Best Available Technique Assessment – FP3630EU

LON1-East Data Centre

Date:	March 2024	**Issue:**	1.0
Reference:	10369572	**Status:**	Issue
Issuing Office:	Glasgow		

DOCUMENT CONTROL

Issue	Date	Status	HDR Author	HDR Approval	Notes
1.0	28/03/2024	Issue	25/03/2024_LP	28/03/2024_NS	First issue.

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1.0 INTRODUCTION

This Best Available Technique (BAT) assessment has been prepared by HDR on behalf of the operator Green Mountain DC UK Ltd (Green Mountain), in support of the application for a variation to existing Environmental Permit (EP), FP3630EU issued 21/04/15. This variation is to add 8no. new diesel generators following expansion works at the 'LON1-East' Data centre (formerly 'Romford North Data Centre'), located at:

3 King George Close
Eastern Avenue
Romford
RM7 7PN
Grid reference: TQ 50290 89820.

For a detailed description of the Data Centre and surrounding area, please refer to the Non-technical Summary submitted as part of this application to vary the existing permit.

1.1 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.

At the time of writing there are no relevant published BAT reference documents (BREF notes) for Data Centres. The previous guidance document: 'Combustion Activities (EPR 1.01)' was withdrawn in August 2018. To replace this, the EA have produced a working draft BAT guidance document specifically for Data Centres: 'Data Centre FAQ Headline Approach v21' (November 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.

Note: Each individual Emergency Standby Generator (ESG) is significantly below the threshold of 15MWth for large combustion plant. Therefore, the BAT requirements for large combustion plant are not relevant for this installation.

2.0 SITE SUMMARY

The site has been operating as a data centre (DC) since 2010. Under normal circumstances, electricity to the site is provided by the National Grid. Grid reliability is critical to a DC and as such the site currently has 7no. emergency standby generators (ESGs) and 2no. emergency DRUPs (Diesel rotary uninterruptible power supply) engines to provide standby power in the event of an outage / failure in the grid supply. The ESGs and DRUPS are on site solely to support the campus in times of grid failure.

will see 8 no. additional ESGs installed in phases. The first phase of 5 no. ESGs are likely to be commissioned in November 2024 with the remaining 3 sometime in the future.

Green Mountain have selected the 3,306 kVA / 2,645 kW Rolls Royce MTU DS3600 generator set with a MTU 20V4000G94F Emissions Optimised Diesel Engine. Each ESG has a thermal capacity of 7.4MWth and all will be located inside the existing building (shown as purple in site plan).

Table 2.1 Summary of MCP details

MCP type	No.	Thermal capacity	Install date
Existing – Diesel generators	7	45.13 MWth	2011/12
Existing – DRUPS	2	9.03 MWth	2010
New – Diesel generators	8	59.21 MWth	Phase 1 -2024 Phase 2 - TBC
Total after expansion	**17**	**113.37 MWth**	

All the ESGs are over 1MWth and are therefore classed as ‘Medium Combustion Plant ‘(MCP). These ESGs are ’limited hour MCPs’ as they are purely standby plant that will operate less than 500 hours per year and there is no capacity agreement in place.

The location of the generators, fuel tanks and emissions points (flues / stacks) and surface water connections are shown below. The installation boundary encompasses the listed activities only.

The site has one main building which houses all the ESGs. There is a substation on site, as well a small security portacabin and two outbuildings, currently used for storage. The locations of the ESGs are shown below in Figure 1.

