Virtus Holdco Ltd.

Saunderton Data Centre Campus

ENVIRONMENTAL PERMIT APPLICATION – TECHNICAL SUPPORTING DOCUMENTATION

RAMBOLL

Bright ideas.
Sustainable change.

Prepared for:

Virtus Holdco Ltd.
20 Balderton Street
London, W1K 6TL
Tel+ (44) 20 7499 1300
Kyle Morrison – kyle.morrison@virtusdcs.com
www.virtusdatacentres.com

Prepared by:

Ramboll UK Limited
240 Blackfriars Road,
London
SE1 8NW
United Kindgom
020 7631 5291

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Contents

1 Introduction

1.1 Background

Temple (now Ramboll) was instructed by Bryden Wood Ltd. (the Client) to prepare an Environmental permit application for Virtus Holdco Limited (the applicant) for their proposed data centre campus to be located off Haw Lane, Saunderton, Buckinghamshire.

The data centre campus will be connected to the local electricity transmission network and will comprise four new data centre buildings known as London 15, London 16, London 17 and London 18, associated plant located in gantries to service the buildings, back up diesel-powered generators for emergency use and associated fuel storage facilities. The 57 No. backup generators will ensure the continuity of electricity supply and critical data centre operation in the event of a utility power outage, or an emergency condition where the normal mains supply to the site or the individual campus buildings is interrupted. It is not anticipated that the typical annual operation of the generators for routine testing and maintenance purposes will exceed 50 hours.

The generators will be diesel fired, however will be capable of operating with HVO as an alternative source of fuel. For this application, diesel has been considered as the primary fuel source to provide a conservative assessment.

A total of 57 high power density diesel generator sets are proposed for installation across the Site. Of this total, 7 Baudouin generators are proposed for installation on building LON15; two have a power rating of 2.8 MW (engine model: 16M55G6D2/5), whilst the other 5 have a power rating of 2.4 MW (engine model: 12M55G10D2/5). The 2.4 MW plant located at London 15 each have a thermal input of 6.3 MWth per set, whist the 2.8 MW plant have a thermal input of 7.86 MWth per set.

The other 50 generator sets proposed for installation on buildings LON16, LON17 and LON18 are 2.4 MW Baudouin generators (engine model: 16M55G3000/5). The 2.4 MW plant located at London 16, 17 and 18 have a thermal input of 6.18 MWth per set. All proposed generators are certified to the US EPA Tier II standard and therefore meet the minimum requirement for Best Available Techniques (BAT). No selective catalytic reduction is requited, following the air quality modelling which did not identify any significant impacts. The generators' exhaust skid is to make space provision and pipework arrangements adaptable for an SCR to be provided, essentially meaning that the generator sets and flues are "SCR ready", in accordance with the EA's recommended BAT.

The total permitted rated thermal input of all the generators across the Saunderton Campus will be 356.22 MWth upon completion of all four data centre buildings.

Emissions from diesel generators could have an impact on local air quality. The main air pollutants of concern are oxides of nitrogen (NOx), nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$) and consequently detailed dispersion modelling has been undertaken to assess the impact of emissions to air from generators on air quality in the area surrounding the Site.

The Environmental Permitting (England and Wales) Regulations 2016 (as amended) (EPR) states that:

".....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."

The EPR also states that the burning of any fuel in an appliance with a rated thermal input above 50 megawatts is a regulated activity, and an environmental permit is required to operate the installation.

This document is therefore submitted on behalf of the applicant to support their application for a bespoke Environmental Permit for the site under the Environmental Permitting (England and Wales) Regulations 2016 as amended, Schedule 1, Section 1.1 Part A (1) (a) activity as a combustion activity having thermal input of >50 MWth. It describes the operating techniques that will be implemented at the facility with respect to the diesel generators and land to ensure that environmental aspects are managed in compliance with the conditions of the Environmental Permit and in line with Best Available Techniques (BAT).

For the purposes of this permit application, the relevant technical standards in the following documents have been used:

- GOV.UK Develop a management system: environmental permits guidance, 14 January 2019;
- GOV.UK Risk assessments for your environmental permit guidance. 25 March 2021. Data Centre FAQ Headline Approach, Environment Agency, dated 15/11/2022 and 03/07/2024; and
- Emergency backup diesel engines on installations: Best Available Techniques (BAT) - GOV.UK

2 Permit Application Forms Supporting Information

2.1 Part A Application Form – About You

Virtus Holdco Limited: Registered office: 4th Floor, 20 Balderton Street, London, W1K 6TL, Company Registration Number: 7670473,

The director details Virtus are provided in the Part A Application form (About you).

Form B2.5 Medium Combustion Plant and/or Specified Generator bespoke permit

The address of the data centre is:

Haw Lane,

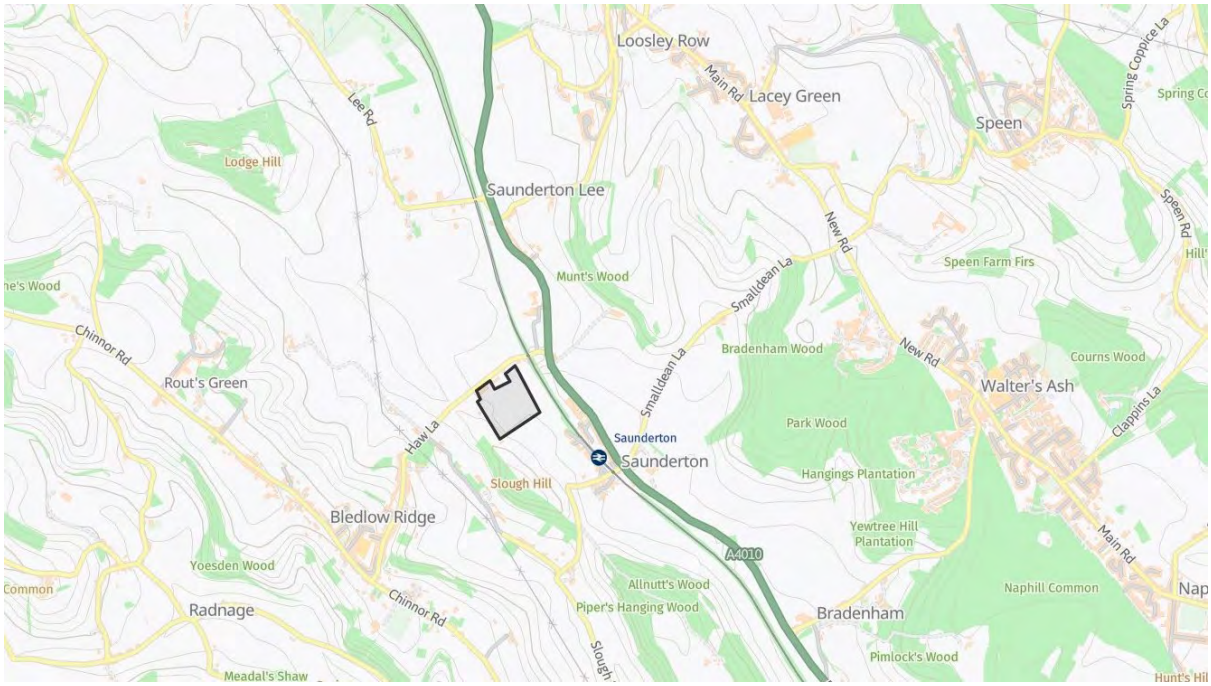
Saunderton,

Buckinghamshire, HP14 4JD

The site's Ordinance Survey National Grid Reference is 480790 198500

A site location plan is provided in Figure 2.1 below.

Figure 2.1 – Site Location Plan (the site boundary is outlined in black)



The completed permit application forms (Part A, Part F1, Part B2 and Part B3) and the MCP Generator list spreadsheet are provided in Appendix A.

The proposed site layout for the Saunderton data centre campus is presented in Figure 2.2 below. The installation boundary is presented in Appendix B – Drawings and Site Plans.

Figure 2.2 – Saunderton Data Centre Campus, Proposed Layout

2.2 Permitted Activities

The installation will consist of a single installation comprising a stationary technical unit (STU) made up of the generator engines and fuel oil storage tanks for emergency use only.

Table 2.1 below summarises the permitted activities while Table 2.2 shows the number of generators that will be installed, their net power output and thermal output for each of the four data centre buildings.

Table 2.1 – Types of Activities at the Installation

Reference	Schedule 1 Part 2 Reference	Description of Activity	Limits of Specified Activity
AR1	Section 1.1 Part A (1) (a) Burning any fuel in an appliance with a rated thermal input of 50 or more megawatts.	Operation of 57 emergency standby generators with a total thermal input of approximately 356.22 MWth. (Total rated thermal input >50 MWth) Generators will burn diesel solely for the purpose of providing electricity to the data Centre in the event of a failure of supply from the National Grid and during maintenance testing. • 5 x 6.3 MWth generators (London 15) • 2 x 7.86 MWth generators (London 15 building) • 50 x 6.18 MWth generators (London 16, 17 and 18)	From receipt of raw materials and generation of electricity to dispatch of waste. Electricity produced at the installation will not be exported to the National Grid.
Directly Associated Activities			
AR2	Storage of raw materials (fuel)	Storage of diesel in belly tanks for each engine, serving the Schedule 1 combustion activity.	From receipt of raw materials to use within the facility.
AR3	Surface water drainage	Surface water drainage	From the input to the site drainage system until discharge to ground via soak away (W1) and public surface water sewer (if applicable). Drainage system covering fuel storage and refuelling bays drains via oil interceptors, then to emission point W1.

Table 2.2 – Quantities and ratings of generators per data centre building

Data Centre Building	Proposed Number of Generator Sets	Net Power Output MW/MVA each	Thermal Input MW fuel based (MWth)
London 15	7	2.4 /3 - x 5 No. 2.8 /3.5 - x 2 No.	6.3 MWth 7.86 MWth
London 16	16	2.4 / 3	6.18 MWth
London 17	12	2.4 /3	6.18 MWth
London 18	22	2.4 / 3	6.18 MWth
Site Total	**57**		356.22 MWth

The installation does not form a Chapter III Combustion Plant under the Industrial Emissions Directive as:

- the new standby generators will not discharge through a common stack;
- the generators will only be used in the case of an emergency or breakdown to replace the thermal input of that part for which they are substituting; and
- the standby generators will at no point be used to boost performance.

2.3 Management Systems

The applicant operates an integrated management system (IMS) for the delivery of quality data centre services, energy and environmental performance, health and safety and information security. The IMS is detailed within Chapter 6 of the Operations Manual (Occupational Health and Safety and Environmental Management (OHSE). The IMS is certified to ISO 14001 to ensure all compliance obligations are met. Chapter 6 of the Virtus Operations Manual details the elements of the management system, these include: an integrated compliance policy, responsibilities, standards, procedures, management principles, processes and controls as well as other resources which are in place to ensure environmental protection across the business. The management system is described in further detail in Section 4.

