ARUP

Virtus Holdco Ltd

London 14 Data Centre, Prologis Park Heathrow, Hayes

Summary Technical Report - Environmental Permit Application

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1. Introduction

1.1 Overview

Ove Arup & Partners Ltd (Arup) has been commissioned by VIRTUS (henceforth referred to as 'the Operator') to prepare a Summary Technical Report (STR) to accompany a bespoke application for an Environmental Permit (EP) for the London 14, or LON14 data centre.

The EP is for the standby back-up generators at the LON14 data centre and directly associated activities only, not for the whole of the data centre.

The application is made by VIRTUS Holdco Limited which is the legal entity that will be responsible for operating the generating installation.

1.2 The Operator

The Operator currently runs own-built data centres at multiple locations in-line with The Environmental Permitting (England and Wales) Regulations 2016.

1.3 The Site

The data centre is located at DC6, Unit D, Plot C, Prologis Park Heathrow, Stockley Road, Hayes in the London Borough of Hillingdon.

The Site is situated in a light industrial and commercial area in Hayes shown in the Site Location Plan[1], which can be found in the application provided as Drawing 294760-EP-DR001.

The northern boundary of the site consists of the Reading to London Paddington train line / Elizabeth line, with commercial / light industrial units beyond. To the west lies the London Heathrow Airport line link and another commercial building in the Business Park. Residential properties are located immediately to the east and south, approximately 15m from the site boundary. The A408 Stockley Road is located to the west, with the M4 located 1km to the south.

The data centre will be manned on a 24-hour basis and will have around 20 operational staff. The majority of staff will be present during normal office hours. A team of key engineering staff and security will also be onsite 24 hours a day, on a shift basis.

[1] Site Location Plan (Document reference 294760-EP-DR001).

2. Legislative Framework

The following regulations and guidance are relevant to the assessment and have been taken into consideration in developing the approach to the assessment:

1. The Environmental Permitting (England and Wale) Regulations 2016, SI2016/1154.
2. EU, 2010 Directive 2010/75/EU of the European Parliament and the Council on industrial emissions.
3. EU, 2015. Directive (EU) 2015/2193 on the limitation of emissions of certain pollutants into the air from medium combustion plant.
4. The Control of Pollution (Oil Storage) (England) Regulations 2001.
5. Best available techniques: environmental permits[2].
6. Risk assessments for specific activities: environmental permits[3].
7. Environment Agency Data Centre FAQ Headline Approach[4].
8. Reference Document – Best Available Techniques on Emissions from Storage 2016[5].
9. CIRIA, 2014. Containment systems for the prevention of pollution (C7367F)[6].

2.1 On-site activities

The site comprises 16 containerised stand-by backup generators (SBG) for emergency purposes. Each of the SBGs are fitted with Selective Catalytic Reduction (SCR) abatement technology to reduce the potential emissions of Oxides of Nitrogen (NOx) by up to 95% once activated.

Each generator has an individual flue terminating at 14.45m above ground, the locations of which are provided in the Site Layout and Emissions Point Plan[7] and can be found in the application provided as Drawing 284474-EP-DR002. The 16 SBG flues are located close to each other but are separate flues.

Fuel will be stored in the 'belly tanks' of the containerised SBGs, each holding 30,868.8 litres in volume which equates to 48 hours use. Each belly tank is containerised and integrally bunded to contain 110% of the storage capacity of the tank. All tanks will comply with the Oil Storage Regulations (*SI 2001/2954, The Control of Pollution (Oil Storage) (England) Regulations 2001*).

Combustion activities are regulated under The Environmental Permitting (England and Wales) Regulations 2016 (EPR). The regulations enact both the Industrial Emission Directive (IED) and the Medium Combustion Plant Directive (MCPD) in England and operators undertaking any of the activities identified under these regulations require an environmental permit to carry out these activities.

The data centre will be operated on power from the national grid however, in the event of grid failure back up power will be provided by the SBGs, with a total installed thermal capacity onsite of around 110 MWth[8].

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[2] https://www.gov.uk/guidance/best-available-techniques-environmental-permits [Accessed July 2023]

[3] https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit [Accessed July 2023]

[4] https://consult.environment-agency.gov.uk/psc/cr0-4td-digital-realty-uk-limited/supporting_documents/Data%20Centre%20FAQ.pdf [Accessed July 2023]

[5] EC (2016) Reference Document – Best Available Techniques on Emissions from Storage. Available at: https://eippcb.jrc.ec.europa.eu/sites/default/files/2022-03/efs_bref_0706_0.pdf [Accessed July 2023]

[6] CIRIA (2014) Containment systems for the prevention of pollution. Secondary, tertiary and other measures for industrial and commercial premises. Available at https://eippcb.jrc.ec.europa.eu/sites/default/files/2022-03/efs_bref_0706_0.pdf [Accessed July 2023]

[7] Site Layout and Emissions Point Plan (2023) (Document ref 294760-EP-DR002)

[8] Based on assumed 35% efficiency

The SBGs will be operated to provide power at a site during an emergency only, as well as routine testing in-line with manufacturers maintenance requirements. They will not be used to provide a balancing service or for demand side response operations such as triad avoidance or fast frequency response. No electricity generated from the site will be exported off-site or fed back into the National Grid.

Combustion plant that have an aggregated capacity of greater than 50 MWth are listed in Annex I of the IED and must therefore be permitted to operate in line with Chapter II of the IED. However, the capacity of individual units are all below 15 MWth so the plant does not fall under the scope of Chapter III of the Directive and therefore are not required to meet the requirements of the EU BAT Conclusions document for Large Combustion Plant (LCP), including the Emission Limit Values (ELVs) set in the Best Available Technique (BAT) conclusions. To cover this gap in the EU guidance, the MCPD will inform site specific BAT for certain IED Chapter II activities, including gas engines generating electricity with a capacity of more than 50 MWth, operated as the primary activity on the site.

On this basis, the EA will include MCPD requirements in the permit, as the minimum standards. These are influenced by the type and frequency of the generator's operation. As the planned operation of the SBGs is for the purpose of maintenance and testing only and for less than 50 hours, the operation of the SBG will not to be subject to any Emission Limit Values (ELVs) or testing restrictions, provided it can be demonstrated that no adverse environmental impacts are predicted, for example to local air quality.

As the aggregated combustion capacity is greater than 20 MWth, the site will be required to obtain a Greenhouse gas emission permit as part of the Emissions Trading System. Conditions will be set out within the Permit detailing the requirements to monitor and report on emissions from the site, including specifying the frequency of monitoring and methods used. Annual monitoring reports will also be submitted.