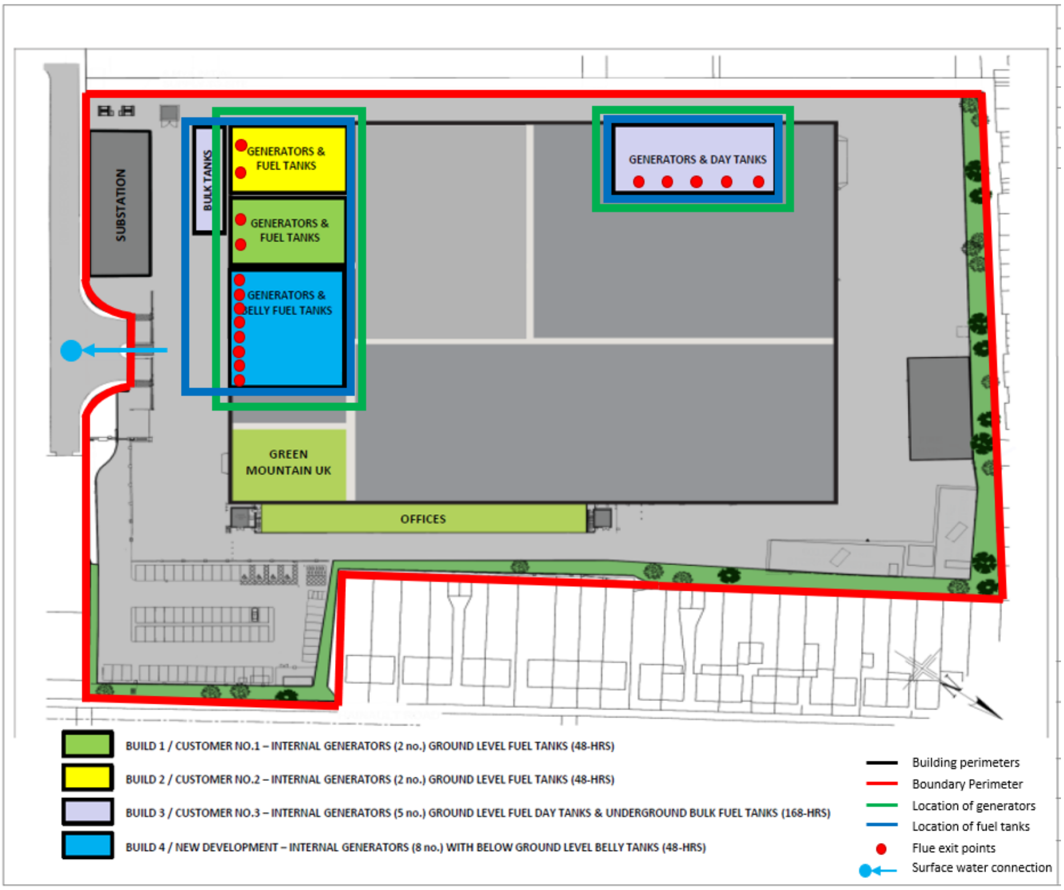

Figure 1 – Installation boundary and emission points

3.0 DATA CENTRE DESIGN

3.1 Uninterruptible power provision

The Data Centre functions by renting out data halls to customers to fill with various servers and associated IT equipment. This equipment requires a stable and constant supply of electricity to operate.

'Uptime' or power availability is a term used to explain how reliable a power source is. Data Centres require a high level of uptime or uninterruptible power provision and being supplied by the national grid brings a risk of a mains failure events (black out) or fluctuations outside of acceptable limits (brown outs). Downtime i.e., power failures or voltage drops, even momentarily, may mean loss of service to customers e.g., banks. This could have significant negative implications to site services, both in terms of direct financial costs and indirectly through reputational damage. Therefore, an uninterruptible power supply is critical to a Data Centre's ability to operate.

The Uptime Institute's Tier classification and performance standard[1] provides an objective basis for comparing one sites infrastructure vs another. The differing tiers are summarised below.

	Tier I	Tier II	Tier III	Tier IV
Active Capacity Components to Support IT Load	N	N+1	N+1	N after any failure
Distribution Paths	1	1	1 active and 1 alternate	2 simultaneously active
Concurrently Maintainable	No	No	Yes	Yes
Fault Tolerance (single event)	No	No	No	Yes
Compartmentalization	No	No	No	Yes
Continuous Cooling*	load density dependent	load density dependent	load density dependent	Yes (Class A)

Figure 2 – Uptime Institute's Tier classifications

Uptime is calculated based on the amount of downtime a site experiences as a % of the year, i.e., 99% or 'two 9's' corresponds to about 7 hours and 12 minutes of downtime per month. As the "nines" uptime increases – to three (99.9%), four (99.99%) and five (99.999%) the downtime decreases. In general, five nines are considered a reasonably high reliability. With six nines, or 99.9999%, an average customer would experience about 2.6 seconds of downtime per month, or less than 32 seconds per year.

The National Grid produce an annual report of performance. Below is the performance statement from the National Grid report for 2021/22[2].

> *"The Overall Reliability of Supply for the National Electricity Transmission System during 2021-22 was: 99.999612%."*

3.2 Onsite electrical infrastructure

For resilience reasons, it is preferable to have numerous power supplies to the site; this provides an alternate route to switch to, should one supply be compromised during an outage. This can be provided in several ways, but the common option is to have separate supply routes within one substation, or to have multiple substations onsite. If one supply route fails, the site can switch to an alternate supply that is unaffected. A process known as "bus coupling". This ability to switch to an unaffected supply route reduces the duration for which the generators operate in the event of an outage.

The grid electrical infrastructure to the site are as follows:

There is one substation on-site (ROMI) with two feeds, A and B, connected to UK Power Networks (UKPN). The UKPN demarcation point is at 33kV, and feeders A and B provide

[1] https://uptimeinstitute.com/tiers
[2] https://www.nationalgrideso.com/document/267701/download

each customer arrangement on site with 11kV. Both feeds can support 100% load, allowing for one to be down in case of maintenance or failure.

A site wide failure is considered extremely rare as it would require a catastrophic regional failure on the grid, or at the supplying power station, and would likely impact not only the site but the surrounding London area.

