	35 - 39	Very fast start-up – can reach full load in 2–5 minutes (faster than OCGTs, much faster than CCGTs). High power-to-weight ratio – Compact and lightweight, so they're easier to transport and install. High reliability – Designed from aircraft engines, they have proven performance in demanding, start-stop operations. Lower maintenance downtime – Modular design allows for rapid swap-out of components. Lower emissions than diesel gensets – Cleaner combustion and lower particulates. Scalable – Units typically range from ~25 MW to 100+ MW, making them suitable for grid backup or large industrial sites.	Lower efficiency than CCGT – higher fuel consumption than combined cycle systems. High operating cost – More expensive per MWh generated compared with baseload plants. Maintenance intensity – While modular, they require skilled technicians and specialised parts. Fuel dependency – Still reliant on a secure gas supply, which may be disrupted in emergencies. Not ideal for very small-scale – Oversized and cost-inefficient for sites that only need a few MW (e.g., hospitals, data centres).	Not considered as BAT as aero derivative gas turbines : • suffer from relatively low efficiencies compared to engines (although they can achieve suitably short start-up times) 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. • High operating costs • Vulnerable to interruptions in natural gas infrastructure.
Gas Fired Generators	1 to 10 mins	35 - 45	Fast start-up – Can deliver power within seconds to a few minutes, suitable for emergency response.	Reliance on gas supply – Dependent on continuous pipeline gas which may be disrupted during emergencies.	Not considered BAT due to: • Vulnerable to interruptions in natural gas infrastructure.

Technology	Start-Up time	Thermal Efficiency (LHV %)	Advantage	Disadvantage	BAT for Site
			Higher efficiency – better than OCGTs and aero-derivative turbines at part-load. Flexible operation – Can handle frequent start/stop cycles and varying loads effectively. Lower emissions than diesel – Produces less NO_x, particulates, and CO_2 compared to oil-based backup. Good for distributed generation – Suitable for medium-scale facilities (hospitals, data centres, industrial sites). Modular scalability – Multiple smaller units can be installed to improve redundancy.	Slower than diesel gensets – Not always as instant; diesel engines can start and synchronise faster (seconds vs. up to a minute). Higher capital cost – More expensive per kW than diesel gensets. Space requirements – Larger footprint than diesel engines for the same output. Maintenance – More complex than diesel engines; requires regular servicing and skilled technicians. Medium NOx emissions; CO2 emissions. Noise impacts.	• Slower than diesel gensets • Higher capital costs • Larger space requirements • More complex maintenance requirements than diesel gensets.
Diesel Fired Generators	<1min	35 - 37	Very fast start-up – Can start and deliver power within seconds, making them ideal for critical facilities (hospitals, data centres). High reliability – Proven, robust technology with decades of operational experience. Independent fuel supply – Can store diesel onsite in tanks, not reliant on gas pipelines or external grids. High power density – Compact size relative to output; easy to install even in confined sites. Lower capital cost – Cheaper to purchase and install than gas turbines or gas engines. Scalable and modular – Multiple units can be installed for redundancy and flexibility. Well-established supply chain – Readily available parts, service, and technicians worldwide.	Emissions – High CO_2, NO_x, SO_x, and particulate matter compared with natural gas–fired options. Fuel storage risks – Requires safe storage; fuel degrades over time and needs periodic replacement or treatment. Noise and vibration – Can be disruptive without significant acoustic treatment. High operating cost – Diesel fuel is relatively expensive, especially during prolonged operation. Maintenance needs – Requires regular testing, servicing, and load runs to remain reliable. Limited run duration – Constrained by available on-site fuel storage; extended emergencies may require refuelling logistics.	Considered BAT for the site due to: • High response and low start-up duration • Good independent performance reliability due to onsite storage of diesel in sufficient quantities. • Fuel managed and control by the facility. • Fuel oil can be sourced from more than on supplier. • Handles variable loads readily. • Diesel can be readily substituted for sustainable fuels such as HVO, which is intended in the future,