2.4 Supporting Information

This section provides additional information to support permit application form B2.5 (Medium Combustion Plant and / or Specified Generator bespoke permit).

A Non-Technical Summary (NTS) of the proposed installation is provided as a separate report, report reference 24027-TEM-ZZZ-ZZ-RP-Y-0005. The NTS explains the application in non-technical terms and includes the following information:

- A summary of the regulated facility; and
- A summary of the key technical standards and control measures arising from the risk assessment.

An Air Quality Assessment which included air dispersion modelling is provided as a separate report entitled Basis of Design Narrative, Air Quality Report, document number 24027-TEM-ZZZ-ZZ-RP-Y-0002 which forms a part of this permit application. The air quality report used the atmospheric dispersion model ADMS-Roads (v5.10.0.21) to quantify potential impact of emissions from the generators on oxides of nitrogen (NOx), nitrogen dioxide (NO_2) and particulate matter concentrations.

2.5 Supporting Information – Form F1 Charges & Declarations

This section provides additional information to support permit application form Part F1 Charges and Declarations.

2.6 Plans

The permit installation boundary is presented in Appendix B which also includes additional figures and diagrams in support of this permit application.

2.7 Site Condition Report

A Site Condition Report (SCRp) has been prepared for the application site, in line with the Environment Agency's Guidance for Applications (H5) Site Condition Report. The SCRp, document number 24027-TEM-ZZZ-ZZ-RP-Y-0007, has been submitted as a separate report to support the permit application.

The SCRp provides information on the site's geology, hydrology, historical land use, potential contaminant sources, pathways and receptors. The report describes historical activities on the site as well as remediation works undertaken, and geo-environmental assessments.

2.8 Environmental Risk Assessment

An Environmental Risk Assessment (ERA) has been undertaken for the site, report reference 24027-TEM-ZZZ-ZZ-RP-Y-006. The ERA has been undertaken in accordance with the EA and DEFRA guidance -Risk Assessments for your environmental permit. The ERA identifies the environmental risks that could occur at the site, and what their environmental impact could be. It develops a Conceptual Site Model, which summarises the residual risk of soil and groundwater contamination at the site.

The ERA was conducted using the EA /Defra methodology, which included the following steps:

1. **Identification and consideration of risks** for the site and the sources of the risks;

2. **Identification of the receptors** (people, animals, property that could be affected by the hazard) at risk from the site;

3. **Identification of the possible pathways** from the sources of the risks to the receptors;

4. **Assessment of risks** relevant to the specific site activity and checking that they are acceptable and can be screened out; and

5. **A statement of measures** that will be put in place to control identified risks.

The ERA considered and assessed environmental risks from:

- Discharges to controlled waters (surface and groundwater);
- Accidents;
- Odour;
- Noise and vibration;
- Uncontrolled or unintended (fugitive) emissions (e.g. dust, litter, pests and discharge pollutants);
- Visible emissions (e.g. smoke and visible plumes); and
- Release of bioaerosols.

The risk assessment defined the likelihood of the receptors being exposed to the identified hazards, and defined the likelihood as:

- **Very low** – Exposure is considered to be very unlikely;
- **Low** – exposure is considered to be unlikely;
- **Medium** – exposure is considered to be likely; and
- **High** – exposure is considered to be highly likely.

The consequence of the receptors being exposed to the hazard is defined as:

- **Very low** – negligible impact to the receptor;
- **Low** – Low impact that can be easily rectified;
- **Medium** – medium impact that will require a moderate level of mitigation; and
- **High** – significant mitigation is required to rectify damage to the receptor.

The ERA identified a very low probability of receptor exposure to identified hazards resulting from:

- Fuel delivery accidents, storage and transport;
- Accidents caused by fire, flooding or vandalism; and
- Noise and vibration caused by the operation of onsite generators and vehicle movements.

The Environmental Risk Assessment (ERA) identified a medium risk to receptors (employees, nearby residents, transient receptors and the atmosphere) from emissions caused by the operation of the onsite generators.

Virtus will implement appropriate mitigation and emergency response procedures, and these are detailed in Chapter 3 and within the ERA.

3 Emissions to Air, Water and Land

3.1 Emissions to Air

Emissions to air from the installation will mainly comprise combustion gases arising from the operation of the generators. Operational emissions to air from the site will vary depending on the operational scenario of the engines. The engines will only be operational during periods of emergency back-up situations (i.e. in the event of a power outage from the national grid, or an internal system failure requiring a power stream to come off grid), or during engine testing. There will be no point source emissions to air outside of these periods. Engine test periods will be kept to an absolute minimum to avoid burning fuel and generating unnecessary emissions.

The engines will be tested monthly, eleven of these tests will be a 15 minute "switch on" offload test. On the twelfth month, a full service onload test will be carried out, this consists of an initial 20-minute test at 100% load immediately followed by 120 minutes at 100% load. For the full service onload test, up to three generators may operate at any one time.

The engines are emissions optimised by design and will be certified to meet US EPA Tier II emissions requirements. All proposed generators are certified to the US EPA Tier II standard and therefore meet the minimum requirement for Best Available Techniques (BAT). No selective catalytic reduction is required, following the air quality modelling which did not identify any significant impacts. The generators' exhaust skid is to make space provision and pipework arrangements adaptable for an SCR to be provided, essentially meaning that the generator sets and flues are "SCR ready", in accordance with the EA's recommended BAT.

The principal emissions of concern are oxides of Nitrogen (NOx, NO_2) and particulate matter (PM_{10} and $PM_{2.5}$).

3.2 Point Source Emissions to Air

Emissions from the operation of each of the 57 generators will be emitted to air via individual flues and would only occur in the event of an interruption to the installation's electricity supply from the National Grid or running the engines for maintenance and testing. All generators are certified to meet USEPA Tier II emissions requirements.

Table 3.1 below details the proposed flue emission points to air and their National Grid References. Flue emission points correspond to each of the 57 diesel powered generators.

Table 3.1 – Flue Emission Points with their Coordinates

Flue Number	X Coordinate	Y Coordinate	Flue Number	X Coordinate	Y Coordinate
Stack height above ground level (m) – 11m in London 15, 16 and 17 and 15.98m in London 18					
A1	480928	198438.4	A30	480633.3	198523.8
A2	480924.7	198443	A31	480636.4	198519.1
A3	480921.7	198447.7	A32	480639.4	198514.3
A4	480918.7	198452.4	A33	480678.3	198455.1
A5	480874	198520.6	A34	480681.4	198450.4
A6	480871.1	198525.2	A35	480684.3	198445.7
A7	480867.9	198529.9	A37 (P36)	480819	198367
A8	480864.9	198534.6	A38 (P51)	480821.5	198368.8
A9	480866.8	198398.7	A39 (P37)	480815.9	198371.8
A10	480864	198403.3	A40 (P52	480818.6	198373.5
A11	480860.9	198407.8	A41 (P38)	480812.9	198376.4
A12	480857.9	198412.5	A42 (P53)	480815.4	198378.1
A13	480813.2	198480.8	A45 (P39)	480759	198458.7
A14	480810.3	198485.4	A46 (P54)	480761.8	198460.1
A15	480807.2	198490.1	A47 (P40)	480755.8	198463.2
A16	480804.1	198494.7	A48 (P55)	480758.8	198464.9
A17	480851.5	198555.1	A49 (P41)	480763.4	198330.9
A18	480848.4	198559.8	A50 (P46)	480760.9	198329
A19	480845.4	198564.5	A51 (P42)	480760.4	198335.5
A20	480842.3	198568.9	A52 (P47)	480757.6	198333.6
A21	480790.8	198515.3	A53 (P43)	480757.2	198340.1
A22	480787.8	198519.9	A54 (P48)	480754.7	198338.4
A23	480784.6	198524.6	A55 (P44)	480703.6	198422.3
A24	480745.1	198485.6	A56 (P49)	480700.7	198420.4
A25	480742.1	198490.2	A57 (P45)	480700.7	198426.9
A26	480739.1	198494.8	A58 (P50	480697.9	198425.2
A27	480700.2	198554.2	A60 (P57)	480812.4	198382.7
A28	480697.2	198559	A62 (P56)	480751.6	198343
A29	480694.2	198563.6			

Note – Where the Plant number (indicated on the MCP Generator list) differs from the flue number, the corresponding plant number is indicated in brackets e.g. (P57)

Emissions to air are discussed in more detail in Chapter 4 (Operating Techniques) and in the Air Quality Assessment prepared in support of this permit application and summarised in Chapter 3.3. Flue locations are shown on Appendix B on the installation boundary site plan.

3.3 Air Quality Assessment Summary

The air quality assessment completed by Temple (now Ramboll), report reference 24027-TEM-ZZZ-ZZ-RP-Y-0002, modelled the air quality based on Virtus' testing scenarios, summarised below.

Virtus will undertake routine testing and servicing at the following intervals:

Virtus Test 1: representative of a 15 minute "switch on" offload test; to be carried out monthly in eleven months of the year. In reality this will be limited to approximately 5 minutes.

Virtus Test 2: representative of a full service onload test consisting of an initial 20 minutes at 100% load immediately followed by 120 minutes at 100% load; to be carried out once per year in the 12th month of the year. Virtus have indicated that up to three generators may operate at any one time.

It is understood that the EA plan for a theoretical failure in mains electricity lasting 72 hours to be tested. Based on the above information the following scenarios have been modelled using the atmospheric dispersion model ADMS Roads (v5.1.0.2):

Scenario 1 (S1) – Emergency Scenario: All generators modelled for 72 hours at 100% output;

Scenario 2 (S2) – Routine annual testing: One generator modelled and factored to operate for three hours per annum at 100% load, which represents the greatest emissions rate; and

Scenario 3 (S3) – Routine monthly testing: To simulate Virtus Test 2, three generators have been modelled to operate simultaneously for 11 hours per annum at 100% load. This load reflects a conservative assumption in the absence of data from the manufacturers indicating emissions rates for off-load tests.

The flue parameters, discharge conditions, emission rates and assessment receptors used for the modelling can be found in chapter three of the air quality assessment report.

The air quality assessment found that none of the air quality objectives (AQOs) were breached at any of the modelled human or ecological receptor locations in any of the modelled scenarios, except for the daily NOx AQO for the emergency scenario.

In the emergency scenario, for human receptors, hypergeometric probability analysis indicates that for 72 hours of continuous operation, the probability of exceeding the objective was found to be greater than 5%. However, given the overall reliability of supply

for the National Electricity System during 2024-25 was 99.999818%[1] and Virtus' operational record, as well as limited on site fuel storage, sustained multi-day emergency operation is not considered a realistic scenario, and therefore the exceedances do not pose a significant environmental risk. Annual mean and short-term NO_2 and PM_{10} concentrations comply with all applicable AQOs. Process contributions exceed screening thresholds in places, but predicted environmental concentrations (PEC) remain compliant and impacts are not significant.