2.2 Permitting regime – IED or MPCD

2.3 Scheduled Activities

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

Section 1.1 Part A(1)(a) burning any fuel in an appliance with a rated thermal input of 50 or more megawatts. In accordance with the EPR:
"*...where two or more appliances with an aggregate rated thermal input of 50 or more megawatts are operated on the same site by the same operator, those appliances must be treated as a single appliance with a rated thermal input of 50 or more megawatts."*

2.4 Directly Associated Activities

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

- Has a technical connection with the activity;
- Is carried out on the same site as the activity; and
- Could have an effect on pollution.

The following activities are therefore considered to be DAAs as they meet all three criteria:

- Generators refuelling area;
- Fuel storage; and
- Drainage system for the permitted activity and DAAs up to the point the drainage system discharges to ground.

The wider drainage system serving the wider site does not meet the above criteria and therefore is not considered to be a permitted activity or DAA.

3. Data Centre Description

3.1 Installed Engines

In response to Application Form Part B3 question 7a.

The site comprises 16 containerised SBGs for emergency purposes, as set out in Table 1. All of the SBGs are fitted with SCR to reduce emission of NOx.

Table 1 Generator details

ID	Type	Model	Rated Electrical Output (MWe)	Thermal Input (MWth)*
A1	Main generator 1	Cat 3516E with SCR	2.4	6.9
A2	Main generator 2	Cat 3516E with SCR	2.4	6.9
A3	Main generator 3	Cat 3516E with SCR	2.4	6.9
A4	Main generator 4	Cat 3516E with SCR	2.4	6.9
A5	Main generator 5	Cat 3516E with SCR	2.4	6.9
A6	Main generator 6	Cat 3516E with SCR	2.4	6.9
A7	Main generator 7	Cat 3516E with SCR	2.4	6.9
A8	Main generator 8	Cat 3516E with SCR	2.4	6.9
A9	Main generator 9	Cat 3516E with SCR	2.4	6.9
A10	Main generator 10	Cat 3516E with SCR	2.4	6.9
A11	Main generator 11	Cat 3516E with SCR	2.4	6.9
A12	Main generator 12	Cat 3516E with SCR	2.4	6.9
A13	Main generator 13	Cat 3516E with SCR	2.4	6.9
A14	Main generator 14	Cat 3516E with SCR	2.4	6.9
A15	Main generator 15	Cat 3516E with SCR	2.4	6.9
A16	Main generator 16	Cat 3516E with SCR	2.4	6.9
Total installed capacity				110
*Thermal input calculated based on an estimated efficiency of 35%				

3.2 Site of units needed

The number and configuration of the generators has been selected in order to ensure that the service requirements of the data centre and associated servers / critical infrastructure in the event of any temporary grid interruptions / failures can always be met, whilst providing the necessary redundancy / resilience to cover any generator failure / maintenance.

Based on the critical power requirements, diesel generators in the range between 1.5 and 8 MWth were considered to provide the best solution because:

- Units are readily available for this back up purpose (i.e. Hospitals, London Stock Exchange, banks, etc);
- They can be modularised (containerised);
- Components are “off the shelf” and easily changeable; and
- Each unit / module is self-sufficient.

The decision for a larger number of smaller generators to be installed on-site, rather than a smaller number of larger generators, was made early in the process based on the flexibility it allows in the event of an emergency situation, whilst appropriately managing risk of unit failure and still guaranteeing supply.

This proposed solution ensures that the SBGs are operated at their optimal design capacity (typically high loads) should they be required, which maximises the fuel efficiency/combustion and therefore emissions to air. Operating a smaller number of diesel generator with greater rated electrical outputs at sub-optimal low loads can have an adverse impact on engine operations and ultimately their longevity, if repeatedly used over long periods.

The Electrical Supply Arrangement can be found in Appendix 03-02.

3.3 Operating regime

In response to Application Form Part B3 question 7a.

The planned maintenance and testing regime of the generators is set out in Table 2. This shows that each generator is planned to operate for significantly less than 50 hours which are used purely for a standby emergency role as stated in the EA Data Centre FAQ (v.10 2018).

Table 2 Generator use regime

Scenarios	Operating profile	Description
Scenario 1: Monthly	Off-load testing / maintenance – 10% load for 15 minutes	Each generator is tested one at a time, once per month (for 11 months)
Scenario 2: Annual	Mains failure testing – 100% load for 20 minutes followed by 75% load for 120 minutes	Each generator is tested one at a time in the 12th month
Annual planned operational time per generator		165 mins + 140 mins = 305 mins (5 hours 5 mins)
Total planned operational time at site		4880 mins (81 hours and 20 mins)

3.4 Network Reliability

Every effort will be made to ensure that the SBGs would not be required in practice. In the event of a loss of power supply, i.e. temporary grid blackout, the diesel-powered standby generators will be utilised to maintain the required power supply.

These generators are designed to automatically activate and provide the required power to the plant pending restoration of mains power, at which time they shall automatically ramp down and switch back to utility supply. The automatic controls are installed for each of the emergency (back-up) generators and each electrical line up is supported by a dedicated back-up generator. Therefore, 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.

Power for LONDON 14 will be supplied from/by the National Grid which operates its transmission system in accordance with the Security and Quality of Supply Standard which is a requirement of its Transmission Licence. In accordance with this standard, a level of redundancy is also built into the transmission system.

National Grid National Electrical Transmission System Performance Report 2021/22 states that the overall reliability of supply during 2021-22 was: 99.999612%[9]. The total estimated unsupplied energy for these 11 incidents during 2021–22 was 143.40 MWh. The longest loss of supply incident lasted 300 mins (7.5 hours) in Elstree, Watford, with a total of 25.7 MWh not supplied. It is also reported that a portion of demand was restored within 3 minutes.

VIRTUS is certified as an Uptime Institute Tier III standard operator[10], which means that during routine maintenance of power and cooling systems there is no interruption to the operation of the systems located in the centre. Virtus has designed an incoming power system to the site to ensure that only the most major power interruption events would trigger the need for the generators to be used outside of maintenance activities. Since operating the existing VIRTUS LONDON data centres in wider Stockley Park and Slough Campuses, VIRTUS has a maintained a 100% uptime record.