Hydrogen Cell	<1 min		Fast response – Can deliver power almost instantly, suitable for critical backup. Clean emissions – Produce only water and heat at point of use; no CO_2, NO_x, SO_x, or particulates. Quiet operation – Minimal noise and vibration compared with engines or turbines. High reliability – Fewer moving parts, reducing risk of mechanical failure. Scalable and modular – Can be deployed from small (kW) to large (MW) systems depending on need. Longer runtime than batteries – As long as hydrogen fuel supply is available, they can run continuously. Future-proof – Align with decarbonisation and net-zero policies, potentially eligible for incentives.	Hydrogen supply dependency – Requires reliable hydrogen storage or delivery; infrastructure is limited in many regions. Storage challenges – Hydrogen must be stored under high pressure, in liquid form, or as hydrides, which adds cost and safety concerns. High capital cost – Much more expensive per kW than diesel gensets or gas engines. Lower technology maturity – Less widely proven in emergency backup compared to diesel or gas systems. Space requirements – On-site hydrogen storage can take up more space than diesel tanks. Limited availability of service expertise – Fewer technicians and suppliers compared with conventional backup systems. Fuel logistics in emergencies – Refuelling may be difficult if supply chains are disrupted.	Not considered BAT because: • current capacities not capable of meeting 24-48hr back-up requirements • additional storage risks • low technical maturity for use in back-up systems • high capital cost.

Technology	Start-Up time	Thermal Efficiency (LHV %)	Advantage	Disadvantage	BAT for Site
				Limited experience in relation to data centre operation; limited capacity - longer-term (24-48hr) capability still in R&D stage	
Battery Storage	<1 mins		Instant response – Can supply power in milliseconds, ideal for critical loads (hospitals, data centres, telecoms). No emissions – Zero on-site pollution (no CO_2, NO_x, SO_x, particulates). Quiet operation – No noise or vibration compared to engines or turbines. High reliability – Solid-state technology with minimal moving parts reduces failure risk. Scalable and modular – Systems can range from kW to hundreds of MW. Low maintenance – Requires less servicing than mechanical generators. Can bridge power gaps – Often paired with diesel/gas generators to cover the time until they start.	Limited duration – Backup typically lasts from minutes to a few hours; long outages need another power source. Longer-term (24-48hr) capability still in R&D stage High capital cost – Expensive for large-scale or long-duration backup compared with diesel gensets. Degradation over time – Performance reduces with charge/discharge cycles and age. Space requirements – Large battery banks needed for extended coverage, which may limit feasibility. Safety concerns – Risk of thermal runaway, fire, or chemical hazards if not well managed. Material sustainability – Reliance on lithium, cobalt, and other critical minerals with supply chain risks.	Not considered BAT due to: • current capacities not capable of meeting 24-48hr back-up requirement • high capital costs • space requirements Vs limitations on site
Solar/Wind	Slow		Clean and renewable – Zero emissions during operation; reduces reliance on fossil fuels. Low operating cost – Once installed, fuel (sunlight/wind) is free. Scalable – Can be deployed from small rooftop solar arrays to large wind farms. Sustainable image – Supports net-zero and corporate sustainability goals. Silent operation – Especially solar; minimal noise compared with engines or turbines. Long-term resilience – Provides ongoing power generation during extended outages (if weather permits).	Intermittent output – Solar depends on daylight and weather; wind depends on wind speed. Not reliable as standalone emergency supply. No instant guarantee of power – If there's no sun or wind at the time of the emergency, output may be zero. Requires storage or hybridisation – Must be paired with batteries or generators to ensure consistent backup. Slow response – Cannot guarantee immediate power unless integrated with fast-acting storage. Space requirements – Solar panels and wind turbines need significant land or rooftop area. High capital cost for reliability – Making them dependable for emergency use usually requires significant investment in storage. Maintenance and exposure – Outdoor equipment can be vulnerable to storms, debris, or damage during the very emergencies when backup is needed.	Not considered BAT as: • Cannot be relied on for power input required in event of grid failure • Slow response in back-up scenario • Space restrictions vs available space on site • High capital cost.