During routine testing, for human receptors, annual mean and short-term pollutant concentrations also comply with all applicable AQOs. Process contributions exceed screening thresholds in some cases; however, PECs remain comfortably below the relevant objectives and impacts are therefore not significant. Emissions from routine testing are minor compared with emergency operation, and no exceedances of any AQO are predicted.

During the emergency scenario, at ecological receptors, long term NOx process contributions exceed 1% of the critical level at several receptor locations. However, PECs remain comfortably below the relevant objectives and impacts are therefore not significant. Additionally, where the process contributions exceed 1% at locally designated sites, the EA's 100% screening threshold applies; below which effects are screened out as insignificant. Daily NOx PECs exceed relevant thresholds; however, these exceedances are driven largely by background concentrations and the highly conservative 72-hour all-generator emergency assumption. Given the overall reliability of supply for the National Electricity System during 2024-25 was 99.999818%, Virtus' operational record, as well as limited on-site fuel storage sustained multi-day emergency operation is not considered a realistic scenario, and therefore the exceedances do not pose a significant environmental risk.

During routine testing, at ecological receptors, process contributions for NOx, nutrient nitrogen deposition and acid deposition remain below the relevant 1%/100% significance thresholds at all designated ecological sites. No exceedances of critical levels or critical loads are predicted, and routine testing impacts are therefore not significant.

Across all plausible operational scenarios; including both emergency operation and routine testing no breaches of the applicable AQOs are predicted for human or ecological receptors. The proposed generators are therefore considered to have an acceptable environmental impact, and no additional mitigation is required to ensure compliance with EA permitting requirements.

[1] https://www.neso.energy/document/369271/download

3.4 Point Source Emissions to Water

The surface water runoff from the site, including the generator areas, is routed across the site through dedicated surface water drainage systems. The fuel filling areas are equipped with dedicated Class 1 full retention forecourt separators. The surface water drainage will pass through Class 1 interceptors prior to entering below ground attenuation tanks. The site will be equipped with two below ground attenuation tanks, one serving the northern portion of the site and the second serving the southern area. The below ground attenuation tanks then discharge to a single soakaway in the east of the site. The site's proposed drainage system is presented in section 5.8 and summarised in Appendix B.

The operation of the Installation will not result in any fugitive discharges of process water to a surface water body.

3.5 Point Source Emissions to Sewer

There are no proposed process emissions to the foul or surface water sewers associated with the regulated activity undertaken at the site.

3.6 Emissions to Land

There are no proposed point source emissions to land from the installation activities.

3.7 Noise Emissions

An acoustic report, document reference 24027-TEM-ZZZ-ZZ-RP-Y-0001 has been prepared for the installation in accordance with BS 4142, which will be submitted separately in support of this permit application. The acoustic and vibration assessment covers the external plant noise emission from the data centre key elements (generators and chillers) at the nearest noise sensitive receptors. Results of the acoustic assessment indicate that the predicted rating noise level of the mechanical plant will meet local authority plant noise requirements during standard daytime and night-time operation, as well as during monthly generator maintenance and testing based on the current design.

3.8 Waste Management

The permitted activity is expected to generate minor quantities of waste, primarily from maintenance and repair activities. All waste generated at the installation will be managed in line with the waste hierarchy and will be removed from the site by a licenced waste management company. Wastes will be stored in appropriate containers, in dedicated waste management areas, in appropriately labelled and suitably sized, segregated skips,

with direct access to loading/dock receiving areas to facilitate efficient removal by waste management companies.

Under testing and maintenance operations of the generator plant (i.e. testing, maintenance and emergency power generation) the potential wastes that could arise from the regulated activity at the installation is outlined in Table 3.2 below.

Table 3.2 – Summary of Wastes: Testing and Maintenance Operations

Description of Potential Wastes	Source	State (Solid / Liquid / Gas)	Estimated Annual Quantity	EWC Code	Waste Classification
Used filters	Filtration of fuel and oil on generators	Solid containers with fuel/oil saturated filter material	Expected to be below 1 tonne.	16 07 08*	Hazardous
Lubricant Oil (Mineral)	Lubrication on generators	Liquid	30,330 litres, based on changing the oil one time per year.	13 02 05*	Hazardous
Propylene Glycol (75/25 solution)	Generator Coolant	Liquid	18,347 litres, based on changing the coolant once every three years.	16 01 15*	Hazardous

Under abnormal conditions, such as breakdown, fuel polishing or periodic overhauls, additional wastes comprising the wastes summarised in Table 3.3 below could arise from the regulated activity at the installation, although this will occur infrequently.

Table 3.3 – Summary of Wastes: Abnormal Operations

Description of Potential Waste	Source	State (Solid / Liquid / Gas)	Estimated Annual Quantity	EWC Code	Classification
Waste fuel oil and diesel	Filtration of fuel (diesel polishing)	Liquid	De minimis	13 07 01*	Hazardous
Batteries	Generators	Solid (contains sulphuric acid)	De minimis	20 01 33*	Hazardous

3.9 Waste Storage and Containment

Waste will be stored in bunded, double walled and lockable containers and will be removed from site by a licenced contractor undertaking these works.

3.10 Waste Minimisation

Waste arising from the regulated activity at the installation will be limited to the maintenance of the generators. Maintenance will be undertaken in accordance with the manufacturers' specification and is intended to prolong the lifespan and the efficiency of the generator sets. As such waste minimisation measures may not always be appropriate for the installation, however, waste minimisation measures will be adhered to wherever possible.

4 Operating Techniques

4.1 General

The installation, as with all of the applicant's Data Centres, will be built to Uptime Tier III standard, which means that there will be no interruption to the operation of the computer hardware located within the centre. This includes during routine maintenance of power and cooling systems. Virtus currently has a 99.94% operational record, where unplanned emergency use over the last three years across their nine sites equates to 0.06% of the total operational time.

The installation's generators will operate as N+1 LV Datacentre Continuous (DCC) rated generators, with sufficient onsite fuel for 48 hours run time in an emergency (near full) load.

The generator output specifications are driven by the data centre design. The new mission critical, standby diesel engines, have an output of 2.4 MW (55 generators) and 2.8 MW (2 generators) and are mapped in factory to a low emission (Emissions Optimised – EO) compliant certification. The data sheets, for the generators planned for the site are included in Appendix C.

The generators will only be utilised for back-up emergency provision, and therefore the routine operation is for testing and maintenance only.

The applicant will undertake routine testing and servicing of the generator sets which will take place as outlined. Table 4.1 below summarises the proposed testing regime for the generator sets.

Table 4.1 – Routine Operational Scenario, Annual Testing Time

Scenario	Load	Total No. of Generator tests per year	Minutes per year per generator	Total per year (minutes)
Routine "Switch on" off-load testing per month (11 months)	15 minutes @ 0% (approximately 5 minutes in reality)	57 x 11 = 627	165	9,405 (156.75 hours)
On-load test once per year (in the 12th month)	20 minutes @ 100% load. 120 minutes @100% load	57 x 1	140	7,980 (133 hours)
Total minutes overall per annum			305 (5.5 hours)	17,385 (289.75 hours)

The designed total test period per generator per annum is 305 minutes or 5.5 hours per generator, 17,385 minutes or 289.75 hours for all generators.

It should be noted that due to the limited operating time on any given day for the testing scenarios, assessment of daily average concentrations is not considered to be applicable and has therefore been screened out of the assessment. The maximum number of consecutive testing hours is understood to be 2.3 hours.

The following standards and guidance have been considered and adhered to in the preparation of this permit application.

- Management Systems – ISO/IEC 27001:2013 ; ISO 9001:2015 ; ISO 14001:2015 ; ISO 50001:2011 ;
- Environment Agency FAQ Data centre BAT v21;
- Engines to comply with US EPA Tier 2; Luft 2G or environmental equivalent.; and

[2]ISO/IEC 27001:2013(en), Information technology — Security techniques — Information security management systems — Requirements

[3]ISO 9001:2015 - Quality management systems — Requirements

[4]ISO 14001:2015 - ISO 14001 - Environmental management systems

[5]ISO 50001:2011 - Energy management systems — Requirements with guidance for use

4.2 Management Systems

The Saunderton Data Centre Campus will be managed in accordance with Virtus' Operations Manual, which incorporates the requirements of the company's integrated management system (IMS). This section describes the management systems and

processes that will be put in place at the installation and includes an assessment of how the management system will meet BAT requirements. The management system scope of certification is the "design, build and ongoing operation of mission critical data centre facilities". The details of how Virtus maintains compliance with management system standards can be found within their operations manual.

4.3 Environmental Management

Environmental Policy

Virtus' ISO 14001 certified Environmental Management System (EMS) is underpinned by an environmental policy wording included as part of an overall Compliance Policy. The Compliance Policy defines the applicant's 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 of Virtus Holdco Ltd. Arrangements are in place to ensure that all employees are aware of the Policy and its contents. The Policy is made available to company stakeholders, including contractors who undertake much of the onsite work around the generators during maintenance, refuelling and deliveries.

4.3.1 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.

4.4 Environmental Aspects and Risk Management

The applicant has incorporated risk evaluation throughout the company to holistically capture internal and external issues (risks). Risks relevant to the provision of services, energy and 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 ISO 20000 – 1:2018 (Information technology).

Virtus' risk management procedures identify potential problems before they occur so that risk-handling activities may be planned and initiated to mitigate adverse impacts. Virtus has identified roles and responsibilities relating to risk management, and risk

management duties and responsibilities are shared between the Enterprise Risk Management (ERM) Committee, a Risk Manager and a Risk Owner.

A risk evaluation register will be maintained in accordance with the Risk Management Process outlined in Chapter 4 of the Operations Manual. This register outlines the environmental aspects and associated risks linked to the organisation's activities, including a significance rating (probability of the risk occurring and its impact) for each environmental aspect. Environmental risks are assessed to highlight opportunities for continual improvement.

This process will be carried out alongside a routine energy performance review, which plays a key role in identifying ways to enhance environmental performance. The energy review also informs the calculation of Power Usage Effectiveness, a metric representing the ratio of total energy consumed by a data centre facility to the energy used directly by computing equipment. "Significant" aspects are managed by establishing mitigating controls, which could comprise:

- operational controls;
- updated processes and / or procedures;
- training; and
- monitoring activities and their effectiveness via an audit programme.

All staff are responsible for working in accordance with procedures relating to environmental compliance.

Incorporating environmental aspects into the Risk Management Process ensures that environmental risks are identified alongside the evaluation of environmental aspects. This approach enables standard management system procedures to address risks during normal operations, whilst emergency plans are in place to reduce impacts under abnormal circumstances. These assessments consider factors such as material storage, surface water drainage, site security and oil transfers. All significant environmental risks are recorded in the business risk register.