The installation has incorporated redundancy / resilience as a risk measure to help ensure that power provision is not interrupted even in the event of a mains failure. The size and number of generators is based on the site electrical IT load plus supporting equipment load on a design day. Generators are only sized to provide the maximum amount of power.

The redundancy arrangement for each group is N+1, where 'N' is the number of generators required to carry the maximum electrical load.

3.3 Grid outage scenario

A site wide failure is considered extremely rare as it would require a catastrophic regional failure on the grid, or at the supplying power station, and would likely impact not only the site but all in the surrounding area. Whilst this risk of downtime due to brown/black outs is low, the installation has installed ESGs to provide an electrical supply to the Data Centre.

In the event of grid failure, the ESGs will start up, but they will not be able to take the electrical load immediately. Power is initially provided by the site's Uninterruptible Power Supply (UPS) (arrangement of batteries) until the generators start to take the site's electrical load. The generators start from 'cold' to take on the load from the UPS (typically within 30-60 seconds). The backup generators then provide ongoing power until a stable mains electrical supply is restored. The redundancy arrangements are to safeguard power to their dedicated data hall. It is expected only a proportion the sites ESGs will operate. This is because the site load will dictate the number of generators required to operate. Any ESG not required is expected to shut down.

3.4 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 for the specific provision of backup power in the Data Centre industry. We are therefore proposing an alternative which is based on the guidance in the EAs "*Data Centre FAQ v21 – Working Draft*".

The key criteria used in the selection of the BAT to fulfil the backup power requirements are split into two categories:

- Operational requirements
- Environmental risks

The criteria for both categories have been chosen based on the main risks posed and in accordance with the risk assessment guidance for bespoke permits.

Operational requirements

Table 2 – Operational requirements

Criteria	Considerations	Weighting
Cost benefit analysis	The initial capital cost of the technology being considered, and the potential cost of potential mitigation measures need to be considered to ensure they are not disproportionately high compared to the environmental benefits. Otherwise, the operator will cease to be competitive.	High – impacts competitiveness

Criteria	Considerations	Weighting
Proven as a reliable technology	The resilience requirements of Data Centres are such that the key operational criterion is for the technology used to be a proven and reliable technology. An indication of reliability of a technology can be taken from the number of instances that the technology in question has been successfully utilised in the industry, i.e., whether this is a tried and tested technology or is it new and emerging. The technology also needs to suit the prevailing model of the industry.	High – if technology is not proven it presents a risk to the operator
Cold start capability	The technology will need to have the ability to start operating quickly in the event of a sudden loss of power. A warm start configuration would necessitate 24/7 operation of generators at the site: creating unnecessary fuel costs and environmental impacts. A slow start technology would necessitate additional energy storage UPS capacity (in the form of batteries or flywheels), taking up additional space and creating additional cost.	High – the ability to provide instant power is critical to business functions
Space requirements	Space requirements are relevant as an environmental consideration as a technology that requires excessive use of space (in the form of generator units, energy storage UPS capacity, and fuel storage) will reduce the amount of space available at the Data Centre for the IT equipment it is designed to host. This will necessitate a larger site area or construction of additional sites to provide the same level of service.	High / Medium – space limitations often dictate the technologies that can be considered
Fuel suitability	The fuel used needs to be capable of being stored / transported to and across the site without excessive risks to operations e.g., low risk of combusting.	Medium – low volatility and low risk is vital
Lifetime of stored fuel	The fuel will need to be stored onsite potentially over a long period of time as mains failure events are rare and as such the generators are not routinely operated, other than for maintenance and testing purposes. The fuel stored onsite may remain unused for a long period of time and should therefore be of a type that will remain useable under these conditions – rather than becoming a waste product in need of disposal.	Medium to low – whilst an added cost it is not top priority

Environmental risks

Table 3 – Operational requirements Environmental risks

Criteria	Considerations	Weighting
Air quality impact	Local air quality impacts from exhaust of combustion gases when operating the technology in combination with the fuel being combusted.	High – internal combustion engines perform poorly but they are run infrequently
Noise / odour	The technology should not incite regular Odour / Noise complaints from nearest sensitive receptors e.g., residences.	Low – complaints are unlikely due to infrequent operation
Global warming impact	The global warming impact of the fuel being combusted should compare favourably against the electrical output of the technology.	Medium – impact is high, but combustion of fuel is infrequent
Release to water (fuel spillage)	The risk of fuel escaping to the environment, e.g., local river course / ground should be low.	Low – fuel use is low due to infrequent operation
Fugitive emissions (leak of gaseous fuel)	The risk of fuel escaping to the air, e.g., gaseous escape should be low.	Low – fuel use is low due to infrequent operation

Technologies considered

The following technologies were considered for the provision of emergency power to the Data Centre:

- Diesel Generators (includes operation on HVO / alternative liquid fuels)
- Diesel rotary uninterruptible power supply engines (DRUPS)
- Natural Gas (piped) Fuelled Generator – Spark Ignition Engine
- Natural Gas (piped) Fuelled Generator – Gas Turbine (CCGT or OCGT)
- Liquid Petroleum Gas (LPG) Fuelled Generator – Spark Ignition Engine
- Hydrogen Fuel Cell Technology: Polymer Electrolyte Membrane (PEM) Fuel Cells
- Hydrogen Fuel Cell Technology
- Standby Gas turbine Technology

Conclusion

The conclusion of the assessment was that Gas and Diesel / Hydrotreated Vegetable Oil (HVO) generators are the preferred method for back up electricity generation at this site. Green Mountain have decided to install 8no. new diesel generators at this installation as they outperform gas generators when comparing their cold start capability and their reliability in providing an uninterruptible power supply, due to the reliance of an off-site supply of natural gas.

Emissions optimised generators were chosen previously for the existing data halls and have been selected again as BAT for this installation. The following are reasons to support the selection of the generators and are in line with EA guidance on BAT for Data Centres:

- Proven technology for providing reliable power supply
- Start-up time & cold start capability
- Space requirements
- Capital expenditure
- Environmental impact
- Fuel storage

3.5 Generator emissions performance

The existing Generators and DRUPS engines conform to the MCP limits for existing plant, i.e. TA -Luft 4000 mg/m^3.

The EA guidance for new generators is that they, as a minimum achieve the following:

> *"TA-Luft 2g' or Tier II USEPA with guaranteed emissions: this has requirements for 2000mg/m^3 NOx; 650 mg/m^3 for CO; particulates and dust 130 mg/m^3 and 150 mg/m^3 for hydrocarbons (all at reference conditions and 5% O_2)."*

The 8no. new ESGs are emissions optimised and achieve the Tier II US EPA standard. The maximum design load for these is 75% per generator and at this load unabated NOx emissions are 1,865mg/Nm3(at 5% Oxygen and standard temperature and pressure). The engine and emissions datasheets have been supplied with the application.

Furthermore, each of the 8no. new ESGs will be fitted with SCR systems that have been sized to reduce NOx emissions concentrations by approximately 81% (at 100% load) to 500mg/Nm3 (at 5% Oxygen and standard temperature and pressure). The engine SCR datasheets have been supplied with the application.

The NOx sensors and Urea dosing system is to be periodically inspected and calibrated to help ensure that emissions are abated in line with design parameters.

The generator emissions rates used in the Air Quality Impact Assessment (See Section 0) are presented in the table below.

Table 4 - Air Quality Model Inputs & Emissions rates for the 8no. new ESGs

Parameter	Unit	Emissions per generator at 75% load
Stack(s) height	m	13.3
Stack(s) diameter	m	0.6
Exhaust gas temperature	ºC	427.0
Exhaust Volumetric Flow (actual)	$m^3.s^{-1}$	8.7
Flue Gas Efflux Velocity	$m^3.s^{-1}$	29.9
NO_X emission rate (unabated concentration of 2362 $mg.Nm^{-3}$)	g/s	3.404
NO_X emission rate (concentration post SCR of 95 $mg.Nm^{-3}$)	g/s	0.750
PM_{10} and $PM_{2.5}$ emission rate	g/s	0.010
CO emission rate	g/s	0.20
Hydrocarbons (benzene) emission rate	g/s	0.050
SO_2 emission rate	g/s	0.002

Reference conditions: 5% Oxygen (for all generators), 278K (for all generators)

Actual conditions: 11.5% Oxygen (PG1-8) 705k ,10.9% Oxygen (EP11-35), 705.65K

3.6 Generator noise attenuation

Since operations commenced on site, there have been no noise complaints associated with the operation of the generators. The generators are located within plant rooms within the main data centre building.

For more information on noise impacts, and the noise impact assessment submitted with the application ('Noise Impact Assessment') please refer to Section 10.1.

3.7 Generator flue design

Dispersion of pollutants has been considered when designing the flues for the new generators. The 8no. new ESGs are set up in units of two, with an adjoining flue stack to dissipate the emissions from each unit. These stacks are not impeded by flaps or cowls, and the exhaust will exit vertically, approximately 13.3m above the ground and in line with the apex of the roof. The design of the flues is therefore considered to be BAT for this application.

3.8 Fuel storage arrangements

The sites ESGs require adequate fuel storage to allow them to operate during a grid failure.

9no. ESGs are already permitted onsite. These are split into three groups; 2no. DRUPs in one group, 2no. diesel generators in a second group, and the remaining 5no. diesel generators in the third group. The 8no. new generators will be within a fourth group. The locations of these are shown above in Figure 1.