The LONDON14 site will initially be fed electricity directly from VIRTUS' existing Stockley Park Campus, housing LONDON5-8, via three separate circuits to provide resilience. The incoming power system to the site will consist of three substations on-site, three separate cables from National Grid's Iver Heath sub-station, and three electrical feeder breakers at Iver. Further details of the High-Voltage (HV) connection are provided in Appendix 03-02 Electrical Supply Arrangement[11].

Two new sub-stations are proposed to be constructed at LONDON14 which will be connected to Iver Heath, after which point the LONDON5-8 connection will be replaced. The proposed electrical design at LONDON14 mirrors that in other VIRTUS datacentres, whereby they system is set up in a ring main unit/circuit, such that if the site was to lose one board, the power can be supplied from the other side of the circuit.

Details of the Low Voltage (LV) Schematic design (one half of) can also be found in Appendix 03-02 Electrical Supply Arrangement[12]. It can be seen that one transformer supports each of the power systems plus a swing. If one transformer goes down, then the associated SBG will come on to supply the relevant load. Each SBG can operate independently for up-to 48hours based on the stored fuel-load on-site within the belly tanks. If for some reason one of the SBG fails, the swing SBG is automatically triggered to provide additional resilience.

It can also be seen in Appendix 03-02 that system has multiple Uninterrupted Power Supplies (UPS) (battery storage), which can supply immediate power for 10 minutes. After 30 seconds however, the relevant SBGs will come on at 100% load to charge the UPS, after which point they will reduce to 88% load.

The LONDON14 site is set up in a N+1 redundancy system[13]. 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 site to fail, it would require a number of failures to the upstream distribution network to occur simultaneously. The requirement to run standby generators is therefore minimised. The measures above will minimise the potential for emergency operation of the SBGs, reducing the overall environmental impact from the installation, in the rare event that they are triggered.

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[9] National Grid ESO, 2022. National Electricity Transmission System Performance Report 2021-22. Available at https://www2.nationalgrideso.com/document/267701/download. Accessed 20th September 2023

[10] https://uptimeinstitute.com/tiers

[11] HV Overview Schematic, LON14-BYES-XX-XX-ST-E-6009, Appendix 03-02

[12] LV Power Stream Overview, VL14-NDY-XX-XX-SC-E-3808[P01], Appendix 03-02

[13] N+1 redundancy is a form of resilience that ensures system availability in the event of component failure. Components (N) have at least one independent backup component (+1). The level of resilience is referred to as active/passive or standby as backup components do not actively participate within the system during normal operation

4. Potential Emissions

A summary of the potential emissions from the site are detailed in Environmental Risk Assessment provided as part of the EP Application (see Document Reference 294760-EP-ERA).

4.1 Emissions to air

Detailed atmospheric dispersion modelling has been undertaken to assess the potential impact of the use of the SBGs during routine testing and maintenance regimes as set out in Table 1.

Furthermore, an additional scenario was also considered to assess the potential impact in the unlikely event of an emergency power outage. This scenario considered a single event where all 16 SBGs will operate at 100% load for up to 72 hours, in-line with EA requirements.

The Air Quality Assessment[14] accompanying the EP Application (see Document Reference 29476-EP-AQ) concludes that no significant impacts are predicted as a result of routine testing or the emergency scenario at any identified sensitive human or ecological receptor.

4.2 Emissions to water

There are no point source emissions to and from the generators or associated fuel storage.

4.3 Emissions to land

There are no point source emissions to and from the generators or associated fuel storage.

Discharges of surface water will be restricted to run-off from the roof hardstanding and paved areas.

4.4 Fugitive Emissions

The potential fugitive emissions from the site have been considered in the ERA**Error! Bookmark not defined.** which also details the measures to manage any potential significant releases. The assessment is included with the application as Document Reference 294760-EP-ERA.

4.5 Noise and Vibration

A Noise and Vibration Assessment[15] has been completed and can be found in Appendix 03-06.

In summary, referencing the routine SBG testing regime set out in Table 2, during the monthly testing (Scenario1) the results show that the predicted SBG noise would not exceed the noise emission limits during the day-time periods at the nearest sensitive receptors. Routine testing and maintenance would only occur during day-time hours.

During the Scenario 2 (annual test), an exceedance of the day-time periods is predicted at residential properties on Nine Acres Close, with a predicted level of 47$L_{Aeq,T}$ above a design level of 44 $L_{Aeq,T}$. Given the annual test is only planned to occur for two hours per year, this exceedance is not considered to be significant. All other modelled receptors are predicted to be below the relevant design level criteria.

During a full emergency scenario, the SBG noise levels are predicted to exceed the day-time limits at nearby sensitive receptors, however the likelihood of this occurring is considered to be low based on the network reliability and in-built design resilience.

[14] Air Quality Assessment for Environmental Permit Application (2023) (Document ref 294760-EP-AQ)

[15] LCP, 2023. Acoustic Consultancy Report, 07194/3/3/2, External Plant Assessment, Virtus DC6 6th October 2023

5. BAT Assessment

In response to Application Form Part B3 question 3a.

This section provides a review and assessment of the site against BAT, in-line with the relevant applicable guidance.

5.1 Generator type

The EA's Data Centre FAQ guidance note[4] states that "*We accept that oil fired diesel generators are presently the default technology for standby generators in data centres.*"

Details into the BAT discussion justifying the choice of engine, the particular configuration and plant sizing meeting the standby arrangement are set out in Section 3.1 and 3.2.

5.2 Alternative Power Considerations

A BAT assessment was undertaken which compares potential standby back-up generation options to other available technologies, to allow a preferred solution to be identified. The following technologies were reviewed for consideration:

- Combined Cycle Gas Turbines (CCGT)
- Open Cycle Gas Turbines (OCGT)
- Aero Derivative Gas Turbines
- Gas fuelled Engines
- Diesel fuelled Engines
- Hydrogenated Vegetable Oil-(HVO) fuelled Engines
- Hydrogen fuelled Engines
- Renewables

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

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

A summary of positives and negatives in relation to each technology option has been provided below:

Table 3 Summary of Back-Up Power Supply Options

Technology type	Positives	Negatives	Summary
Combined Cycle Gas Turbines (CCGT)	High efficiency (58.8-60.7%)	Slow start up time – 1 to over 3.5 hours Only suitable for large facilities (c.100MW+) Size limitations Requires gas storage on site or a gas pipeline through the site – no space for storage, health and safety risk and requires reliance on third party	Not feasible
Open Cycle Gas Turbines (OCGT)	None	Relatively slow start up time of 15-30 minutes Low efficiency (38.3-39.9%) The significant amount of heat lost in the exhaust gas makes open cycle gas turbines significantly less efficient than combined cycle systems High capital investment, operating and maintenance costs Requires gas storage on site or a gas pipeline through the site – no space for storage, health and safety risk and requires reliance on third party	Not feasible
Aero Derivative Gas Turbines	Fast start up time - as low as 1 minute More flexible than OCGT plant Are able to operate under wider ranges of load	Low efficiency (35-39%) but higher than diesel engines and OCGTs at the upper end of the range Heat loss in exhaust gases means these systems are not as efficient as other options. High capital investment Requires gas storage on site or a gas pipeline through the site – no space for storage, health and safety risk and requires reliance on third party	Not feasible
Gas Engines	Start up time of 5 minutes Perform well and emit relatively low amounts of NOx and negligible SOx and particulates when compared to diesel fired engines Can utilise gas delivered by the national gas grid, avoiding the additional transport and fuel storage issues associated with diesel systems	Low efficiency (35.0-45.0%) Steady load requirements Requires gas storage on site or a gas pipeline through the site – no space for storage, health and safety risk and therefore requires reliance on third party for fuel supply/	Potentially feasible
Diesel Engines	Almost immediate start up time of 15 seconds and accepts variable loads Good independent performance reliability due to the on-site storage of diesel fuel in sufficient quantities Allows the option for fuel oil to be sourced from more than one supplier Parts readily obtained and replaced Low maintenance costs	Low efficiency (35.0-37.0%) Emissions of NOx, SO_2, particulate matter and NOx from diesel engines are considerably higher than other options Large number of moving parts which can be subject to failure and require regular ongoing maintenance to ensure reliability Can be noisy	Potentially feasible

Technology type	Positives	Negatives	Summary
Hydrotreated Vegetable Oil (HVO) Engines	As with diesel engines, but with significant savings in CO_2	As with diesel engines, however concerns over potential fuel supply chain. Emissions to air data unclear to compare to diesel, due to differences in fuel supply and manufacture's engine type.	Potentially feasible
Hydrogen Engines	As with gas engines, but with significant CO_2 savings.	As with gas engines, however technology is not proven yet, estimated to be approximately 10 years away. The supply of hydrogen and also storage /transportation is not yet established and again relies on third-parties.	Not feasible
Renewables	Instant power if battery-stored Emission free Minimal operational expenditure	Significant instant power demands not possible through solar / wind directly without batter storage. The area required for battery storage to provide the mission critical power demands would be significant and not feasible on the current site.	Not feasible

Overall, for the back-up generation purposes on-site, only the gas, diesel and HVO-fuelled engines offer the potential start-up time, sizing and availability of engine supply and parts to be considered as potential design solution options and have been taken forward for a BAT assessment.

VIRTUS must demonstrate the ability to maintain supply and replicate national grid power outputs in the event of a national grid supply failure.

To summarise, all three options provide the following requirements for the potential emergency/standby power for the data centre:

- These engines provide a fast response speed to the required load. As set out above, fast start-up of standby generators for data centre is fundamental as an almost instantaneous supply of electricity is required in the event of power loss to the site.
- Engines have low maintenance costs and replacement parts are readily available.

When considering the load requirements, diesel engines are able to accept a load after approximately 15 seconds from starting, whereas gas engines would require approximately 5 minutes to reach the same condition. In the event of a mains power failure where the generator sets are relied upon to provide immediate back-up power supply to the data centre, this significantly longer period to reach a point where load may be applied to the gas engines would compromise the integrity of the data centre's power supply to maintain essential operations.

When considering load stability, gas engines require a consistent load to be applied to them. Due to the emergency back-up nature of the system, the exact power requirements needed at the time to support the mechanical equipment will vary, potentially starting or stopping (i.e. a non-stable load profile). This variable load profile could not be feasibly accommodated by gas engines.

Fuel supply is also a critical consideration. The need for a reliable supply of fuel is essential to ensure reliance in the event of network failure. Therefore, the on-site storage of sufficient quantities of fuel is also needed by VIRTUS to provide the required level of independent performance reliability.

The nature of the proposed application of the generators means that they will require a secure supply of fuel for operation in the event of a mains power failure.

Where piped natural gas is used to support backup power systems, the risk of the natural gas supply being interrupted at the same time as the electricity mains supply (e.g. due to natural disasters, domestic industrial

action or terrorism) means that sufficient resiliency is not guaranteed to satisfy the mission critical IT operating requirements of the data centre.

In order to achieve security of supply for gas fuel, there would be a requirement for a large quantity of gas to be stored under pressure on site in a large vessel/s. This would likely represent a potential major hazard installation, which would introduce both on-site and public health and safety risk considerations. Additionally, the level of potential risk posed by the on-site storage of such a large quantity of pressurised gas, could undermine the fundamental integrity of the data centre operation itself.

In terms of potential environmental impacts, noise emissions from the back-up generators are considered to be comparable for all engines. Emissions to air are the lowest for the gas engines and highest for the diesel engines, with emissions from HVO-fuelled engines likely to be better than diesel but not as good as gas engines.

In regards to HVO, VIRTUS has been looking at alternative fuels in particular HVO (Hydrotreated Vegetable Oil). HVO claims many environmental credentials but from the work completed with generator manufacturers the reduction in emissions is considered to be marginal (and in many cases ambiguous) on modern electrical generators but can have much greater impact on old generators. The main reason for not putting this fuel forward at present is that many of the generator manufacturers have not concluded their testing and provided recommendations. Whilst the generator manufacturers do confirm that the generators can operate on HVO, VIRTUS would require full testing and certification reports before making a full transition. Widespread testing in this area is on-going as the world seeks to decarbonise and move away from diesel-use / fossil fuel reliance and VIRTUS are keeping a close eye on industry developments for current and future operations. Furthermore, there is also uncertainty around the supply-chain for HVO, which is less well established and understood.

When considering all options, the necessary gas storage and supply requirements for the gas engines made this option infeasible as a final design solution for VIRTUS at this site. Uncertainty around the supply, use and emissions data for HVO-fuel also removed this as the final design solution for VIRTUS at this site at this time.