Chapter 2 of Virtus' Operations Manual incorporates the management processes and responses to environmental incidents into an overall Incident Management Process. This is controlled via the Virtus Service Management Centre (VMC). All incidents are reported to the Compliance Manager, who is responsible for assessing the completed actions and the updating of procedures.

The applicant has identified and documented a list of likely environmental incidents and developed controls around these. Environmental incidents are assigned a priority level, based on the severity of the incident, ranging from Priority 1 (P1) to Priority 4 (P4).

A spill response procedure is in place and spill kits will be deployed strategically around the site. A major diesel spill would initiate a High P2 incident with implementation of the Virtus Incident Management Process and Pollution Incident Response Plans. The applicant implements a nine-point fuel or chemical spill procedure, outlined in Chapter six of Virtus' operations manual.

It should be noted that due to the limited operating time on any given day for the testing scenarios, assessment of daily average concentrations is not considered to be applicable and has therefore been screened out of the assessment. The maximum number of consecutive testing hours is understood to be 2.3 hours. Standards

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4.5 Training

The site will be managed by a suitable number of staff, who shall have the required knowledge and experience to competently operate the site. Virus have indicated that each of the four data centre buildings (London 15, London 16, London 17 and London 18) will have the following number of operational and maintenance staff once operational.

- London 15 – 9 staff
- London 16 – 10 staff
- London 17 – 12 staff
- London 18 – 13 staff

Environmental training will be provided for all staff for general awareness as well as job specific training. The site will be managed in accordance with the IMS and Virtus will adhere to the following requirements with respect to the training of employees and contractors.

- All staff will have clearly defined roles and responsibilities;
- Records will be maintained of the knowledge and skills required for each post;
- Records shall be maintained of the training and relevant qualifications undertaken by staff to meet the competence requirement of each post;
- Operations will be governed by standard operating instructions;
- Everyone'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; and
- All contractors and sub-contractors will be given appropriate training prior to the commencement of any works or services.

The primary training methods employed by the applicant to improve awareness of their HS&E awareness include:

- staff inductions;
- near miss reporting tools;
- safety moments;
- senior leadership walkarounds;
- engagement and participation regimes;
- annual awareness training for all staff;
- toolbox talks and refreshers;
- site sign in screens;
- Dynamic Risk assessments present in each plant room;
- adequate safety signage and instruction;
- mandatory safety delivered training;
- internal compliance audits; and
- the use of the Occupational Health and Safety and Environment Forum.

4.6 Review and Audit

Virtus will continuously review and update their EMS and Policy to ensure that it remains effective, in line with developing best practice and relevant to the business. To ensure that the EMS remains appropriate and effective in controlling environmental performance and to identify areas where improvement opportunities exist, an annual management review of the EMS will be undertaken. Legal compliance auditing is a planned activity and Virtus maintain an internal audit schedule, owned and maintained by the Compliance Manager.

Internal audits will be carried out by suitably qualified site staff of the EMS and site activities at least annually.

Where improvement opportunities are identified throughout the audit process (or otherwise) the implementation of the rectifying actions will be managed by the EMS change management process.

The management system will include a review of the risks of climate change on the operations in line with EA guidance2 and will have integrated climate change adaptation measures. A review of climate change related risks to the operation has been undertaken and included in the Environmental Risk Assessment document; this will be reviewed regularly and updated as necessary. A climate change adaptation plan of action will be developed in line with ISO 14090:2019. as part of the management system. The installation shall record environmental near misses and extreme weather events, and these will be reviewed to inform the future planning process related to climate change risks; these will be logged appropriately and the record retained on site. Critical Asset Management

Virtus use a critical asset management process to manage critical assets comprising of physical, non-computing systems such as power cooling and line safety systems.

It identifies areas of criticality and ensures appropriate levels of planned preventative maintenance, Standard Operating Procedures, Emergency Operating Procedures as well as an Operation and Maintenance Manual.

4.7 Contractor Management

Chapter 13 of Virtus' Operations Manual outlines their approach to contractor management. A Facilities Management (FM) Team, specialists in data centre maintenance, will be contracted to large areas of operation and maintenance. Other assets will be maintained and tested by the vendors – including the engines and generator sets.

All planned preventative maintenance (PPM) scheduling will be undertaken within the enterprise asset management system IBM Maximo. SFG20 will be used as the standard to govern best practice in maintenance and parts replacement schedules. 4.9.3The FM team will deploy a scheduling system that provides regulation of Vendors for maintenance and repair works using information controlled and retained in Maximo. The system to be utilised is the proprietary Corrigo solution. This solution details the planned maintenance and the Vendor details. Records of the completed works will be uploaded to Optimum for full reconciliation of the activity.

[2] Climate change: risk assessment and adaptation planning in your management system, Environment Agency, Published: 03 April 2023

The FM team will deploy a scheduling system that provides regulation of Vendors for maintenance and repair works using information controlled and retained in Maximo. The system to be utilised is the proprietary Corrigo solution. This solution details the planned maintenance and the Vendor details. Records of the completed works will be uploaded to Optimum for full reconciliation of the activity.

The FM Team will schedule maintenance activities as governed by SFG20 and the PPM schedule (Maximo) once vendors are appointed. Vendors must upload RAMS, competencies and qualifications of operatives and other relevant documentation to the Corrigo system prior to arrival on site. The FM Team will be responsible for approving RAMS alongside Virtus site staff.

4.7.1 All maintenance works are to be completed through Maintenance Operating Procedures (MOPs) that intend to:

- Create a safe system of work for the Vendor operatives
- Ensure maintenance works are carried out in accordance with OEM specifications
- Associated or linked systems are not impacts during maintenance activities

Operating Procedures must be followed to maintain the quality control and quality assurance processes and ensure continued service provision. The Operating Procedures will be reviewed regularly by the FM Team senior contract staff. Current copies of the MOPs will be made available at each site situated in proximity of equipment. The FM team will also maintain Emergency Operating Manuals and the Emergency Operating Procedure (EOP) which explains emergency functionality, safety routines and procedures needed to establish a status of safe working in equipment and infrastructure for emergency operation.

4.8 Management System BAT Assessment

The relevant Best Available Techniques (BAT) requirements for the installation are set out in Table 4.2 below. The BAT requirements have been identified from relevant GOV.UK guidance.

Table 4.2– Management System BAT Requirements

GOV.UK Requirements	Proposed Arrangements	BAT?
You must include a **Site Infrastructure Plan** which highlights where the activities covered by an Environmental Permit are undertaken. Your plan must also include: • Buildings and other main constructions such as treatment plants, incinerators, storage silos and security fencing. • Storage facilities for hazardous materials like oil and fuel tanks, chemical stores, waste materials. • Locations of items for use in accidents and emergencies. • Entrances and exits to be used by emergency services. • Pollution control points, such as inspection and monitoring points. • Trade effluent or sewage effluent treatment plants. • Effluent discharge points; and • Contaminated land, or land you believe is contaminated. The plan must also demonstrate areas which are vulnerable to pollution from the site. Such as rivers and streams; groundwater sources; residential, commercial or industrial premises; protected wildlife. Your plan must show foul and combined drainage facilities marked in red and surface water drainage facilities in blue. It must also show: • The direction of flow of water in the drain. • The location of discharge points to sewer, watercourse or soakaway. • The location of manhole covers and drains; and, • The location of stop and diverter valves and interceptors.	As part of the EMS, the applicant maintains all necessary documents for operational planning and control on a site-specific basis. This includes relevant site infrastructure plans containing the information detailed in the relevant guidance. Site plans including point source emission points, drainage system and discharge points will be incorporated into the EMS	Yes

Your plan must show the location of mains water, gas and electricity supplies on your site including: • The mains water stop tap; • Gas and electric isolating valves and switches; and • The routes for gas, electricity and water supplies around the site. If your permit covers a standalone water discharge activity or point source standalone groundwater activity, your site plan must show: ETC – N/A	The Environmental Risk Assessment (ERA) for the Saunderton Campus covers this aspect of the requirements and will be incorporated into the Virtus EMS documentation. The permitted activity at the installation is for the combustion of diesel to generate backup electricity. For this reason, this section is not deemed to be relevant N/A as the permit is not for a standalone water discharge activity or point source standalone groundwater activity.	
Site Operations List the operations that will be carried out on your site during start up, normal operation and shut down. For waste, mining waste, and installations, list the wastes that will be produced by each activity or process. List the steps you will take to prevent or minimise risks to the environment from each activity or process and type of waste. [If you are a waste operator you must include a waste storage plan that states: (N/A)] Fire Prevention Plans (FPP) (N/A)	All significant environmental effects stemming from site operations are incorporated into the existing EMS. These will be reviewed and updated as necessary during the site development and permit application process. All details relating to waste generation and waste minimisation and management are held on Virtus internal environmental systems. This will be reviewed and updated as necessary as part of the permit application process.	Yes
You will need to produce a **Site and Equipment Maintenance Plan** detailing how you will maintain the site infrastructure and any machinery.	Virtus and its Facilities Management (FM) provider utilise IBM Maximo. All plant and equipment installed	Yes

	will be included in the maintenance regimes which are implemented following the manufacturer's recommendations. These documents are described and form part of the Critical Asset Management chapter of the Virtus Operations Manual.	
You will need Contingency Plans to demonstrate how you minimise the impact on the environment of any: ▪ Breakdowns. ▪ Enforced shutdowns; and, ▪ Any other changes in normal operations. Changing climate and how this could affect your operations should also be considered as part of contingency planning.	The Virtus Emergency Preparedness Response Process covers this. The process identifies risks under the headings of operational (environmental), third party (environmental), standards/statutory risk, and risks arising from natural disasters. Note the application is to test generator equipment to ensure it can be safely started in the event of a grid failure. A breakdown of an engine / generator set will result in the shutdown of the generator with minimum environmental impact. Loss or leakage of fuel will be managed through the site emergency procedures.	Yes
You will need an Accident Prevention and Management Plan which details how you would deal with any incidents or events that could result in pollution. This plan must: ▪ Identify any potential accidents or other unexpected incidents which could cause an unexpected change to normal operations. ▪ For each potential incident the following must be stated: ▪ Likelihood of the accident happening. ▪ Consequences of the accident happening. ▪ Measures taken to avoid the accident from happening; and ▪ Measures to minimise any impact if the accident happens. The plan must say how you will record, investigate and respond to accidents or breaches of your permit. It must also include:	The OHSE MS and Emergency Preparedness Response Process details incidents which could occur including spillage, leaks, F-gas release, hazardous waste contamination, etc. All incidents are managed through the Incident Management Process (Chapter 2 of the Ops Manual). Additional Pollution Incident Response Plans are initiated depending on the Incident Category. Response procedures are tested annually.	Yes

▪ Date last reviewed. ▪ Date of next review. ▪ A list of emergency contacts and how to reach them. ▪ A list of substances stored on site and storage facilities; and, ▪ Forms to record accidents on.		
Contact Information for the Public A noticeboard is to be displayed at the site entrance including the following information: ▪ Permit holder's name. ▪ Emergency contact name and telephone number. ▪ Statement to show the site is permitted by the Environment Agency. ▪ The permit number; and, ▪ EA contact number and incident hotline number.	This is not considered relevant for a data Centre operation.	N/A
You need a Complaints Procedure to record: ▪ Any complaints received in relation to the activities covered in your permit. ▪ How complaints are investigated; and, ▪ Any actions taken as a result of complaints.	A complaints procedure will be developed to ensure compliance with the environmental permit condition.	Yes
Include details in the management system on Staff and Resources including: ▪ An explanation of who is responsible for what procedures. ▪ Technical competency records. ▪ A list of roles carried out in relation to activities covered in the permit and by whom; and, ▪ Competency check procedure and training records.	Details on posts, roles & responsibilities are displayed in the Virtus OHSE MS. Competency is addressed in the Awareness chapter in the OHSE MS. Sub-contractors on site are subject to site induction which provides the above awareness.	