4. BAT Assessment Against the Data Centre FAQ Document

BAT No	Requirements	Demonstration of BAT	Operating to BAT
1	**Management Standards** Site's management system to embrace aspects of environmental impacts this would include the non-combustion related requirements for the protection of groundwater (i.e. fuel oil storage regulations), noise, dust and odour.	The Proposed Installation will be operated under an Environmental Management System (EMS) in line with BS EN ISO14001: 2015 or suitable equivalent standard. The EMS will include: ▪ an environmental policy and other relevant management principles; ▪ organisation structure with defined responsibilities including integrating EMS responsibilities within line management; ▪ an ongoing commitment to the training and development of staff ▪ site specific procedures, process controls and monitoring arrangements; ▪ the annual establishment of objectives and targets ▪ ongoing monitoring and review of environmental performance; and ▪ commitment to working to achieve continual improvement in environmental performance. Further details of the EMS is provided in Section 3 of the Supporting Statement (Document reference: SP3334LP/APP/SS in Part 3 of the Application).	Yes
2	**Engine Selection** Choice of engine, the particular configuration and plant sizing meeting the standby arrangement	Diesel generators have been identified as the preferred solution for delivering standby power to the installation during grid interruptions (see section 3 above). As stated in section 3 above a diesel fuelled engine has been chosen due to the ability to store the required volumes of diesel or HVO on site and therefore maximise energy security in the system. The generators will support two data centre buildings on a single site. The EA's Data Centre FAQ guidance[3] note states that "We accept that oil fired diesel generators are presently the default technology for standby generators in data centres." The size of the engines has been selected in order to ensure fast start up and shut down can be achieved as this is a fundamental requirement of the emergency back-up nature of the generators. Generator procurement is still being progressed but reviewing the specification sheets for the generators going through the procurement process, it is expected that: • Main generators will have electrical output of 2.8 MWe and thermal inputs are ranging between 6.93 to 7.57 MWth, resulting in an efficiency of between 37 – 40.4%. • House generators will have electrical output between 0.8 to 1.4 MWe and thermal inputs ranging between 1.78 to 3.45 MWth, resulting in an efficiency of between 35 – 45.5%. • There will be 36 main generators and 2 house generators on site and assuming the generator selected for each type has the highest MWth thermal input, the Operator is seeking a permit for an aggregated 280 MWth for the Proposed Installation. Generator units chosen can deliver an N+1 standby arrangement. All generators will be new and examples of the typical specification for the main generator is provided in Appendix A to the Supporting Statement (Document reference: SP3334LP/APP/SS in application part 3). The final selected generator specification will be provided to the EA pre-operation. The diesel engines are considered to be BAT on the basis that: • There is the ability to store the required volumes of diesel/HVO on site and therefore maximise energy security in the system; • instantaneous supply of electricity is required in the event of power loss to the site, which diesel engines provide; • the technology is well established, replacement parts are readily available, and the maintenance costs are low; and the size of the engines has been selected in order to ensure fast start up and shut down can be achieved as this is a fundamental requirement of the emergency back-up nature of the generators.	Yes
3	**Electrical System Reliability** The magnitude of risk posed by operation of the backup generators is strongly linked to the reliability of the provision of electricity from the local transmission network (in addition to the Uninterruptable Power Supply (UPS) arrangements within the site). The permit application must assess and provide evidence of actual reliability data for the local electricity grid distribution (including data centre internal electrical design) for the EA to judge the realistic likelihood of	The overall reliability of supply for the National Grid Electricity Transmission (NGET) System is reported each year in the annual National Electricity Transmission System Performance Report[7]. The performance for England and Wales for the five years from 2021 are presented in Table 3 of the Supporting Statement (Document reference: SP3334LP/APP/SS in Application Part 3) and as can be seen the reliability of the grid in the 2024 – 2025 year was 99.999832% with 394 reported events across England and Wales of which only 8 resulted in a loss of supply to customers. The data centre electrical supplies have been designed taking into consideration grid reliability and adequacy of existing supplies and will include the installation of a HV substation compound which includes a transformer yard with switchgear and an associated Client Control	Yes