Overall, the diesel-fuelled generators for back-up emergency use were considered to offer the business the most reliable balance between supply, output and safe storage at this time. Whilst potential environmental impacts from the use of diesel fuel are acknowledged, the standby nature of the back-up generators and the infrequent testing regime (5 hours per year per unit) has been demonstrated to not result in any exceedances of the air quality standards at nearby sensitive receptors. Exceedances of the daytime noise limits are predicted for the Scenario 2 two hour annual test at the nearest residential receptor, however given the infrequency of this event, it is not considered to be significant.

Generators are subject to rigorous testing for performance and reliability of output. This requirement must also enable a reliable supply of fuel and the safe storage of adequate volumes, within a relatively limited operating space and not result in any significant environmental impacts.

As such, the (ultra-low sulphur) diesel-fuelled SBGs are considered to be BAT for this site.

5.3 Emissions to air

The follow sections are set out in-line with those topics contained within the Pre-application Guidance for the Combustion sector[16] and the Data Centre FAQ Headline Approach[17], provided by the EA, which require responses to demonstrate that the engines are specified to be BAT. This is for emergency SBGs with a net rated thermal input above 1 MW, which are exempt from MCPD emission limits because they operate for less than 500 hours per year.

[16] Environment Agency. Supplementary combustion sector (Part A installations) basic pre-application advice (Version 1.0) (2021)

[17] Environment Agency. Data Centre FAQ Headline Approach (Version 11.0) (2022)

5.3.1 Generator emissions

In the event of a loss of power supply, i.e. temporary grid blackout, the SBGs will be utilised to maintain the required power supply.

These SBGs are designed to automatically activate and provide the required power to the plant pending restoration of mains power, at which time they shall automatically ramp down and switch back to utility supply. The automatic controls are installed for each of the SBGs and each electrical line up is supported by a dedicated SBG.

Therefore, the specific number of SBGs 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.

The guidance specifies the BAT emissions specifications for new diesel-fired reciprocating engines as 2g TA-Luft or US EPA Tier II (or equivalent standard) with NO_x emission levels in the range of 2000 mg/m^3 at 5% oxygen and reference conditions.

The SBGs to be installed and included in the assessment (as set out in Table 1) state NO_x emission concentrations of 1938 mg/Nm^3 at 5% O_2[18] and reference conditions (100% load standby mode – nominal emissions) which comply with this EA guideline. Furthermore, so as to minimise the potential impact of NOx emissions at nearby sensitive receptors, the SBGs will be fitted with Selective Catalytic Reduction (SCR) emissions abatement with a minimum NOx emission reduction of 95% (<86mg/Nm^3 at 5% O_2).

Generator specification sheets and details on the SCR solution can be found in Appendix 03-01 alongside this report submission[19]

5.3.2 Stack height and design

Air Quality modelling has been undertaken to assess the potential impact of the use of the SBGs during routine testing and maintenance (5 hours per year per generator), as well as in the unlikely event of an emergency power outage for 72 hours.

The SBG for the Proposed Development each have an air intake, driven by a fixed volume fan, which is used in part for generator cooling and in part input air to the generator combustion process. At LONDON14, the SBG exhaust emissions combine with the cooling air stream and discharge through the same flue stack. The resulting effect is a significant dilution of the SBG emission concentrations through a combination with the unpolluted cooling air at the point of release to atmosphere.

All of the SBGs will have individual vertical release flue stacks which are clear of caps and any cowl impediments.

Significant impacts are not predicted at any of the modelled sensitive human or ecological receptors for either the planned maintenance or emergency outage scenario.

5.3.3 Maintenance periods

The planned testing and maintenance regime is set out in Table 2 which shows a total of 5 hours per year per generator run time. This is significantly less than the 50 hours per year expectation set out in the Data Centre FAQ 2018[4] to minimise the potential for adverse air quality impacts and minimised diesel usage.

In-line with Hillingdon Council Planning Condition 12 - Operating Regime for Emergency Generator (18399/APP/2022/411), no testing of generators will be undertaken during school hours (9am – 3.30pm). This is to reduce the impact on air quality within an Air Quality Management Area, in close proximity to sensitive receptors, in accordance with Policy EM8 of the Hillingdon Local Plan: Part 1 (2012), Policy

[18] Nominal NOx emissions at 1746mg/Nm^3 @5% O_2 – Potential Site variation NOx emissions at 1938mg/Nm^3 @5% O_2

DMEI 14 of the Hillingdon Local Plan: Part 2 (2020), the London Borough of Hillingdon Air Quality Action Plan 2019- 2023, and Policy SI 1 of the London Plan (2021).

5.3.4 Flue gas monitoring

The guidance specifies the BAT is also the provision of flue gases sampling ports to allow for monitoring or NOx and carbon monoxide in line with web guidance 'Monitoring stack emissions: low risk MCPs and specified generators'.

Sampling ports will be installed within each of the flues which comply with the EA's MCERTS (monitoring certification scheme). Monitoring is expected to be required within four months of permit granting and when three times the number of maximum average annual operating hours have elapsed.

Further details on the monitoring strategy are set out in Section 7.1.

5.4 Emissions to water/ land

No process waters will be generated by operation of the installation, hence there will be no associated process water discharge to ground or groundwater. Discharges of surface water will be restricted to run-off from the roof hardstanding and paved areas.

Surface water drainage plans are illustrated in the Site Layout and Emissions Point Plan[7] and also the Drainage drawings which can be found in Appendix 03-03.

5.5 Fugitive emissions/ leaks

5.5.1 Fuel overview

The SBGs fuel storage, fuel delivery and engine lubrication oil systems have been designed to consider the potential impact of leaks / spillages on the site.

VIRTUS takes the protection of the environment, particularly relating to the management of diesel fuel on all sites, very seriously. It is the goal of VIRTUS data centres to effectively control these sources and to prevent the pollution of underground aquifers, canals, or waterways.

This is demonstrated through the VIRTUS Fuel Management – Best Practice document which operations at the LON14 site will be adhered to. The purpose of this document is to detail the controls in place to mitigate such pollution, covering key areas including (but not limited to): -

- Diesel storage guidelines
- Water Pollution
- Fuel Management Responsibility
- Delivery Procedures; and,
- Fuel Storage – management checks

VIRTUS also has its own Pollution (Oil Spill) Procedure which the LON14 site will be added to for formal adherence. The Procedure sets out the responsibilities and actions required for any incidents involving a spill.

Protection systems will include automatically triggered safe plant emergency shutdown in the event of major faults in equipment.

5.5.2 Spill Kits

Spill kits will be located at strategically important locations that are at risk to spill incidents. The VIRTUS Facilities Management (FM) Teams are responsible for ensuring that adequate spill response kits are available at key locations, as well as for ensuring key staff have received training on how to deal with a spill within their area of responsibility.