Record Keeping Any records required by your permit must be kept. You must keep records to show how your management system is being implemented. Records to be kept include: ▪ Permits issued to the site. ▪ Legal requirements. ▪ Risk assessment. ▪ Management system plans. ▪ Any other plans required by your permit (such as noise). ▪ All operating procedures. ▪ Staff competence and training. ▪ Emissions and any other monitoring undertaken. ▪ Compliance checks, investigation findings and actions taken. ▪ Management reviews and changes made to the management system; and, ▪ Certification audit reports and any actions taken. [Waste Operators must also record the following for each waste delivery to the site: N/a] If you hold a permit for waste, mining waste or installations, a Site Condition Report is required. This must detail the condition of land or groundwater on the site and be kept updated regularly. The following information is to be included: Details of historic spills or contamination and responses to these incidents; and, Evidence of the effectiveness of any measures taken to protect land and groundwater.	All relevant records will be retained in accordance with the requirements.	Yes

	A Site Condition Report has been prepared and is submitted with this application.	
A procedure needs to be in place for checking you are complying with permit conditions and management system requirements. The management system is to be reviewed and updated when: ▪ Changes are made to the site, operations, or equipment that affect activities covered by your permit. ▪ If you apply to change / vary your permit. ▪ After an accident, complaint or breach of your permit; and ▪ If a new environmental issue is encountered, new control measures are implemented. Changes made to the management system will be recorded.	The EMS will be reviewed and updated as necessary (currently undertaken on at least an annual basis). The review will consider the permit conditions being applied for and environmental risks from the associated plant and equipment. Any changes will be recorded in the relevant Operations manual documentation.	Yes

4.9 Raw Materials

Fuel Consumption

The likelihood of the emergency generators being required for extended periods of time is low. This is both noting the applicant's last three years of recorded data across all nine sites where emergency generator use equated to 0.06% of the total operational period, and the frequency and duration of power outages recorded by the National Grid. The fuel consumption of the generators has therefore been calculated for the engine testing only.

It is understood that Virtus will undertake a 15 minute "switch on" offload test to be carried out in eleven months of the year. In the 12th month of the year, Virtus will conduct a full service onload test consisting of an initial 20 minutes at 100% load immediately followed by 120 minutes at 100% load.

The proposed engines are diesel generator sets. The density of the fuel is taken as 840g/l and fuel consumption rates are taken from the example generator manufacturer's data sheets, presented in Appendix C. Fuel consumption has been conservatively estimated at 100% load, in the absence of data from the manufacturers indicating emission rates for off load tests. Table 4.3 below estimates the annual fuel consumption in litres and tonnes for each of the proposed data centre buildings.

Table 4.3 – Estimated Annual fuel consumption per data centre building

Data Centre Building	Number of generators	Engine	Consumption as stated on Performance Data Sheet		Total fuel consumption per year (l/y)	Tonnes of fuel per year (t/y)
			% load with fan	Fuel consumption (l/hr)		
London 15	5	2,400kWe	100%	642.5	16,329	13.7
London 15	2	2,800kWe	100%	787.0	8,002	6.7
London 16	16	2,400kWe	100%	623.0	50,671	42.6
London 17	12	2,400kWe	100%	623.0	38,001	31.9
London 18	22	2,400kWe	100%	623.0	69,672	58.5
Total	57				182,675	153.4

4.9.1 The raw material use associated with the operation of the generator plant is detailed in Table 4.4 below.

Table 4.4 – Summary of Raw Material Use

Substance	Reason for Use	State (Solid/Liquid/ Gas)	Estimated Annual Use (Litres)	Maximum Storage Capacity	Environmental Hazard Statements
Diesel/HVO	Generator Fuel	Liquid	182,675 litres (1)	Usable – 1,980,500 litres (2) Brimful - 2,296,000 litres (3)	H411-Toxic to aquatic life
Lubricant Oil (Mineral)	Lubrication of generators	Liquid	30,330 litres (4)	30,330 litres (5)	Not classified
Propylene Glycol (75/25 solution)	Generator coolant	Liquid	18,347 litres (6)	55,041 litres (7)	No Environmental classifications

Notes

1) Based on the Virtus testing regime and fuel consumption rate shown in Table 4.3.
2) Based on the 2.4 MW generator belly tanks having a usable capacity of 34,500 litres and the 2.8 MW generator belly tanks having a usable capacity of 40,000 litres. Assuming the density of diesel is 840g/litre, the total usable fuel stored on site could be 1663 tonnes.
3) Based on the 2.4 MW generator belly tanks having a brimful capacity of 40,000 litres and the 2.8 MW generator belly tanks having a brimful capacity of 48,000 litres. Assuming the density of diesel is 840g/litre, the total brimful fuel stored on site could be 1,929 tonnes.
4) Based on lubrication oil being changed annually.
5) Based on the 2.4 MW generators at London 15 having a capacity of 582 litres, the 2.8 MW generators having a capacity of 460 litres and the remining 50 2.4 MW generators having a capacity of 530 litres.
6) Based on coolant capacity being changed every three years
7) Based on 57 generators each with a capacity of 637 litres within the coolant systems and associated pipework.

Estimated fuel consumption for the Saunderton Campus is therefore 153.4 tonnes per annum for routine operations (engine testing). The fuel consumption is likely to be significantly less than the estimations above as a result of the absence of off load testing fuel consumption data. Fuel consumed for routine operations is reported under the UK Emissions Trading Scheme (ETS). In total, the generators belly tanks will be able to contain 2,296,000 litres of fuel when full to the brim, when filled to a usable level the tanks can store up to 1,980,500 litres as set out in Table 4.4.

Other Raw Materials

The generators will require lubricating oil which will be stored in the engine sump, and to be replenished directly into the engine sump.

The data centre will utilise a mixture of air and liquid cooling systems for the generators. Liquid cooling has several benefits over air including enhanced cooling efficiency, space saving and energy savings. The liquid coolant will be a chilled water system composing of 75% water with 25% propylene glycol. Propylene glycol will be brought to site in containers by specialist water treatment contractors as required to test and top up the system volume. Propylene glycol will not be stored on site without being mixed with water in the chilled water system.

Water will not be routinely used at the Installation, however it may be used during scheduled maintenance activities to ensure that the engine coolant level within the engines is maintained by the operators nominated maintenance contractor. As water use is not considered to be routine, efficiency measures are not considered appropriate at the Installation.

4.10 Grid Reliability

The overall reliability of supply for the National Electricity Transmission System during 2024-2025 was 99.999818%. This coupled with Virtus' record of 0.06% of total operation time in emergency operation across their nine UK data centre sites demonstrates that it is highly unlikely that the generators will be required to operate for prolonged periods of time.

5 Generator Engines BAT Assessment

5.1 Engine and set up choice

The diesel-powered, stand by electrical generator sets that will be used on the Saunderton Campus are typical fit for purpose vendor supplied units, having the following characteristics.

- Prime mover: V12 or V16, four-stroke liquid-cooled diesel, low emissions set up;
- Set arrangement: Containerised with close coupled radiator; and,
- Standby rating: 2.4 or 2.8 MW at 1,500 revolutions per minute, 400 volts, 50 Hertz.

Redundancy will operate on a swing engine basis; this will usually be within a power stream group of up to seven primary generators. In an emergency related to the power stream, the swing engine will act as a backup should one of the engines fail to start. In this instance one engine is assumed to be on swing duty.

Historically emergency generator engines have been specified to be low brake specific fuel consumption combustion strategy. The choice of engines has also been driven by the data centre design. The resulting options are limited by the availability of options on the marketplace, with low emissions of more engine types being released.

Low levels of Oxides of Nitrogen (NOx) are achieved in the combustion process by lowering the air temperature in the cylinder which requires greater cooling airflow, in turn requiring a larger radiator and increased airflow, increasing the overall physical design dimensions of the acoustic enclosures, increasing fuel consumption and hence overall capital and operating costs. This will impact on competitive viability for the client (primary business being the operation of a Data Centre, not the running of back-up generators). In addition, this will also lead to a reduced load step acceptance figure and response time which is critical to Data Centre designs (Mission Critical standby function of the engines) and the fuel consumption rate will increase, so whilst meeting a level of NOx, other pollutant emissions such as PM, CO and unburned hydrocarbons may increase.

However, the Agency Data Centre FAQ requires engines that are low emission combustion strategy, and hence the Saunderton Data centre engines will meet this. Emission standards and real-world emissions are discussed further in US EPA Tier 2.

Generator Cost Benefit Analysis

Published EA guidance for datacentres states that in order to minimise the impact of Nox emissions from electricity generators the default engine specification is 2g TA-Luft (or equivalent standard), consisting of NOx emissions of up to 2,000 mg/Nm3 (at 5% O2 content). The generators proposed for the installation meet this specification and therefore, a detailed cost benefit analysis (CBA) to justify using these engines is not required.

Generator Housing

The generator sets will be delivered to site in purpose-built containers, acoustically treated, with combustion exhaust gas flued back into the vertically discharging engine cooling air. Each flue will discharge vertically without a cowl serving to impede dispersion. The container layouts within the east and west gantries are shown in Appendix B of this report.

The proposal is to house plant on external gantries on the west and east sides of each data centre buildings. The number and type of plant proposed is presented in Table 5.1 below:

Table 5.1 – Raw Materials Stored at Each Data Centre Building

Building	Generators	Fuel Storage (Usable) (Litres)	Fuel Storage (Brimful) (Litres)	Lubricating Oil (Litres)	Coolant (Litres)
London 15	5 x 2.4 MW	172,500	200,000	2,910	4,715
London 15	2 x 2.8 MW	83,000	96,000	920	1,976
London 16	16 x 2.4 MW	552,000	640,000	8,480	15,792
London 17	12 x 2.4 MW	414,000	480,000	6,360	11,844
London 18	22 x 4.4 MW	759,000	880,000	11,660	21,714
Total		1,980,500	2,296,000	30,330	56,041

The generators are located on the ground floor gantries at each data centre building except for London 18, where they are also located on the first-floor gantries. The raw materials will be provided with suitable containment measures, as outlined in Section 5.8.