Table 5 – ESG groups and fuel storage arrangements

Building	ESGs in place	Fuel tanks	Capacity per tank (litres)
Build 1	2no. DRUPs	2no. above ground bulk tanks	25,500
Build 2	2no. generators	2no. above ground bulk tanks	28,000
Build 3	5no. generators	4no. underground bulk tanks with 5no. above ground day tanks.	100,000 (underground) 4,700 (day tanks)
Build 4	8no. generators	8no. belly tanks	44,546 (38,915 useable)

The 8 no. Build 4 generators are all single level, accessed via corridors within the main building. These will be split across x4 rooms, with 2no. ESGs per room. The layout of each room will be identical and is shown in Figure 3 below.

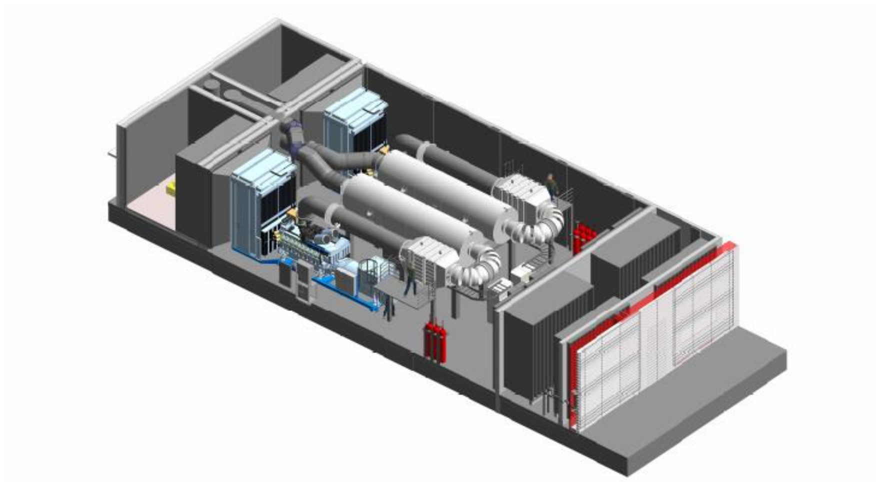

Figure 3 - Plant layout for new ESGs

The 9no. existing ESGs run on diesel. The 8no. new ESGs will run on HVO, although can also run on diesel. The tanks will be appropriately bunded and made of a steel which conforms to BS799 standards.

The existing plant are in 3 different configurations. 2no. ESGs and 2no. DRUPs have individual ground level fuel tanks, whilst 5no. ESGS have ground level day fuel tanks fed by underground bulk fuel tanks. Tanks are bunded and fitted with bund and overfill alarms. Generator rooms and/or corridors are bunded with spill alarms.

For the ground level fuel tank configurations, tanks are filled via a local double fill point cabinet installed on the building. The cabinets are locked when not in use, have a drip tray, instrument mounting panel, 3” filling valve and cap, and a BSP valve. Overflow and bund overfill alarms present.

The underground fuel tanks are filled by via a locked floor cabinet, fitted with instrument mounting panel, 3” filling valve and cap, drip tray, a BSP valve, and hi/low alarms.

The ground surrounding the fuel storage points are tarmac / hardstanding.

Each new generator will have its own belly tank. Tanks are to be bunded to BS799 Part 5 Type J 2010 specifications. Fuel detection tapes will be in place around each generator set and along the fuel line zone. Fuel tanks are vented back to the fuel filling points. Tanks are to be filled via 2no. local fill point cabinets installed on the front of the building. The cabinets will be locked when not in use, the contents of which are still in design. The ground surrounding the ESGs and the fuel storage tanks is to be tarmac / hardstanding.

3.8.1 Fuel management procedures and security

Fuel consumption is low in this installation due to the plant being used for emergency back-up power generation only. As such, fuel deliveries are infrequent, generally 0-2 per year. When required, refuelling is conducted by trained fuel tanker drivers, and supervised by a trained member of the site engineering team. Green Mountain has procedures and processes in place to manage refuelling activities, supplemented by additional supplier procedures. In addition to this, additional controls are in place to help reduce the risk of an incident including spill response and spill kits.

The sites periodic preventative maintenance (PPM) regime includes periodic visual checks for leaks / spills and checks for suitably stocked spill kits, and that these are located within close proximity of fuel storage tanks and fill points. Additionally, a petrol interceptor is in situ as part of the below ground drainage system (see Section 10.2 for more details).

The Data Centre is currently 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.

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

3.9 Urea storage arrangements

Urea is to be used in the Selective Catalytic Reduction (SCR) equipment to reduce the NO_x emissions from the ESGs. This SCR system uses Urea as a raw material to achieve the prescribed NOx reductions. Each SCR system will have an individual urea tank, although further details of the storage and supply of this is currently in design.

4.0 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 monthly maintenance and testing, and emergency use only.

4.2 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 or black smoke.