[7] https://www.neso.energy/industry-information/industry-data-and-reports/system-performance-reports

BAT No	Requirements	Demonstration of BAT	Operating to BAT
	the plant needing to operate for prolonged periods in an emergency mode (especially if emissions model so as to exceed short term air quality standards).	Building (CCB). The power distribution system, on-site, starting from the HV intake substation down to the low voltage distribution, is designed to be safe, reliable, redundant, robust, and efficient and have in- built redundancy. The site will be supplied with a 132 kV dual-circuit supply from the National Grid. The dual redundant circuit provides security of supply in the event of a fault or loss of supply from one source; the other circuit is capable of supplying full load to the site. The on-site infrastructure is designed on N+1 reliability (i.e. components (N) have at least one independent back-up component (+1). This means that there is redundancy built into the system, so that any one component, or any one distribution path can be out of service without affecting operations. Similarly, for the grid connection to the data centre to fail, it would require a number of failures to the upstream distribution network to occur simultaneously. The requirement to run back-up generators is therefore minimised. The specific number of back-up generators in use (and the relevant loads required) will always be reflective of, and proportionate to, the power demands at the time, to maintain operations until the supply is restored.	
4	**Operating Regime**		
	a. Planned Maintenance and testing The permit application should consider the known managed hours of operation for maintenance and testing (e.g. each engine 1 hour per month). It would be expected that the maintenance and test hours are managed to avoid potential air quality impacts especially if the site is within an urban area which has designated a local air quality management zone LAQMZ.	The emergency backup plant at this installation will adhere to a defined maintenance schedule, aligned with manufacturer guidelines. Compliance with these recommendations supports the longevity of the equipment, minimises the consumption of raw materials - such as replacement components and lubricants - and ensures optimal engine performance. This proactive approach helps prevent emissions - related issues, including elevated pollutant levels or visible black smoke. The proposed schedule for planned testing and maintenance for each generator will be typically up to 31 hours which is below the 50 hours per annum in accordance with the BAT threshold. See Table 4 of Supporting Statement for details (Document reference: SP3334LP/APP/SS in application part 3).	Yes
	b. Elective Electricity Generation Use of generators for short term operating reserve (STOR), Triad, fast frequency response (FFR), Frequency control by demand management (FCDM)	The generators are designated solely as standby units, intended to provide emergency power in the event of a grid black out or brown out outage. They will not be subject to any capacity agreements nor are they operated electively for revenue-generating schemes such as Short-Term Operating Reserve (STOR), Triad avoidance, Demand Side Response, or peak demand support. Consequently, generator operation will be limited to routine monthly maintenance and testing, estimated at approximately of less than 50 hours per generator per year.	N/A
	c. Operating Regime – Time Limit A maximum 500 hour 'emergency/standby operational limit'	The backup generators will be operated during periods of testing and for the planned maintenance which totals up to 31 hours per annum per generator. Whilst emergency operation (if required) would increase the total operational hours of each backup generator, it is extremely unlikely that operation of any single generator would exceed 500 hours per annum (this being the definition of an 'emergency' unit). A level of redundancy has been included such that even in a worse case gird blackout scenario, whilst all generators would start up they would not operate at full capacity. The operational capacity of the generators during a grid blackout would depend on the extent of the facility's IT load at the time. Emergency operations are taken to include unplanned hours required to come off grid cover a grid black out and brown out scenario as well as 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 72 continuous hours (as modelled); and ▪ Upon an incident of unplanned continuous outage that exceeds 72 hours.	Yes