Plant specification data sheets can be found in Appendix C – Engine Data Sheets. Layouts of the proposed plant can be seen in Appendix B.

Size Number and Configuration

The design of the data centre informed the decision of the choice and configuration of the backup energy plant. Each unit is based on its ability to provide the backup power required to supply the strict requirements of the servers, cooling plant and Uninterrupted Power Supply (UPS) battery system. Each array is required to be independently

manageable and therefore the number and choice of suitable engines in the marketplace is defined by the power required for each power stream. Virtus subscribes to the internationally recognised data centre standards of the Uptime Institute's Tier III design certification, this is a non-negotiable target for the business and as such this has influenced the generator choices

Stepping up to a 3 MWe unit would mean a huge cost increase on capital equipment and generator and enclosures, fuel tanks, switchgear and associated equipment on site, to the point where this would become unviable.

Standby generator selection for the construction of a data centre is based on:

1. Size to support the critical IT loads and their associated supporting infrastructure, such as cooling equipment.
    - The optimally/appropriately sized-to-power-stream generator (modular) approach allows for single generators to activate in the event of a single power stream failure instead of a larger generator activating to accommodate a similar failure. If the correctly sized generator is rated to support the power stream's demand load by design, then this configuration will minimise emissions. Larger generators supporting more than one power stream will have increased chance of activating.
2. Flexibility to support isolated power streams in support of N+1 redundancy designs
    - Parallel configurations of smaller engines have the advantage of supporting load sharing and management especially for variable load applications such as a data centre IT load.
3. Flexibility to support continuous N+1 operation
    - Inclusion of a swing generator set to support N+1 resilience during maintenance. Maintaining a smaller generator supporting a single power stream is more cost effective and more resilient than maintaining a larger generator supporting multiple streams.
4. Market availability and lead up times
    - Small to medium sized generators are more readily available and quicker to procure than larger generators.
5. Initial delivery and installation costs
    - Lower initial install costs for diesel generators
    - Lower weight / kW for diesel generators
6. In-operation costs
    - Online in less than 10 seconds (NFPA requirement under Tier III Uptime) and excellent transient capability. Gas engines have less load pickup (transient) capability and a larger frequency deviation (stability) than diesel generators.

7. Fuel type availability, upkeep costs (such as fuel polishing), storage and supply costs
    - To store quantities of diesel onsite is both more cost effective and safer (COMAH) than storing compressed fuel types. The availability of diesel is such that Virtus have retained emergency diesel suppliers with a four-hour delivery SLA.
    - Diesel oil can be safely stored on site in quantities allowing for prolonged, emergency use (48 hours). Natural gas may be stored on site, but not in the quantities to achieve 48 hours without consequence. Customer SLAs typically demand a minimum of 48 hours of site-based emergency power generation. A gas pipeline would be a primary source of supply with a smaller stored amount of compressed gas available for emergency generation. The gas would then be considered a single point of failure if supply was affected. Natural gas is extremely explosive. A leak would possibly result in the entire site and its supporting emergency infrastructure being shut down for safety purposes until repairs are made, especially concerning the proximity to HV/LV transformers and switch rooms.
8. Replacement costs and/or availability of spare parts
    - Defective, larger engines have longer lead times and are more costly to replace.
9. Effective Emissions
    - Marginal NOx reductions against increased cost per MW output and increased physical footprint in for larger generators.
    - If the individual engines are greater than 3 MWth input and cumulative MWth input is greater than 20 MW, then the data centre must enter the UK ETS emissions trading scheme. All diesel-consumption is recorded, and carbon emissions reported to the Environment Agency legalised under a GHG emissions permit.

Table 5.2 below outlines how different generator types meet relevant BAT requirements.

Table 5.2 – How different types of generators meet relevant BAT requirements.

Backup power source	Advantages	Disadvantages	Decision
Diesel/HVO Generators	Rapid response time; readily available with ability to store fuel directly on site; handles variable loads readily, fuel can be sourced from more than one supplier.	High NOx & CO_2 emissions; storage and transport of diesel creates an additional environmental risk; noise impacts.	**Selected** - Due to their reliability which is critical for back-up power
Natural gas generators	Readily available; food response time	Medium NOx emissions; high cost; noise impacts; supply could be cut off at the same time as electrical supply; storage on site would use excessive space.	**Not Selected** – cost and lack of control over fuel supply reduces reliability.
Phosphoric Acid Fuel Cells (PAFCs) and Molten Carbonate Fuel Cells (MCFCs)	Readily available; highly efficient; very low to moderate emissions levels	Long start up times due to high operating temperatures, regular maintenance due to corrosion of components.	**Not selected** – long start up times and high operating temperatures. This is a particular problem for MCFCs which operate at 650˚C and have a load ramping of 0.5kW per minute.
Battery storage	No emissions; low noise impact.	Limited capacity, longer term capability is not yet a viable option.	**Selected** for immediate Uninterruptable Power Supply (UPS) provision only – current capacities are not capable of meeting 24–48-hour backup requirement.
Hydrogen fuel cell	No emissions; low noise impact.	Limited experience in relation to data centre operation; limited capacity – longer term capacity is not yet a viable option.	**Not selected** – current capacities are not capable of meeting 24–48-hour backup requirement.
Solar/wind	No emissions; low to medium noise impact.	Cannot be relied on for power input required in event of grid failure.	**Not selected** – cannot be relied upon during loss of power event.

5.2 The Exhaust System

BAT Assessment – Stack set up

The stack set up and height was driven and confirmed by the following:

- The need to operate generators as individual units, i.e. not rely on joint exhaust air flows from other units to assist velocity or buoyancy;
- Planning consent requirements to reduce visibility and retain the stack exits hidden which rise up to provide a designed finish;

- Heights increased above those normally associated with emergency generators for short duration operation (typically venting through top of container to a max of 5m above ground);
- Industry standard data centre solutions packages availability from suppliers; and
- Demonstration by Atmospheric Dispersion Modelling System (ADMS) modelling of dispersion of test regime and emergency emissions to be submitted with this application.

Other options for stack arrangements are limited and would include:

- Ducting flues together – larger structures, longer flues, into common windshields or gantries. This would need additional fan power and support foundation and would lead to increased visibility, complex ductwork and maintenance and,
- Ducting flues into a common chimney – complexity of structure and increased fan power to overcome stack air backpressure. At testing this would lead to loss of flow and velocity if single unit being tested (planning constraint) with subsequent loss of dispersion.
- Similar studies have shown (e.g. Centrica Roosecote) that combining stacks does not necessarily lead to improved dispersion ("the potential aggregation of stacks would have minimal effect on both the predicted short term and long-term air quality impacts associated with the development").

A similar conclusion was drawn at Colt Welwyn and accepted by the Environment Agency:

"The operator has justified its use of a large number of smaller generators rather than installation of fewer larger generators because of the modular nature of the site and potential restriction of its expansion plans as new clients would be less able to modify data hall designs to suit their individual needs."

Smaller generators can be more readily added to the site giving greater flexibility as the site expands. The operator has justified not limiting the number of stacks or not grouping stacks into common windshields because that would compromise the "2n" redundancy arrangement as, if one stack was unable to be used, then multiple generators may not be able to operate. In addition, routing stacks to common windshields is problematic due to the geographical location of the generators on site, the amount of pipework and support structures necessary and the overall space constraints on the site due to the fact it was not originally designed as a data centre."

Stack heights at the Saunderton data centre campus will be 11m above ground level in London 15, London 16 and London 17 buildings and 15.98m above ground level in the London 18 building. London 15, 16 and 17 buildings will be 9.90 m tall, and London 18 will be 14.90 m tall.

Temple (now Ramboll) completed an Air Quality Assessment Report, document reference 24027-TEM-ZZZ-ZZ-RP-Y-0002, submitted separately as a part of this application, which used the atmospheric dispersion model ADMS-Roads (v5.0.0.1) to quantify the impact of emissions from the generators on NOx, NO_2 and particulate matter concentrations.

Following the above arguments, it is considered that for emergency standby generator arrangements with a low likelihood of operating in emergency scenarios, the proposed stack heights of between 11m and 15.98m are entirely appropriate and meet BAT.

5.3 Engine Emission Standards

Back up, Diesel Generators (2.8 MW x 2; 2.4 MW x 55)

The engine BAT standards hierarchy quoted by the Environment Agency are presented in Table 5.3 below. These standards have been taken from the EA's document Data Centre FAQ v21. It should be noted that this document is currently a draft document for discussion, however details are referenced in the table below as potential "future BAT".

Table 5.3 – Engine BAT Standards Hierarchy

• **1.11 Engine Emission Standards and BAT** •
1. Generic new diesel plant BAT (as previously) (1.11.1): • Emissions optimised 2g-TA Luft or US EPA tier 2 or equivalent – the current status quo BAT
2. Outage Ambient NOx peak limited due to scale or location of standby; or technically where the peak NOx over short timescales (first few hours) to sensitive receptors could not reasonably be managed via the Air Quality Management Plan (AQMP):
3. Local Authority or regionally designated AQF, AQP, planning requirement (1.11.2) and possibly EA designated clusters • Emissions optimised 2g/US EPA tier 2) engines fitted with fast-response (<=10minutes) full Selective Catalytic Reduction (SCR) abatement achieving better than 90% reduction (to at least an indicative 95mg/m3 at 15% O2 to all engines.
4. Advisory BAT – "SCR-ready" configurations are included to allow retrospective fitting of SCR abatement if necessary.
• **1.11.1 New "2g/Tier 2" – Emission Optimised** • **Notes from EA Guidance** • New data centre diesel engines (prime movers) shall be emissions optimised (i.e. not efficiency optimised) to at least one of the two recognised main international standards 2g-TA Luft or US EPA tier 2 or an equivalent • ".....the main reason for BAT is to minimise emission impacts for peak NO and NO_2 during a prolonged outage using primary technology • Generally, it is felt that provision for BAT emission optimised 2g/EPA engine plant in the building design to allow an easy retrofit of SCR – in essence ensure space/design for "SCR-ready"
3. When the EA is assessing plant emissions specification sheets and comparing between standards and engines the qualitative requirement is that NOx emissions profile over a range of representative output loads, typical for a data centre or as proposed by the operator, is less or around 2000mg/m3 at 5% O2. Data centre plant is not expected to operate in a prolonged outage at the maximum/continuous rating (i.e.