Testing regimes for monthly and annual testing are detailed below. The AQA in Section 10.3 has not identified significant impacts to short term Air Quality from the proposed test regime. The current test regime is considered to meet the BAT requirements.

Where possible and practicable, the intention will be to avoid testing during peak traffic periods when background NOx has the potential to be elevated. There may be instances where operational requirements dictate the time tests are to be undertaken.

Table 6 – Build / Customer 1 testing schedule

Frequency	Duration	No. tested	Approach	Load	Total hours per Gen
Weekly test	10 minutes	2no.	Staggered, one generator operating at a time for 10 minutes.	**Offload (0%)**	**0.17**
Monthly test	20 minutes	2no.	Staggered, one generator operating at a time for 20 minutes.	**Approx. 10%**	**0.34**
Quarterly test	20 minutes	2no.	Staggered, one generator operating at a time for 20 minutes.	**Approx. 10%**	**0.34**
Annual test.	120 minutes	2no.	Staggered, one generator operating at a time for 120 minutes using a load bank.	**100%**	**2.0**

Table 7 – Build / Customer 2 testing schedule

Frequency	Duration	No. tested	Approach	Load	Total hours per Gen
Fortnightly test	10 minutes	2no.	Staggered, one generator operating at a time for 10 minutes.	**Offload (0%)**	**0.17**
Quarterly test	120 minutes	1no.	One generator in the set operating for 120 minutes per quarterly cycle. Runs alternate between generator A and B per quarter.	**Approx. 20%**	**2.0**
Annual test.	120 minutes	2no.	Staggered, one generator operating at a time for 120 minutes using a load bank.	**100%**	**2.0**

Table 8 – Build / Customer 3 testing schedule

Frequency	Duration	No. tested	Approach	Load	Total hours per Gen
Fortnightly test	10 minutes	5no.	Staggered, one generator operating at a time for 10 minutes.	**Offload (0%)**	**0.17**
Monthly test	120 minutes	4no.	Four of the five generators operate at once for 120 minutes. Runs alternate between generators monthly, i.e. each generator runs in four out of five cycles.	**Approx. 16.5%**	**2.0**
Annual test.	120 minutes	5no.	Staggered, one generator operating at a time for 120 minutes using a load bank.	**100%**	**2.0**

Table 9 – Build / Customer 4 testing schedule

Frequency	Duration	No. tested	Approach	Load	Total hours per Gen
Fortnightly test	10 minutes	8no.	Staggered, one generator operating at a time for 10 minutes.	**Offload (0%)**	**0.17**
Quarterly test	120 minutes	7no.	Seven of the eight generators operate at once for 120 minutes. Runs alternate between generators monthly, i.e. each generator runs in seven out of eight cycles.	**Site load for build 4 system**	**2.0**
Annual test.	120 minutes	8no.	Staggered, one generator operating at a time for 120 minutes using a load bank.	**100%**	**2.0**

5.0 F-GAS

Fluorinated gases or ‘F-gases’ will not be used in the permitted activities e.g., generators and associated fuel storage.

There is potential that F-gases will be used in the chiller plant and/or air conditioning units. This plant is to be maintained in accordance with manufacturer specifications and recommendations with relevant documentation retained. During the development of the sites Environmental Management System, an F-gas register is to be maintained onsite, and will include details such as plant make, model and serial number, the type and volume of refrigerant, and maintenance history. Any significant releases or leaks are to be recorded and, notified to the EA as soon as possible.

6.0 ENERGY EFFICIENCY

6.1 Energy management

As energy prices rise and customers demand more of their Data Centre providers, there is increasing attention on energy efficiency and better energy management. The most prominent indicator of a Data Centre's energy efficiency is PUE (Power Usage Effectiveness), and this is often reported as a metric to customers. PUE is the ratio of the total energy delivered to the site compared with the energy used by just the IT equipment. A PUE of 2 means that 50% of the power delivered to the site is used to run the IT equipment. The closer the PUE is to 1, the more efficient the Data Centre is. Most efficient Data Centres are seeking to achieve a PUE of approx. 1-1.2.

6.2 EED

The Energy Efficiency Directive (EED) provides an exemption for emergency back-up plant operating under 1500 hours per year. The current testing and maintenance plans do not exceed this limit and therefore EED requirements are not deemed to be applicable.

6.3 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 (approx. <30 hours per year). To ensure the generators operate as efficiently as possible, the site follows a periodic preventative maintenance (PPM) regime. This involves regular checks of the generators to help ensure each generator is operating efficiently. Once the new 8no. ESGs are operational, they are to be included within the existing PPM regime.

7.0 EFFICIENT USE OF RAW MATERIALS

The main raw materials that will be used within the permitted installation are as follows.

7.1 Diesel / HVO

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, as outlined in Section 4.2. The PPM regime in place will help seek efficient fuel use by the generators.