5	**Emissions** BAT emissions specification for new diesel-fired reciprocating engines as 2g TA-Luft or US EPA Tier II (or equivalent standard).	The Environment Agency's guidance[3Error! Bookmark not defined.] for new data centre generators specifies that, at a minimum, they must meet the following standards: *"New Data Centre diesel engines (prime movers) shall be emissions optimised (i.e. not efficiency optimised) to at least one of the two recognised main international standards 2g-TA Luft or US EPA tier 2 or an equivalent."* Although generator procurement is still being progressed, generators which cannot meet the above emissions standards have been screened out and only generators that can meet the emissions standards without the use of SCR are being considered. The Environment Agency's guidance[3Error! Bookmark not defined.] states that "*we would ordinarily expect specification sheets provided to EA at permitting to be EPA Tier 2 D1 test cycle (ISO8178-4) figures and/or 2g TA-Luft. This broadly equates to 2000mg/m3 (+/-10% tolerance) at 5% O2 = 750mg/m3 (+/-10% tolerance) at 15% O2 being realised between about 67% and 87% of peak load rating. Typically the best match to '2g' being at 75% quoted load rating as the default single point for comparison*."	Yes

BAT No	Requirements	Demonstration of BAT	Operating to BAT
		Indicative specification sheets for the generators which were used for the Air Quality Assessment have been provided and the indicated emissions for 75% load are summarised below and meet BAT:	

Generator	Type	NO_2 emissions (mg/Nm^3) at 75% load and at 5% Oxygen
CAT (3516E)	Main	1,910
CAT (174-20)	Main	1,588
Cummins (QSK95-G5)	Main	1,830
CAT (3512B)	House	1,546
MTU (20V4000G94F)	House	1,865

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6	**Stacks** Release stacks are vertical to aid the dispersion of emissions from the SBGs.	Each generator set will be equipped with a dedicated flue / stack and generator flue heights have been assessed at 25m. This height is intended to ensure that exhaust fumes are effectively separated from the data hall air intakes, thereby preventing any adverse impact on internal air quality. Stack configuration proposed is for a single stack for each generator as this ensures effective emissions control and accurate monitoring at source, improves operational flexibility, reduces the risk of abnormal emissions, and ensures robust compliance with permit requirements. A single combined stack would introduce unnecessary operational complexity and compliance risk without providing an equivalent level of environmental protection. An air quality dispersion assessment (Document Reference: SP3334LP/APP/AQ in Part 7 of the Application) has been completed which assumed: • The modelled emissions parameters for each generator represents the worst-case value, in terms of air quality impact, across the BAT compliant short-list of generator models being considered for the installation. For example: - The highest emissions concentration of each pollutant - The lowest emissions exit velocity - The lowest emissions temperature • Each generator has been modelled to operate at 100% load for all testing, maintenance and emergency operations. Emission rates used in the modelling represent maximum rated output for each generator, and no partial-load adjustments have been applied. Detailed dispersion modelling using the atmospheric dispersion model ADMS (V6) has been used to calculate the predicted PC at each receptor location. These concentrations have been compared with the relevant Environmental Standard for each pollutant species released. The assessment has identified that the operation of the installation under testing and maintenance, and under emergency operation would not cause an air quality compliance issue with impacts screened out as insignificant. Hypergeometric distribution analysis of the hourly mean NO_2 impact during an emergency identified the probability of an exceedance occurring of less than 1% with up to 72 hours of emergency operation in a year. In relation to impact on ecological sites: • All scenarios screened as insignificant against the air quality standards and for nitrogen deposition; and • All scenarios were <0.1% of the critical load for acid deposition. All flues shall incorporate a low-point drain connection, to be installed by the general contractor or designated party. The generator flue will feature twin-wall construction, comprising internal liners and external casings. It will be fabricated in modular sections suitable for on-site assembly. The system will include all necessary guide brackets, thrust brackets, and support frames, designed for secure attachment to the purchaser's structural steelwork and foundations. Flues will be engineered to evacuate combustion products using the natural buoyancy of the flue gases, ensuring efficient and passive exhaust dispersion. Cowls or caps will not be fitted to the exhaust stacks in line with BAT.	Yes