• **1.11 Engine Emission Standards and BAT** •
because of the sharing load across multiple engines); emission concentrations can be a lot higher at lower loads but, since the net mass emission rate does not broadly change significantly from typical loads, are not so important to focus on for impacts. •
4. So practically for data centres we would ordinarily expect **specification sheets provided to EA at permitting** to be EPA Tier 2 D1 test cycle (ISO8178-4) figures and/or 2g TA-Luft. This broadly equates to **2000mg/m3** (+/-10% tolerance) at 5% O2 = 750mg/m3 (+/-10% tolerance) at 15% O2 being realised between about 67% and 87% of peak load rating

The Saunderton Campus will consist of 55 No. Diesel Generator Sets (2.4 MW) and 2 No. Diesel Generator Sets (2.8 MW). These are all certified to the US EPA Tier 2 standard and therefore meet the minimum requirement for Best Available Techniques (BAT). The regulatory information from the example data sheets for the generators is included in Appendix C.

The generators are certified to the US EPA Tier II standard; no selective catalytic reduction (SCR) has been recommended by the Air Quality Assessment. Each generator exhaust shall be directed vertically to above the height of the chillers on the upper level of each respective gantry. Each exhaust skid shall be supplied as a separate standalone element. The exhaust skid is to make space provision and pipework arrangements adaptable for an SCR to be provided essentially meaning that the generator sets and flues are "SCR ready", in accordance with the EA's recommended BAT.

Selective Catalytic Reduction (SCR)

The EA's draft data centre FAQ Headline Approach (v21.0) Guidance states that "emissions optimised (2g/EPA tier 2) engines fitted with fast response (<=10mins) full SCR abatement achieving better than 90% reduction (to at least an indicative 95mg/m3 at 15% O2) to all engines shall be used in:

- AQMAs;
- AQ focus areas (AQF);
- Local Authority designated Air Quality Neutral or Air Quality Positive areas
- Regionally designated Air Quality Neutral or Air Quality Positive areas e.g. London plans; and
- Possibly EA designated clusters.

The site is not located within an AQMA, or any other specially designated air quality zones as outlined above. The air quality modelling completed by Temple (now Ramboll) and presented in a separate report, found that none of the AQOs were breached at any of the

modelled receptor locations in any scenario, with the exception of the daily NOx in the emergency scenario. However, given the overall reliability of supply for the National Electricity System during 2024-25 was 99.999818%, Virtus' operational record, as well as limited on-site fuel storage sustained multi-day emergency operation is not considered a realistic scenario, and therefore the exceedances do not pose a significant environmental risk.

As a result of this, SCR has not been recommended for the generators at this stage. The generator sets and flues, will however be SCR ready in accordance with EA guidance, should SCR be required for any reason in the future.

Emissions Monitoring

Test ports have been included in the design of the exhaust flue ductwork prior to discharge to the cooling air stack to allow for MCERTs compliant particulate testing. Emissions testing under the permit will be undertaken on commissioning and at 5 yearly intervals thereafter.

Emissions will be tested for information purposes only, no Emission Limit Values (ELV) will apply, given the emergency duty of the generators. Compliance is in the form of type-certification to the relevant standard, and not by individual engine exhaust point source emissions monitoring.

Emissions monitoring will be undertaken as per the EA guidance for low-risk generators.[3]

New Engine Emissions Compliance

The engines will meet the US EPA Tier 2 Standard. Compliance is shown in Table 5.4 below.

[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

Table 5.4 – Saunderton Data Centre Engine Emissions Compliance

Engine Type	2G or Type 2 compliant	Compliance	Completion Date
55 No. 2.4 MW and 2 No. 2.8 Mwe diesel generators	Tier 2 (US EPA Stationary Emergency standard)	The engines will be built in factory to meet US EPA Tier 2 emissions certification	N/A Compliant on delivery

5.4 Emissions to Air

Emissions to air from the installation will vary depending upon the operational scenario of the engines (specifically the testing regime required by the manufacturers and in some cases also by the data centre clients). Outside of the testing and maintenance regime, the engines will only be operational during periods of emergency back-up situations (i.e. in the event of a power outage from the national grid, or an internal system failure requiring a power stream to come off grid), or during testing. There will be no point source emissions to air outside of these periods.

Emissions from diesel generators could have an impact on local air quality. The main air pollutants of concern are oxides of nitrogen (NOx), nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). Detailed dispersion modelling has been undertaken in the Air Quality Assessment to assess the potential impact of the emissions to air from the generators on air quality in the area surrounding the site. Example engine data sheet emission values are presented in Appendix C, for various loads.

It is understood that Virtus will undertake routine testing and servicing of the generators at the intervals outlined in Chapter 3.3.

The following scenarios have been modelled for air quality at receptors in the vicinity of the site.

- **Scenario 1 (S1)** – Emergency Scenario: All generators modelled and factored to operate for 72 hours at 100% output.
- **Scenario 2 (S2)** – Routine annual testing: One generator has been modelled and factored to operate for three hours per annum at 100% load, which represents the greatest emissions rate; and
- **Scenario 3 (S3)** – Routine monthly testing: To simulate Virtus Test 2, three generators have been modelled to operate simultaneously for 11 hours per annum at 100% load. This load reflects a conservative assumption in the absence of data from the manufacturers indicating emissions rates for off-load tests.

The operator (Virtus) calculated the average annual emergency operation scenario assuming an emergency occurs once every 5 years for 24 hours based on Ofgem grid operator outage data and on-site outage worst case estimates).

5.5 Operational Scenario (Testing)

The emissions of NOx associated with the generator tests are presented in Table 5.5 below. The table provides the cumulative totals for the test regime (annual basis) for the 57 engines.

Table 5.5 – Operational Scenario Emissions London 15, 16, 17 and 18

Scenario	Min / Load	No of Generators	NOx g/s	NOx g/yr
Scenario 2 (Building LON 15)	1 generator for 3 hours per annum at 100% load	5 No. 2.4 MW	6.98	75,384
Scenario 3 (Building LON15)	3 generators have been modelled to operate simultaneously for 11 hours per annum at 100% load	5 No. 2.4 MW	6.98	82,9224
Scenario 2 (Building LON15)	1 generator for 3 hours per annum at 100% load	2 No. 2.8 MW	7.25	78,300
Scenario 3 (Building LON15)	3 generators have been modelled to operate simultaneously for 11 hours per annum at 100% load	2 No. 2.8 MW	7.25	57,4200
Scenario 2 (Buildings LON16, LON17, LON18)	1 generator for 3 hours per annum at 100% load	50 No. 2.4 MW	4.65	50,220

Scenario 3 (Buildings LON16, LON17, LON18)	3 generators have been modelled to operate simultaneously for 11 hours per annum at 100% load	50 No. 2.4 MW	4.65	55,2420
Total annual (Kg/year)				**2,159.7**

Engine testing therefore results in 2159.7 Kg per year of emissions from the four data centre buildings (London 15 – London 18). The operational emissions scenario is also presented below for the permitted units at the Saunderton Campus to determine the overall installation emissions.

5.6 Emergency Scenario

For the emergency scenario the Air Quality Assessment report modelled all generators for 72 hours at 100% output.

For the emergency scenario, a hypergeometric distribution calculation has also been undertaken to determine the emergency operation to determine the probability of exceeding the 1-hour mean NO_2 objective. For 72 hours of continuous operation, the probability of exceeding the objective was found to be 38.9% following the hypergeometric distribution analyses. Given that the probability is greater than 5%, this indicates potential for exceedance.

However, the likelihood of emergency generators being required for extended periods of time is limited. This is both noting the overall reliability of supply for the National Electricity System during 2024-25 was 99.999818%, Virtus' operational record, as well as limited on-site fuel storage making all-generator operation over a 24-hour period unlikely.

Modelling inputs and outputs are described fully in the accompanying air quality assessment, submitted as a part of this permit application.

5.7 Fuel Storage, Deliveries and BAT

The diesel (BS EN 590 ULSD, ultra-low sulphur)) will be stored in Grade S355 steel "belly" tanks, with each one situated under and dedicated to a generator set.

Design

Each generator shall be supplied complete with a double-skinned belly tank suitable to provide 48 hours continuous operation at full design load. Belly tanks are provided with

leak detection within the interstitial space and are internally bunded to 110% of total fuel volume.

Each generator set is fed via the onboard fuel pump and an internal connection from the base tank through to the canopy. The fuel tanks of the 55 2.4 MW generators have a usable capacity of 34,000 litres and a brimful capacity of 40,000 litres. The fuel tanks of the 2 2.8 MW generators have a usable capacity of 41,000 litres and a brimful capacity of 48,000 litres.

Secondary Containment:

The Environment Agency guidance states that secondary containment is "a drip tray" or "a bund – outer case which holds the container", secondary containment does not include 'double-skinned' tanks etc "where the tank is surrounded by a second skin for extra strength".

Each generator or set will be fitted with a belly tank, sized to provide at least 48 hours of fuel capacity when the set is running at 100% output power rating. The tank will be double skinned/internally bunded with a capacity to contain no less than 110% of the total fuel volume in the event of a leak of the primary tank. The belly tank will be supplied complete with fuel level monitoring system, a fuel polishing system, filling station, set-mounted refuelling cabinet, supply pipework, vents, fire safety, isolating and control valves, drip trays and facilities to link to the fire alarm interface. All generator, fuel, fire and leak detection system statuses and alarms are to be monitored by the facility monitoring system via the ICN.

Tank Filling

The fuel delivery areas are strategically located to the north and south of each gantry, (two per building located on the eastern and western sides of each data centre building) ensuring efficient and accessible fuelling points for the generators. Fuel will be supplied to the generators through dedicated filling stations, each connected by both primary and secondary (backup) supply pipes, ensuring a reliable and uninterrupted fuel supply. The fuel delivery areas will be surfaced with an impermeable material in accordance with the with the Environment Agency's and DEFRAs guidance "Oil Storage Regulations for Businesses.". Surface water runoff from the delivery area will be directed to a class 1 full retention forecourt separator designed to accommodate the containment of a catastrophic fuel spill of a single delivery with spare capacity for additional runoff to accommodate a 1:100-year rainfall event, with a duration of 6 hours. The forecourt separator will be fitted with an alarm to indicate when the separator is reaching capacity.

Fuel deliveries to the belly tanks are arranged via an N+N fuel oil filling point system. The fuel fill point cabinets shall be IP65 rated, lockable with drip tray and leak detection. The cabinet shall be fitted with 2-pin overfill protection pockets to disable pump on tanker,

one per generator belly tank with identifying labels. The local control panel of the diesel fuel system shall be provided with measures that allow the components to ride through power outage or voltage dip.

All fuel delivery pipework will be double walled 'pipe in pipe' with leak detection in the annular space, linked back to the control panel and facility monitoring system. All fuel pipework will be EN10255 red heavy carbon steel pipe SCH40/black iron fully welded. Inner/carrier pipe will be suitable for service and environment. Pipework shall be insulated and trace heated for frost protection.