Diesel / HVO has been selected due to the ability to store sufficient volumes to ensure security of supply. Other fuels have been considered but do not currently provide the same level of security. Natural gas could not be stored in sufficient volumes and would be reliant on the National Transmission System. A contract for an uninterruptable supply would be excessively costly given the infrequency of use. Further reasons for fuel selection are present within Sections 3.0 and 4.0. Due to the limited hours of operation, any potential benefits from the lower impacts associated with emissions from natural gas are reduced.

7.2 Lubrication oils

The engines require lubrication oil to reduce wear and tear through friction. Periodic replacement of this oil is required. Waste oils are to be stored and disposed of responsibly and in accordance with applicable legislation.

7.3 Urea

Urea is to be used in the Selective Catalytic Reduction (SCR) equipment to reduce the NO_x emissions. It is expected that there will be urea deliveries every 1 to 2 years as limited amounts will be required during routine site operation. Urea deliveries are to be controlled as part of the onsite procedures which seek to reduce the risks of accidents e.g. spillages occurring.

8.0 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.

A licenced third-party maintenance contractor is responsible for removing waste produced as a result of generator maintenance. Duty of Care information including waste carriers' licences and transfer notes should be retained.

Waste streams arising from this installation can include:

- Lubrication oils used in maintenance and servicing (minimal)
- Air and fuel filters (minimal)
- Fuel that has reached end of life (infrequent)
- Used spill kits (emergency only, unlikely)
- Decommissioned plant (end of life only)

Green Mountain aims to minimise waste generation through efficient use of raw materials including diesel, filters, and lubrication oils. For example, the need to dispose of waste fuel is reduced / minimised by fuel polishing. The units filter the diesel, removing moisture and particulates from the fuel, ensuring the generators run cleanly. The aim is to help maintain the fuel to a usable standard, preventing early degradation and ultimately extending the life of the fuel.

9.0 GENERAL MANAGEMENT

9.1 Management Standards

Green Mountain is certified in accordance with:

- ISO 9001:2015 – Quality Management System
- ISO 14001:2015 – Environmental Management System
- ISO/IEC 27001:2013 – Information Security Management System
- ISO 45001:2018 – Occupational health and safety management

The LON1-East campus is also certified according to the following standard:

- ISO 20000-1:2018 – Information Technology Service Management

9.2 Environmental Management System

Green Mountain has an Environmental Management System (EMS) accredited to the internationally recognised ISO 14001:2015 standard.

The EMS focusses on ensuring continual improvement and includes information on policies, management principles, organisational structure, responsibilities, standards / procedures, process controls and resources in place to manage environmental protection across the permitted activities at the installation. It also includes Green Mountain's commitment to protect the natural environment through set objectives that comply with relevant legislation.

10.0 EMISSIONS

There will be no point source emissions to water, air or land, except from the sources and emission points identified in Section 2.0, Figure 1. Emissions identified as significant have been further expanded in the following sections.

10.1 Noise Impact assessment

A noise impact assessment has been completed as part of the planning application and this has been submitted as part of the application to vary the existing environmental permit (‘Noise Impact Assessment’).

This report assesses the likely impact from the operation of the 8 new ESGs and the associated equipment that serves the data halls including the chillers etc.

The impact assessment concluded the following:

> *“The proposed plant and building design are predicted to produce noise levels of 10 dB below the existing background noise levels at the nearby receptors, during normal operation, with the proposed mitigation.”*

The results indicate that operation of the sites ESGs is unlikely to have a significant impact on surrounding receptors.

10.2 Point source emissions to sewer / surface water

A site drainage plan is attached to this application, showing the site drainage system for surface water drainage lines, the location of the petrol interceptor and the indicative location for where these enter the local network. Please note, drainage works on the site are ongoing and an updated plan will be available once these are completed later in 2024.

Additionally, in the event of a fuel spillage within the no. new generator rooms, the fuel will naturally fall to one side of the fully bunded and tanked pit and into a linear gully. A temporary pump will be lowered into the gully and fuel pumped into an external tank for site removal.

The site is covered in good quality hard standing including the areas surrounding the tanks, generators and fuel delivery points.

The EA are to be notified where significant pollution incidents occur that have the potential to cause environmental harm. Site drainage exits into the drainage network for the entire industrial estate. Thames Water are the sewerage provider, whilst CBRE are the 24/7 service provider for Green Mountain.

Discharges are expected to be limited to surface water run-off, which is not anticipated to contain spilt fuel due to the mitigation measures in place (described below).

As per the drainage plan, a petrol interceptor is in place to act as tertiary containment for only the area surrounding the substation and the existing sub surface fuel bulk tanks. This is fitted with an automatic sensor / shut off valve that will close upon detecting the presence of spilt fuel.

The sites drainage system and interceptor will be subject to periodic visual inspections and integrity testing as part of the PPM regime. The tank will be emptied periodically or in the event of a spillage with contaminated liquids disposed of appropriately as hazardous waste.