BAT No	Requirements	Demonstration of BAT	Operating to BAT
7	**Use of secondary abatement** Use of selective non-catalytic or catalytic reduction (SNCR or SCR) would not normally be expected for standby plant to mitigate the emissions for standby/emergency operation. BAT might include improved flue gas dispersion (e.g. stack modifications, increased height) or improved low NOx engine management controls or possibly fuel choice.	All generators being considered during procurement have been confirmed as being capable of meeting the required emission standards without the need for secondary abatement. This is because of the conservative ('worst-case') approach taken in the modelling of air quality emissions as outline above.	N/A
8	**Monitoring** Monitor key process parameters and report standby engine operational hours and discussion of any electrical outages. Monitor emissions to air with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality	Process monitoring will be done through the electrical power management system (EPMS) and will facilitate reporting in accordance with permit requirements. Key process monitoring will be carried out to monitor the permitted facilities plant performance including water usage, energy consumption (diesel and electricity), hours of operation and power generated. These performance parameters will be reported on an annual basis. As operating hours won't exceed 500 hours per annum per generator there are no emission limit values applicable to the site. Furthermore, emissions from the generator plant are not anticipated on a routine basis other than for testing or short-term operation in the event of a failure of the National Grid supply. Therefore, emission monitoring will be limited to that undertaken as part of routine maintenance for information purposes only as no ELVs will apply. Monitoring of the emissions from the generators will be undertaken as per EA guidance for low-risk generators. Test ports will be included in the design of the exhaust flue ductwork to allow for MCERTs compliant monitoring. Compliance will be in the form of type-certification to the relevant standard and not by individual engine exhaust point source emissions monitoring. There will be no process emissions to controlled waters i.e., groundwater, surface waters or sewers associated with the proposed installation and therefore no monitoring is required.	Yes
9	**Air Quality Management Plan (AQMP)** BAT would be to develop an AQMP if an air quality exceedance is likely.	The air quality assessment has identified that the operation of the installation under testing and maintenance, and under emergency operation would not cause an air quality compliance issue with impacts screened out as insignificant. Hypergeometric distribution analysis of the hourly mean NO2 impact during an emergency identified the probability of an exceedance occurring of less than 1% with up to 72 hours of emergency operation in a year. In relation to impact on ecological sites: • All scenarios screened as insignificant against the air quality standards and for nitrogen deposition; and • All scenarios were <0.1% of the critical load for acid deposition. On this basis, the Operator would not propose an AQMP although it is recognised that, based on the previous planning permission granted for data centre use, the Local Authority (LA) may seek an AQMP with respect to NOx and the local air quality management area (AQMA). If required the Operator would develop an appropriate AQMP for agreement with the LA and EA.	Yes
9	**Fluorinated gases** the EA considers the F-Gas regulations as falling under the remit of the EPR permit (for notifications and management) where F-gases (or potentially any polluting potential substance) are used directly under the combustion aspects of the permitted activity (e.g. switchgear). It is important to notify the EA of any significant releases. Other uses of F-gases e.g. for server room cooling are not strictly under the EA permit but are regulated by the EA generally so it may still be prudent to make the EA aware of your F-gas releases.	Fluorinated gases are not utilised in any of the permitted activities, including generator operations and associated fuel storage systems.	N/A