The pipework will be designed by a specialist. The oil/ fuel delivery procedures are set out within Chapter 6 of Virtus' operations manual and are summarised on the following page.

A further procedure exists in the event of a spillage or leakage of fuel; triggering 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. Any spilled oil and absorbent material collected will be disposed of as hazardous waste. A diagram of the fuel fill points is included in Appendix B.

Virtus' Fuel Delivery Procedures

A fuel refill request will be made by a member of staff; this will invoke a safe system of working, whereby a trained member of the Facilities Management (FM) team will take a gauge reading and cross reference this with the monthly log. If there is any doubt about the accuracy, this may be cross referenced with the secondary fuel gauges. All personnel must be aware of the maximum capacity of the generator fuel tanks; these are set out in the Operations Manual.

The tanks must not be filled to more than 95% of their capacity. The supplier must be given an accurate reading. Any concerns over the accuracy of the readings must be reported to the FM Team Contract Manager or Supervisor and Virtus.

The FM team shall inform both Virtus and site security that fuel delivery is taking place. Where necessary the local area will be appropriately cordoned off using barriers and cones. The tanker and its crew must always be supervised, a permit to work process is applicable. Any "at risk" drains must be covered to prevent potential loss to the drains and spill kits must be positioned nearby. Any concerns over the quality of the spill kits or drain covers must be reported to the FM team contract manager and Virtus. Delivery of fuel will not be carried out until any remedial actions are conducted.

The FM team must obtain delivery receipts/reports indicating the exact amount of fuel delivered to individual fuel storage tanks.

Tank Inspections (Asset Integrity Programme):

The structural design of the tank system (to BS 799: Part 5) and the tanks protection from impact is described above. Tank quality is managed/mitigated by:

- Using the correct specification / type of fuel;

- On-site continuous circulation of the diesel through the fuel polishing system to remove water and particulates;
- Fuel sampling as described in the Virtus Operations Manual;
- Regular empty tank inspections; and
- Visual inspections of the external structures daily for signs of corrosion, with checks also being carried out as the generator is serviced (minor and major service) by the OEM or OEM approved provider.

Chapter 6 of the OHS&E Manual will be submitted as part of the site documentation. All plant and asset management are controlled in Maximo and referencing SFG20 and other industry standard databases. The level and frequency of inspections and fuel sampling is greater than industry standard. Full details of the 5-year tests will be provided when available, which will be closer to the commissioning point.

5.8 Site Drainage

The proposed surface water drainage system divides the site into two areas (north and south), each of which is drained by a separated road and roof pipe network and attenuated in below ground storage tanks. The two areas then discharge into an infiltration basin located in the landscaping in the northeast of the site (refer to drainage drawing 24027-BWT-ZZZ-ZZ-DR-C-A0400 for additional details on the proposed layout).

The surfacing for the fuel delivery areas will be impermeable and surface water runoff from the delivery area will be directed to channel drains around the perimeter of the delivery area. This will then discharge runoff to a below ground class 1 full retention forecourt separator. The forecourt separator will be designed to accommodate the containment of a catastrophic fuel spill of a single fuel delivery tank compartment of 7,600l, and will have spare capacity for additional run-off in case spillage happens during a 1:100 year rainfall event, with a duration of 6 hours. The forecourt separator will be fitted with an alarm to alert when the separator is at capacity. Table 5.6 below presents the preliminary surface water attenuation volumes for each of the catchment areas.

Table 5.6 – Preliminary Surface Water Attenuation Volumes

	Storage Element	Outflow restriction	Volume
Northern catchment	Below ground attenuation tank	Vortex device	1793.3 m^3
Southern catchment	Below ground attenuation tank	Vortex device	1948.2 m^3
Complete site	Infiltration basin	Infiltration into the ground	4403 m^3

The data centre buildings will be fitted with attenuation tanks with automated shut off valves that will be triggered by the fire alarm system, these will be allocated upstream of the proposed infiltration basin. Storage tanks will be designed to retain the volume of surface water run-off generated by a fire scenario in 1No. building (50 + 150 m3 respectively of sprinkler and fire hydrant water) in concurrence with a rainfall event (1in10 year return period, 24hr duration).

There are no available surface water connections into public sewers and all runoff from the site will pass through a Class 1 By-pass petrol interceptor before entering the below ground attenuation tank, the northern catchment will be serviced by a NSBE125 from Kingspan or similar approved interceptor (length 9.6m diameter 1.92m) and the southern catchment will be serviced by a 4125 C1/SC from SPEL or similar approved interceptor (length 9.05m diameter 2.70m). This ensures that hydrocarbons are removed from any surface water runoff prior to entering the basin.

Surface water runoff from the delivery area will be directed to channel drains around the perimeter of the delivery area which will then discharge runoff to a below ground class 1 full retention forecourt separator. The forecourt separator will be designed to accommodate the containment of a catastrophic fuel spill of a single fuel delivery tank compartment of 7,600l, and will have spare capacity for additional run-off in case spillage happens during a 1:100-year rainfall event, with a duration of 6 hours. The forecourt separator will be fitted with an alarm to alert in the case that the separator is at capacity. Each fuel delivery area will be fitted with a forecourt separator, in total there will be 14, in addition to the 2 interceptors servicing the below ground attenuation tanks.

To mitigate the risk of fuel leaks and fire water runoff within the generator and fuel delivery areas, attenuation tanks with automated shut off valves triggered by the fire alarm system will be installed upstream of the proposed infiltration basin. The below ground attenuation tanks will be designed to retain the volume of surface water run-off generated by a fire scenario in 1No. building (50m3 + 150m3 respectively of sprinkler and

fire hydrant water) in concurrence with a rainfall event (1:10 year return period, 24-hour duration).

Each fuel delivery area will be serviced by a class 1 full retention forecourt separator with manual penstock valves on downstream manholes (to be closed during refilling operations). The road drainage network will be serviced by class 1 Bypass petrol interceptors. The southern catchment will be serviced by a 4125 C1/SC from SPEL (or similar approved), and the northern catchment will be serviced by a NSBE125 from Kingspan (or similar approved).

5.9 Waste Diesel Management

Significant volumes of waste diesel will only be produced if fuel polishing measures have failed to sufficiently maintain the quality of the diesel. Virtus processes therefore exist to avoid fuel degradation. Expected quantities of waste diesel are anticipated to be very low however, the process for the collection of waste diesel is as follows:

- Upon evidence from quarterly diesel sampling results that diesel is no longer suitable for combustion, the data centre site teams would contact the contracted diesel supplier to remove the unsuitable diesel and replenish the bulk tanks. The removal of waste diesel requires the mandatory on-the-spot completion of a Hazardous Waste Consignment Note with a Part E update to follow. All waste consignment notes are required to be issued to Virtus site management and compliance departments for verification against permits/registered activities.
- All waste consignment notes are required to be issued to Virtus site management and compliance departments for verification against permits/ registered activities/ The diesel sampling contracted methodology is summarised in the box below. Just state it will be appropriately categorised and removed by fully licensed waste carrier

Diesel sampling contracted methodology:

Gain access to the top of the diesel tanks and take two samples of diesel, one from the middle of each diesel tank and one from the bottom of the tank.

The diesel tank samples will be sent to a laboratory, and the results will determine the condition of the diesel which will include the following:

1. Density of the diesel at 15^0 C
2. The flash point of the diesel
3. Water content – ppm
4. Specific gravity – g/ml
5. Bacteria TC – Colony forming unit (cfu)
6. Fungus / mould – cfu
7. Sulphur – ppm
8. Practical Count
9. Supply a diesel sample test report for each generator diesel tank.

Sampling will be carried out by Crown Oil, SDM and CATF. A full method statement is available if required. Virtus operate a Duty of Care system which identifies the appropriate contractors for waste removal, ensures correct licensing and permitting of carriers and disposal locations, and undertakes audits to ensure legal compliance. All contractors/subcontractors who have a responsibility to collect or remove waste have their waste credentials registered in the Duty of Care spreadsheet, ensuring that all waste (both hazardous and non-hazardous) is handled in accordance with regulations.

6 Energy Use and Efficiency

6.1 Energy Consumption

This application for an environmental permit is made for the proposed regulated activity of burning any fuel in an appliance with a net rated thermal input of 50 or more megawatts, when the National Grid electricity supply is interrupted. Therefore, the focus of energy consumption under the permit is in relation to the generators alone, rather than the energy consumption of the data centre operations, which are not considered to be a regulated activity under the environmental permitting regime, and are outside of the permit boundary.

The annual fuel oil consumption associated with the testing and maintenance of the generators is estimated to be 182,675 litres or 153.4 tonnes. Based on an annual operation of up to 50 hours on the basis of a conservative approach, it is expected that the Installation will have an energy consumption of XXXXX. Electricity consumption will be relatively small and based around preheating the engines, monitoring and control systems.

Table 6.1 Summary of Energy Consumption

Energy Source	Approximate Annual Energy Consumption		
	As Delivered (MWh)	At Primary Source (MWh)	% of total (primary)
Electricity	Nominal	Nominal	<1
Diesel	17,811	17,811	>99

6.2 Energy Efficiency Measures

Operating and Management Procedures

The generators will be maintained and serviced in accordance with the manufacturer's recommended maintenance schedule to ensure the efficiency of the engines is maintained.

Given the infrequent, intermittent and unplanned nature of the operation of the generators, other energy efficiency measures are not considered appropriate.

Energy Efficiency Directive – Article 14

Article 14 of the Energy Efficiency Directive (2012/27/EU) requires a cost-benefit analysis in relation to measures for promoting efficiency in heating and cooling at industrial installations with a thermal input exceeding 20 MWth. Whilst this capacity is exceeded at the Installation, the operating hours for the plant are significantly

below the 1500 hours a year threshold which also applies. Therefore, the generators are exempt from the requirement to provide a cost-benefit analysis on recovery of heat as part of the application.

6.3 Global warming potential

The release of greenhouse gas emissions at the Installation is anticipated to be primarily from direct emissions produced or associated with the operation of the emergency generators. This is diesel combustion at the installation.

The anticipated emission of carbon dioxide resulting from the Installation as a result of the consumption of diesel is presented below. Note that this data is based upon the regulated activity only (electricity generators). Other greenhouse gas emissions associated with the operation of the data centre are excluded from the assessment.

Table 6.2 Primary Energy Consumption

	Primary Energy Consumption		
Energy Source	Litres of Fuel	CO2 emission Factor (kg CO2e/litre)	Annual CO2 emissions (tonnes)
Diesel	182,675	2.66155	486.2

Appendix A Permit Application Forms and MCP Generator Spreadsheet

Appendix B Appendix B – Site Plans and Figures

Appendix C Generator Engine Data Sheets

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London
240 Blackfriars Road,
London, SE1 8NW
United Kingdom
+44 (0)20 7631 5291
ramboll.com