The site has operating procedure to facilitate refuelling activities. This is intended to help reduce the risk of a spillage during refuelling. These are supplemented by additional supplier procedures for fuel deliveries. In addition to this, additional controls and procedures are in place to help reduce the risk of an incident including for spill response and the use and disposal of spill kits.

10.3 Air Quality Assessment

Emissions to air will occur from the operation of the generators. 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 capacity agreement / 'elective operation' as detailed in the above sections.

An Air Quality Assessment (AQA) was completed in support of the permit application to predict the impacts of operating the generators on short- and long-term air quality. A summary of the findings is below, with further information in the 'Air Quality Assessment' attached to this application.

Scenario 1: 'Testing and Maintenance' (no SCR)

This scenario accounts for all generators being tested at 75% load, with all but one generator running within each phase concurrently, for 10 mins to 1 hour bi-weekly/monthly and 2 hours annually.
Note, these results are overestimations and present a "worse case" scenario, as the generators have been grouped for modelling purposes and the load set at 75%, which exceeds the standard testing and maintenance regime.

Scenario 2: Emergency operation (no SCR)

This scenario accounts for a site-wide power outage. Here all but one generator from each phase (i.e. 13 out of 17 generators) will operate cumulatively at 75% load for 72 hours.

Scenario 3: Scenario 1 + Scenario 2 (with SCR)

Both Scenario 1 and Scenario 2 outlined above will be assessed as stated above, with abatement applied to the 8no. proposed generators only.

At the time the AQA was completed, it was uncertain whether abatement would be fitted to the 8no. new ESGs. Green Mountain have since decided to go ahead with abatement in the form of SCR on the 8no. new ESGs. As a result, Scenario 3 is regarded to be most realistic representation of impacts.

The conclusion of the assessment is as follows, with further details, in the AQA:

*"Predicted impacts at all human and ecological sensitive receptors for all pollutant concentrations and both annual mean nitrogen and acid deposition rates, with the exception of 1-hour nitrogen dioxide and 24-hour oxides of nitrogen concentrations, associated with normal operation of the site (Scenario 1 & 2) can be considered **not significant**.*

*Based on the predictions and the use of worst case emissions, it is considered that the overall air quality impacts of the development following the alterations to testing operations would be **not significant**."*

The conclusion of the AQA indicates that there is a low likelihood of that short- and long-term impacts from operation of the sites ESGs is likely to be not significant.

10.4 Air Quality Management Plan

The AQA identified that an exceedance of the Air Quality Objective (AQO) is more likely to occur during a prolonged outage over regular testing and maintenance of the ESGs. As a result, an Air Quality Management Plan (AQMP) is to be implemented to help mitigate impacts in the event of a prolonged outage. This site already has an AQMP in place, and this is to be updated to include the additional ESGs that are being installed and to reflect the most recent AQA.

The AQMP is a basis for identifying which receptors may be affected and if notification is required. Following commissioning of the new ESGs, the AQMP will be updated to include more information on the following:

- Outage occurrence – e.g., date, time, season, meteorologic factors
- Receptors – e.g., AQ model receptors, general public
- Outage situation – e.g., likely duration, how receptors are affected

The plan is to be developed in conjunction with the Local Authority and its Local Air Quality Management (LAQM) process. Once the AQMP is finalised, it shall be submitted to the EA for final approval.

11.0 MONITORING

11.1 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 'limited hours MCPs' which are exempt from meeting the new plant BAT emissions limit values (ELVs).

To facilitate monitoring the flues are to be fitted with appropriate sampling ports to allow for NOx and CO monitoring.

Monitoring of flue gas monitoring is to be completed in accordance with web guide 'Monitoring stack emissions: low risk MCPs and specified generators' Published 16 February 2021 (formerly known as TGN M5)[3] .

In line with existing permits for datacenters, the expectation is that monitoring will be undertaken every 1500 hours of generator operation or once every five years (whichever comes first). The first round of monitoring is to be conducted on the new generators within the first year of operation.

This monitoring will seek to confirm that the generators and their respective SCR systems are achieving the performance specification detailed in Section 3.5.

11.2 Generator operation

Generator operational hours and fuel consumption for maintenance, testing and during an outage, are currently monitored for the existing ESGs. Once the 8no. new ESGs are commissioned, monitoring will be undertaken in a similar fashion. In addition to the annual report, outages should be notified to the EA within 24 to 48 hours of emergency operation commencing.

11.3 Discharges to sewer

As per Section 10.2, discharges to sewer are not anticipated. The EA is to be notified by the operator where significant pollution incidents occur that have the potential to cause harm.

[3] https://www.gov.uk/government/publications/monitoring-stack-emissions-low-risk-mcps-and-specified-generators/monitoring-stack-emissions-low-risk-mcps-and-specified-generators

12.0 CONCLUSION

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