10	**Fuel Storage** If the oil storage is above ground the oil storage regulations apply and are covered by permit conditions as a directly associated activity (DAA). Bunding and management control for deliveries are expected in the permit application. Below ground and in building (basement) fuel storage, the Oil storage regulations don't apply but we still expect BAT. • Leak detection (pipes and tanks) • Bunding and procedures at the filling points • Spill procedure and kits	***Fuel Storage*** To ensure the required resiliency for an optimised data centre, generator belly tanks with a central fill and top-off (receiver) system, and bulk fuel oil storage will be provided. Given the reliance on fuel oil for standby power generation (i.e. generators), a minimum of 24 hours' on-site fuel oil storage will be maintained at all times for both main and house generators. The current design basis is: • 36 x belly tanks (1 per main generator) –gross capacity is 19,500 litres per tank and net capacity is 17,400 litres per tank. • 2 x belly tanks (1 per house generator) – gross capacity is 5,000 litres per tank and net capacity is 4,560 litres per tank. • 2 x Top-up Tanks (1 per fuel loading area) – each has 40,000 litres capacity	Yes

BAT No	Requirements	Demonstration of BAT	Operating to BAT
	• Double skinned for tanks and minimisation of underground pipework i.e. maximising inspectability for leaks.	The fuel oil storage system will meet the following requirements: • Belly and top-up tanks shall be constructed from one-piece carbon steel and sized according to site-specific needs. • All tanks and associated containment will comply with the requirements of the Oil Storage Regulations 2001 and with CIRIA C736. • All tanks will be fitted with an Overfill Protection Valve (OPV). • All tanks will be fitted with level monitoring which will be continuously monitored via the BMS and high level and critical high level alarms will be included that will signal both audibly and visually. • All tanks shall be designed with integrated leak containment (110% of the tank volume) which includes leak detection systems comprising a leak detect float switch within the tank bund to alarm if a leak is detected. Should the primary tank become compromised an audible alarm will be provided once the float level has been reached, alerting the operator. • Pipework will be routed above ground with flanges kept to a minimum. Fuel pipelines will have a pipe-in-pipe arrangement with leak detection to minimise risk of leaks.	
		Refuelling Each generator yard will have a dedicated fuel loading system which is installed above ground and will be located in a lockable cabinet with a drip tray to capture minor spills. The fuel fill area will be covered in hard standing to help ensure any spillages are directed to the nearest foul drain. A fuel interceptor, with a capacity equivalent to one tanker compartment, will be installed at the loading ramp to prevent any spillages from entering the foul water drainage system, and the forecourt separators are installed at the fill points to prevent spillages from entering the foul water system. Only one tanker compartment will be unloaded at any one time. Each fill station will be equipped with a hydrocarbon analyser to monitor for potential leaks. In the event of a leak detection, the fuel oil valves will be automatically inhibited from operation, and an alarm will be triggered within the EPMS (Electrical Power Monitoring System). Fuel consumption will be low in this installation due to the plant being used for emergency back-up power generation only. As such, fuel deliveries are anticipated on average to be less than once per year. When required, refuelling is conducted by trained fuel tanker drivers and supervised by a trained member of the site engineering team. A standard operating procedure (SOP) is to be implemented to facilitate refuelling activities. This SOP is intended to help reduce the risk of a spillage during refuelling. These will be supplemented by supplier procedures for fuel deliveries. Furthermore, additional controls will be developed to help reduce the risk of an incident including a Spill Response Plan (SRP) and spill kits.	Yes
11	**Noise** Generally same rules acceptable for planning though clearly noise control is a BAT issue within the permit application.	The generators will be containerised to provide acoustic attenuation. A Noise Impact Assessment is presented at Application Part 8 (Document Reference: SP3334LP/APP/Noise) and the results conclude that based on the data centre design and its embedded noise mitigation measures: • during back-up generator testing and maintenance scenarios, noise levels at all receptors are predicted to not exceed the respective daytime and night-time noise limits assessed in accordance with BS 4142. The operational noise impact from the Proposed Installation during testing and maintenance is assessed as not significant • During the 72 hour emergency scenario. the predicted noise levels at HR1, HR3 and HR4 are considered an adverse, not significant impact. At receptor HR2, during the night-time, a significant adverse impact is predicted. However, the longest outage for England and Wales in the last five years was 12.75 hours, so the 72 hour scenario is very conservative and coupled with the grid reliability, the likelihood of an outage occurring is very low. Therefore taking this into consideration, the risk in relation to noise at HR2 should be considered acceptable. The Operator has prepared a Noise Management Plan which is presented at Application Part 9.	Yes