The specific locations of spill kits have not yet been formally identified however will be focussed around the generator yard re-fueling area and parking areas. Spill kits will be subject to regular checks to ensure they are in place and maintained. Collected spilled oil and absorbent material will be disposed of as hazardous waste.

The locations of the spill kits will however be formally identified as part of the site Environmental Management System when it is finalised and training will be provided to all operational staff.

5.5.3 Re-fuelling

When accepting bulk deliveries, the process to manage accidental spillage is contained within the VIRTUS Business Partner Fuel Policy. It includes the following requirements:

- To cover all drains within a 20-meter radius of delivery & filling activities using neoprene drain covers.
- To have sufficient, unused spill kits readily available for filling delivery & filling activities
- To have the T-Key ready for use to activate the manual penstocks in the event of a spillage.
- Delivery & filling activities to be attended by both a member of VIRTUS technical staff and a member of the FM Team.

For re-fueling, the fuel tanker will be parked on an area of treated slab that slopes towards drains which are connected to an oil separator, before discharge to ground. The oil interceptor has been sized to accommodate one compartment of a fuel tanker i.e. capable of retaining the full loss of contents of one road tanker.

The Pollution (Oil Spill) Procedure also sets out the four steps to follow upon identifying any spill, namely around: -

- Containing a spill
- Cleaning a spill
- Waste disposal
- Drainage system check/clean.

The FM Team shall also inform both VIRTUS and site security that fuel delivery is to take place. Where necessary the local area will be appropriately cordoned off using barriers and cones.

Delivery of fuel will not be carried out until any remedial actions are conducted.

The FM Team must ensure that all combustible materials, flammables and naked lights and mobile phones are removed or switched off within the fuel delivery area and immediate vicinity. The FM Team are also to obtain delivery receipts/reports indicating the exact amount of fuel delivered to individual fuel storage tanks.

An Emergency Operating Procedure (EOP) exists in the event of a spillage or leakage of fuel (EOP (M) 013 – Diesel Fuel Spill), which triggers the Pollution Incident Response Plan if required. Virtus operate a Nine Point Fuel / Chemical Spill Procedure which assesses the severity of the spill and associated risks, and initiates the appropriate response in terms of alarms, actions, notifications and records.

Re-fueling will occur with a direct connection to the containerised generator package. The fill point cabinet will house the 2” delivery connection, a drip tray, a CTS alarm unit (audible tank bund, low & high conditions at 25% and 95% fuel capacity, respectively) and the visible gauge, with continuous level reading. All signals will be repeated at the generator control panel. The cabinets will be lockable, with a common key to be used on both fill point & polisher cabinets.

The pipework between the fuel tank and the generator / filter assembly & fuel tank / fuel fill point is within the (bunded) enclosure. Both of these runs utilise single-skin, mild steel pipes, with final connections using standard, flexible hoses. There is no leak detect facility for these pipes, however, the bunded enclosure is complete with two off floor recesses, each containing a float switch to detect the presence of liquids/leaks. These two float switches are connected in parallel and monitored by the electronic management system.

Each belly tank also has a breathing vent associated with the generators. These breathing vents allow the release of air during filling and avoid vacuum during consumption and terminate inside the enclosure.

5.5.4 Fuel Storage

The principal guidance for the design of the oil storage and associated infrastructure is the Control of Pollution (Oil Storage) (England) Regulations 2001. Additionally, the requirement for the safe environmental storage of fuel on-site (including transport of fuel) is covered within the EPR.

Best Available Technique (BAT) Reference (BREF) document 'Emissions from storage' for sites regulated under the IED has also been considered as part of the design.

The carbon steel fuel belly tanks built to BS799: Part 5 are integrally bunded to a capacity of 110%. The steel tanks are fitted with leak detection alarms, such that if any fuel is released into the secondary containment, the audible alarm will sound and VIRTUS FM will be alerted.

Scheduled maintenance of diesel tanks will be incorporated into the Environmental Management System (EMS), to minimise the risk of fugitive emissions of fumes to air.

The tanks will be visually checked daily for corrosion, together with third-party checks undertaken as part of routine maintenance of the generators. A 5-yearly empty tank inspection is undertaken to check for corrosion.

5.5.5 Fuel Polishing

In order to retain the integrity of the diesel it will be polished regularly. If the diesel fuel is left unpolished for extended periods of time it can cause clogging of the fuel lines and damage to the engines. Diesel fuel polishing is the process or removing contaminants and impurities from the fuel and involves the filtration of the diesel fuel using a 50-micron filter to remove contaminants. Fuel polishing is undertaken by a fuel polishing unit which is fixed to the tank, or wall mounted internally to the acoustic enclosure and piped to the tank, so as to avoid any risks with the use of mobile units.

This polisher will run autonomously based on a stand-alone timer with no input from either the engine control system, or the BMS. The pump controller will have additional outputs for ‘pump running’, ‘flow detected’, ‘filter blocked’ & ‘fault’ which will be audible via the generator control panel.

The flowrate of the fuel polishing unit is 50 litres / min (maximum). As the brimful capacity of the tank is 41,474 litres, a full turnover of fuel would take (41,474/50), i.e., 829.48 minutes / 13.50 hours.

As an additional level of maintenance, quarterly fuel sampling is also undertaken to ensure the quality of the fuel (see Appendix 03-08).

5.5.6 Accident Management / Fire

VIRTUS has a comprehensive Fire Prevention and Control procedure set out within the 6.6.2 of Chapter 6 OHS manual (see Appendix 03.08).

In the event of a fire within the generator container units, each generator enclosure is equipped with multi-sensor fire detectors (smoke & heat) and a manual call point. The generator enclosure fire alarm system is fully interfaced with the data centre fire alarm system and notifies operations, and is an addressable system.

There is no suppression within the enclosure and separation distances are used per UK regulations to provide minimum separation distances between the generators and the main building.

6. Resource Use and Efficiency

6.1 Raw Materials

In response to Application Form Part B3 question 3c.

In response to Application Form Part B3 question 6d.

The raw materials to be used at the site are:

Diesel fuel oil: each generator will require (when providing 'standby' power):

- Main SBGs up to 643 litres per hour (at 100% load).

Each SBG will store 48 hours' worth of useable diesel fuel in its integrally bunded bulk fuel tank, which equates to 30,868.8 litres of useable capacity in each SBG containerised unit.