12	**Energy, Raw Materials and Waste** An EA IED permit includes some standard conditions and the general requirement for the 4-yearly permit review requirements for • 1.2.1 Energy Efficiency; • 1.3.1 Efficient use of raw materials; and • 1.4.2 Avoidance, recovery and disposal of wastes produced by the activities	***Energy efficiency*** Generator procurement is still being progressed but reviewing the specification sheets for the generators going through the procurement process, it is expected that: • Main generators will have electrical output of 2.8 MWe and thermal inputs are ranging between 6.93 to 7.57 MWth, resulting in an efficiency of between 37 – 40.4%. • House generators will have electrical output between 0.8 to 1.4 MWe and thermal inputs ranging between 1.78 to 3.45 MWth, resulting in an efficiency of between 35 – 45.5%.	Yes

BAT No	Requirements	Demonstration of BAT	Operating to BAT
	These are not reviews of the data centre operation but apply solely to the combustion plant activity. These can be covered for data centres within a discussion for these topics within an annual report generally; and are unlikely to be a separate focus for regulation.	Energy management will form an integral part of the Installations EMS and measures will be in place to minimise energy use as far as possible. Training programmes will be in place to ensure that operational and maintenance staff are aware of relevant procedures for ensuring energy efficiency. Efficiency parameters will be monitored, and a commissioning test will be carried out, at full load after commissioning and after each modification that could significantly affect the net electrical efficiency, net total fuel utilisation, and/or net mechanical efficiency of the generators. On-site electricity usage will be minimised as far as possible within the constraints of the process optimisation.	
		Efficient Use of Raw Materials The site will maintain an inventory of raw materials and will review usage annually. The main material is diesel or HVO in future and the built-in redundancy in the data centre power supplies and the use of the EPMS will contribute to reducing the likelihood of the generators to be operational other than for testing and maintenance.	Yes
		Avoidance, Recovery and Disposal of Waste The site will establish a Waste Management Procedure (WMP) prior to commencing operations. This document will define site-specific protocols for waste handling and storage, including the identification of waste streams, appropriate segregation methods, and secure containment within designated areas. In alignment with the waste hierarchy, the site will prioritise prevention, reuse, and recovery in managing any waste generated. Given the operational profile and fuel type, waste volumes are expected to be minimal and primarily related to maintenance activities. In accordance with permit obligations, the operator will actively seek to minimise waste generation through the efficient utilisation of raw materials, including diesel, filters, and lubricating oils.	Yes
13	**Groundwater Monitoring** The groundwater monitoring of fuel storage tanks and distribution pipework using GW boreholes is risk based for the site condition report (SCR) and IED 5-yearly monitoring. Should GW monitoring be required for underground tanks and/or the SCR, the boreholes should be positioned for whole site surveillance (for the SCR) rather than as a very local control immediately around the buried fuel oil tanks (i.e. not be just an addition to double skinned tanks already protected by leak detection and hence ignoring distribution pipework etc).	Since the site is a new site with all tanks being located above ground and other infrastructure being installed in line with current standards and guidelines, it is considered that the risk from the fuel storage tanks and associated pipework is very low. Groundwater monitoring is therefore not proposed.	N/A

5. Conclusion

The proposed design and operational techniques for this installation have been defined in detail and are considered to be consistent with the Environment Agency's Best Available Techniques (BAT) requirements applicable to data centre facilities.