Lubricating oil and anti-freeze: to be used in the engines and other mechanical equipment. Occasional top up or replacement will be required during scheduled or forced maintenance periods only.

The lubricating oil and anti-freeze for the generators will be stored within the engines and manually topped up during servicing by an appointed service contractor.

Transformer oil: Occasional top up or replacement will be required.

No lubricating oil/anti-freeze or transformer oil will be stored on site by the operator; all oils will be brought to site and topped up/replaced during planned or forced maintenance periods only.

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

The SBGs are designed for the combustion of diesel fuel oil, this being the fuel recommended/specified by the engine manufacturers. The diesel fuel used on-site will be ultra-low sulphur only.

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

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

The lubricating and transformer oils may have other alternatives, however the type of fluids used are limited to those recommended/specified by the engine manufacturers and site engineers.

6.2 F-gases

In response to Application Form Part B3 question 6d.

F-gases will be used within the wider LONDON14 site however will not be used as part of the Scheduled Activities or Directly Associated Activities listed; namely the combustion of fuels with a rating >50MWth for the standby diesel generators, together with the storage of associated fuels.

The site will use the refrigerant R32 within the Air Handling Units. This refrigerant will be used in accordance with the F Gas regulations applicable to England.

Regular maintenance will be undertaken by an approved specialist contractor to ensure the units are all operating correctly and to prevent any leaks. Records will also be maintained of any refrigerant top-ups needed.

6.3 Energy Efficiency

In response to Application Form Part B3 question 6a and 6b.

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

As the total installed planned maintenance and testing schedule falls below the 1500 hour threshold (16 generators x 5 hours each = 81 hours 20mins), the data centre is therefore exempt from the EED requirements and an assessment of energy efficiency is not required.

The SBGs will be subject to regular maintenance and inspection that will include ensuring the engines are optimised to minimise the heat rate (energy consumption) whilst maintaining the relevant emissions standards.

The SBGs are designed for use in the event of an emergency. The efficiencies of the SBGs at the data centre are 35% each, with a total installed thermal input of 110 MW and a rated electrical output rating of 38.4 MWe.

The provision/implementation of combined heat and power (CHP) is not applicable as the back-up generators will each operate for substantially less than 500 hours per annum for the provision of emergency power generation.

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

Energy efficiency will form part of on-site staff training.

6.3.1 Climate Change Agreement

In response to Application Form Part B3 question 6c.

VIRTUS will enter into a Climate Change Levy Agreement for LONDON14 once the Environmental Permit Application is granted.

Energy management techniques will be implemented to monitor, record and track power usage effectiveness (PUE) at the data centre.

6.4 Water Minimisation

In response to Application Form Part B3 question 6d.

There will be no consumption of water associated with the standby generators / combustion activities and use/storage of diesel at the site. A CCCW system will be installed which has no associated process discharge under normal operation. No process waters will be generated by the plant, hence there will be no associated process water releases to surface water or sewer from the installation.

The area containing the coolers and CCCW circulating pumps will be within the engine containers so the risk of accidental discharge of process waters to controlled waters is minimised.

6.5 Waste Minimisation

In response to Application Form Part B3 question 6e.

The site will not produce significant amounts of waste due to the nature of its operations.

Each main engine lubricating oil is changed at 500 run hours or 3 year intervals, whichever is shorter.

Any waste oil generated during testing/ maintenance will be removed from site by the appointed third-party contractor and managed by a suitably regulated waste management contractor.

The same applies to any Waste Electric and Electronic Equipment generated on-site (not related to the Scheduled Activity or DAA, but wider site operations).

7. Monitoring

In response to Application Form Part B3 question 4.

7.1 Emissions to Air

Each of the back-up generators will each operate for less than 500 hours per annum and will not be subject to emissions limit values (ELV) as described in Section 2.2.

As the generators will also not be used for the elective generation of electricity they will not be considered specified generators in accordance with EPR 2018 and hence will not be subject to the ELV.

In-line with BAT guidance received during engagement with the EA, it is expected that the operator will need to demonstrate that the engines are BAT by including the provision of flue gas sampling ports to allow for NO_x and CO monitoring, designed to meet BS EN 1525922 clause 6.2 and 6.3;[20].

To summarise: -

- Access is adjacent to the ports large enough to provide sufficient working area, support and clearance for a sample team to work safely with their equipment throughout the duration of the test;
- The sample location(s) will be at least 5 HD from the stack exit;
- The sample location(s) will be at least 2 HD upstream and at least 5 HD downstream from any bend or obstruction; and
- The sample plane will have a constant cross sectional area.

Any testing will be undertaken by an organisation with the EA's MCERTS accreditation for these measurements, so that the data meets the requirements of the MCERTS certification for emissions monitoring systems.

In-line with the MCPD requirements captured by the EPR 2018, it is expected that periodic measurements shall be required at least when three times the number of maximum average annual operating hours have elapsed for medium combustion plants with a rated thermal input >1MWth and less than <20 MWth. This is for plant which operate <500 hours and have no ELVs associated with their operation.

The first measurements shall be carried out within four months of the grant of a permit to, or registration of, the plant, or of the date of the start of the operation, whichever is the latest.

In addition, the operator will also record:

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

As detailed in Section 4.1, one of the reasons for the decision to choose diesel back-up generators on-site is in relation to their minimal start-up or shut-down times.

Operational hours will be counted from the first fuel ignition. This will include the shorter periods of plant 'overlap' when redundant plant is started as a precautionary measure before final load is reached with the optimum/minimum number of generators in use.

[20] BSI, 2007. Air Quality. Measurement of stationary source emissions. Requirements for measurement sections and sites for the measurement objective, plan and report. BS EN 15259:2007

7.2 Emissions to water

7.2.1 Surface water

There are no point source emissions to and from the generators or associated fuel storage.

Uncontaminated surface water runoff from generator compounds will be discharged via the on-site surface water drainage system. This run-off will pass via two full retention oil interceptors and discharge to ground through the soakaway.

Monitoring of the surface water discharge from the data centre is not considered necessary.

For the purpose of the environmental permit, in relation to surface water runoff from the permitted Installation, there will be two point source emissions to water, referred to as S1 and S2. These locations are indicated on the Site Layout and Emissions Point Plan[7], downstream of the two oil interceptors, before discharging to ground in the soakaway.

7.2.2 Foul water

There are no point source emissions to and from the generators or associated fuel storage.

The wider data centre, not the permitted installation, will be connected to the municipal combined sewer system for discharges of domestic grey water / sanitary effluent (sinks, toilets, cleaning water, etc.)

Based on the above information, monitoring of the foul water discharge from the data centre is not considered necessary.

8. Environmental Management Systems

In response to Application Form B2 question 3d.

8.1 Overview

VIRTUS currently has an ISO 14001:2015 certification (Document reference Appendix 03-07) for *'the design, build and ongoing operation of mission critical Tier III data centre facilities*' and will look to develop an Environmental Management Systems (EMS) for LONDON14 in line with the requirements of the international standard.

The EMS will include the policies, management principles, organisational structure, responsibilities, standards/ procedures, process controls and resources in place to manage environmental protection across all aspects of the business.

- Environmental aspects and impacts
- Objectives and targets
- Training and competence
- Reporting
- Legislation
- Auditing

The EMS will place particular importance on:

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

Full details are set out in VIRTUS' Occupational Health & Safety and Environmental Management System (Chapter 6) document, provided as Appendix 03-08 to this EP application. However an overview of the pertinent points is set out in the following sections.

8.2 Policy

As part of this EMS, VIRTUS will include LONDON14 within their existing Compliance Policy which set out the commitment to operating their facilities in *'adherence to all applicable regulatory requirements, to meet or exceed customer requirements and continually improve the effectiveness of our management systems'.*

VIRTUS' Compliance Policy defines their commitment to continual improvement and to developing objectives and targets aimed at preventing pollution and improving environmental performance. The Policy is reviewed annually by the Senior Management Team. Arrangements are in place to ensure that all employees are aware of the Policy and its contents and that the Policy is made available to company stakeholders, including contractors who undertake onsite work around the generators (maintenance, deliveries, etc).

The Policy emphasises commitment to:

- Minimising (and where possible) preventing pollution;

- Improving environmental and energy performance;
- Ensuring robust maintenance regimes are in place;
- Auditing and evaluation of operational policies, processes, staff and controls, communicating findings to senior management; and
- Communicating and promoting policies, processes and controls to all relevant parties

8.3 Organisation

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

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

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

8.4 Environmental Aspects Evaluation

VIRTUS ensures that internal and external issues relevant to the provision of services, energy & environmental aspects, information security, strategic direction, and in maintaining compliance are captured, evaluated and mitigated through a Risk Management System compliant with the requirements of BS ISO31000:2009 Risk Management.

Environmental aspects and risks associated with the organisation's activities, including a significance rating for each aspect will be captured within the Risk Evaluation Register, which forms a key part of VIRTUS' Risk Management Process. This is set out in Chapter 4 of the VIRTUS' Operations Manual. The potential impacts (direct and indirect) relevant to the activities are also set out, highlighting which substances, activities or incidents related to the aspects that could potentially have a harmful effect on the environment.

Any substance, activity or incident that has the potential to cause harm, or under the worst case scenario has a high-risk of potential to harm will be identified as being 'significant'. Aspects which are identified as being 'significant' will be managed by establishing operational controls, process, procedures, training and monitoring activities such as audits. The operator's management team will be responsible for reviewing aspects and impacts defined as being significant. All staff will be responsible for working in accordance with procedures relating to environmental compliance.

8.5 Environmental Risk Assessment

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

Environmental risk assessments will be carried out:

- Under normal operating conditions;
- Under potential abnormal/emergency conditions;

- For existing equipment;
- For existing material storage;
- Before a new substance is introduced;
- Before the installation of new plant on-site; and
- Before existing plant is modified.

All significant risks will be recorded in the Business Risk Register.

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

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

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

8.6 Monitoring, Control and Change Management

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

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

Change control will include consideration of the proposed change requirement, identification of the potential environmental implications, measures required to minimise the potential environmental impacts and the responsibility for resolution and a timescale. Change control will include consideration of (inter alia):

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

8.7 Accident Prevention and Management

VIRTUS will develop systems for managing accidents or incidents. Risks as a result of activities undertaken, or proposed to be undertaken, at the data centre will be considered and documented, in the Risk Evaluation Register, set out in Section 8.4. The Register will be updated to include any specific requirements of the Environmental Permit.

VIRTUS also has an Emergency Preparedness Response Process. The process identifies risks under the headings of operational (environmental), third party (environmental), standards/statutory risk, and risks arising from natural disasters. This will be reviewed and updated as necessary.

Further details can be found in VIRTUS' OHSE procedures (Chapter 6) Appendix 03-08 to this EP application.

8.8 Climate Change Adaption Plan

Adaptation to climate change must now be integrated into the management system for permitted activities. VIRTUS will consider the risks to the site from climate change, the risks the site creates due to climate change and how to embed controls throughout the EMS. Based on climate projections over the coming decades the following risks are identified as potential risks:

- Summer daily maximum temperature may be around 7°C warmer which could resulting in increased use of standby generator on-site in the event the summer temperatures affect the electricity grid.
- Winter daily maximum temperature could be 4°C more than the current average, with the potential for more extreme temperatures, both warmer and colder than present resulting in potential impacts on the site.
- Daily rainfall intensity could increase by up to 20% on today's values resulting in flooding on the site.
- Average winter rainfall may increase by over 40% on today's averages resulting in potential increased risk of site surface flooding and could impact site wide drainage capacity.
- Sea level rise resulting in flooding events.
- Drier summers could see potentially up to 40% less rain than now.
- Generation of CO_2e emissions from generator use.

The Environmental Risk Assessment (294760-EP-ERA) submitted as part of the application assesses the above risks.

As part of the EMS VIRTUS will develop a Climate Change Adaptation Plan which will be compliant with the EA guidance on risk assessment and adaptation planning in your management system. The climate change adaptation plan will be monitored on an annual basis by VIRTUS to determine if the plan is achieving its original objectives, managing priority risks, if the plan is still effective and if the plan needs updating.

8.9 Training

Environmental training will be provided; this will be for both general awareness and job-specific training. The site will be managed by a sufficient number of staff, who have the competencies to operate the site. In accordance with the EMS:

- All staff will have clearly defined roles and responsibilities;
- Records will be maintained of the knowledge and skills required for each post;

- Records will be maintained of the training undertaken and relevant qualifications obtained by staff to meet the competence requirement of each post; and
- Operations will be governed by standard operating instructions.

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

Training records will be maintained and training needs regularly reviewed. All contractors will be given appropriate training prior to the commencement of any works or services.

8.10 Review and Audit

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

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

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