PERMIT APPLICATION SUPPORTING INFORMATION

Didcot North Data Centre Campus

794-DES-ARC-30974
2
1
30 September 2025

Document status

Version	Revision	Authored by	Reviewed by	Approved by	Date
1	0	Joanna Bruce	Jennifer Stringer	N/A	2 May 2025
1	1	Joanna Bruce	Sarah Gillie	N/A	28 May 2025
2	0	Joanna Bruce	Jennifer Stringer	Jennifer Stringer	2 July 2025
2	0	Joanna Bruce	Sarah Gillie	N/A	17 September 2025
2	1	Joanna Bruce	Jennifer Stringer	Jennifer Stringer	30 September 2025

Approval for issue

Jennifer Stringer	Technical Director	JS	30 September 2025

File Name

250930 R 794-DES-ARC-30974 JB Didcot Data Centre V2 R1 .docx

Prepared by:

RPS

Joanna Bruce
Environmental Consultant

20 Farringdon Street
London
EC4A 4AB

T +44 1454 279650
E joanna.bruce@rps.tetratech.com

NON-TECHNICAL SUMMARY

Introduction

This document and associated appendices form the application for an Environmental Permit (EP) to operate an emergency back-up generation installation under the Environmental Permitting Regulations 2016 (as amended).

There will be 129 generators in total with a combined net thermal input of approximately 925 MW_{th}. The proposed installation will consist of 122 x 7.5 MW_{th}, 4 x 1.9 MW_{th}, and 3 x 1.3 MW_{th} generators and will operate to provide emergency back-up power to an associated data centre, including a substation and central industrial water building (CIWB), should there be a break in supply from the grid.

The generators can 'operate' during an emergency for up to 500 hours per calendar year. Individual generators would each be test operated up to a maximum of 50 hours per year, although the envisaged testing routine is likely to be less (24.5 hours per annum).

Approximately 2,400 m^3 of fuel will be stored at the site at any one time to serve the engines.

Site Location

The site is located at part of the former Didcot A Power Station in Didcot, Oxfordshire. The approximate post code is OX11 7BF and the site is centred at National Grid Reference SU 51443 91794.

The site covers approximately 23 hectares of former Didcot A Power Station which was used for coal storage and cooling towers.

The closest sensitive ecological receptor to the site is an Ancient Woodland located circa 1.2km northeast from the site. Culham Brake Site of Special Scientific Interest (SSSI) is located approximately 4.5 km north of the site. The Little Wittenham Special Area of Conservation (SAC) and (SSSI) is located approximately 5.5 km to the north east of the site and Cothill Fen SAC is located approximately 10 km northwest of the site.

The nearest surface water feature is an unnamed stream located on the eastern and western boundaries of the site. Moor Ditch is located 900 m to the east of the Site.

The nearest residential receptor is located 600 m southeast of the site. An industrial park is located 50 m to the east and 50 m south of the site.

Operations

The data centre will be served by a direct connection to the National Grid. In the unlikely case of a break in supply, back-up generation will be provided by the emergency generators.

There are four data centre buildings, each with its own generator compound.

Data centre buildings A, B and C are 3 storey and will have 38 x 7.5 MW_{th} generators each which will be double stacked, plus a smaller 1.9 MW_{th} 'house' generator.

Data centre building 4 is single storey and will have 8 x 7.5 MW_{th} standby generators plus a smaller 1.9 MW_{th} 'house' generator.

Back up power to the Central Industrial Water Building (CIWB) will be provided two smaller 1.3 MW_{th} generators.

A single 1.3 MW_{th} generator will serve the onsite substation.

Each generator will discharge combustion gases from individual dedicated stacks.

Fuel will either be diesel or HVO, subject to availability. The generators will be individually containerised within the compound. Fuel will be stored on site and it is anticipated that each data centre generator compound will be served by a main top-up tank holding approximately 40,000 litres. In addition, each main generator will include belly tanks of 19,300 L capacity. Belly tanks for the house generators will hold 5,600 L of fuel and those for the CIWB generators and substation generator will hold 1,300 L of fuel.

All tanks will be above ground and with secondary containment. Each tank is containerised and self-bunded to contain 110% of the storage capacity of the tank. All tanks will comply with the Oil Storage Regulations[1].

Management Activities

An environmental management system (EMS) will be in place and will follow certain aspects of the EMS standard ISO 14001. The EMS will be underpinned by an environmental policy. All staff and external contractors will be made aware of the environmental policy as part of the induction training and a copy will be made available on site.

The operator will also implement a record keeping system on site as part of its management system.

Energy Efficiency

Due to the back-up nature of the installation operation which requires fast, flexible operation; combined cycle operation is not a feasible option and is considered unavailable on this basis. The plant selected to provide back-up generation have a net electrical efficiency of approximately 37.6% (House Generator), 37.3% (Main Generators) and 34 % (backup generators for CIWB and substation).

Raw Materials, Water and Waste

The main raw materials used within the installation will be diesel or HVO fuel, and lubrication oil.

No routine water use is required for the installation, although an internal mains water connection will be in place to allow washing of the plant and topping up of water circuits.

Waste generation from the installation is anticipated to be low and will result primarily from maintenance activities.

Emissions to Air

Emissions to air will result from the combustion of fuel within the generators which will be released into the atmosphere via dedicated exhaust stacks. There will be no significant sources of odour resulting from the operation of the installation.

A stack height assessment has been carried out to determine the height for the stacks and the effects on air quality from the installation have been assessed on this basis.

Detailed dispersion modelling has been carried out for testing, maintenance and in the case of a 72-hour emergency power outage.

Under the testing and maintenance scenarios, the predicted emissions at all sensitive human receptors surrounding the plant were screened out as insignificant. In addition the assessment of air quality effects at sensitive ecological sites concluded that the effects of:

- Annual-mean nitrogen oxides (NO_x);
- Annual-mean sulphur oxides (SO_2);
- Nutrient nitrogen deposition; and
- Acid deposition;

were also all screened out as insignificant.

For the 72 hours emergency power outage scenario, there were no predicted exceedances of the relevant Air Quality Object (AQO) for any pollutants modelled at all human receptors, except for one exceedance of

[1] SI 2001/2954. The Control of Pollution (Oil Storage) (England) Regulations 2001

the 1-hourly mean AQO for benzene. The probability of this exceedance occurring was calculated as less than 5% and so the impact is assessed as not significant. It is noted that for the purposes of assessment the benzene content in hydrocarbon (HC) emissions was assumed to be 100% when in reality it would be less.

The assessment of ecological receptors identified that impacts associated with the operation of the backup plant in the combined testing and maintenance scenarios were screened to be insignificant. Impacts at ecological receptors in the 72-hour outage scenario were found to be potentially significant impacts for the 24- hour mean NOx critical level. Due to the Site having two substations, the likelihood of a 72-hour outage is considered an overly conservative assessment and is considered highly unlikely to occur. However, the very short-term nature of potentially high NOx emissions associated with the use of the backup plant would not reasonably be considered to result in significant changes to the vegetation assemblages of the designated sites, because increased nitrogen uptake would only potentially occur for a few hours at most. It is therefore concluded that effects to the designated sites of the short-term increase in nitrogen deposition as a result of NOx emissions from the backup plant would not be significant.

Emissions to Water, Land and Groundwater

There will be no point source emission to land or groundwater.

There will be no process water discharges to sewer or surface water. Discharges to water will be restricted to surface water run-off from the generator containers, roof, hardstanding, fuel storage, refuelling and handling areas and paved areas. Water will flow through the surface water drainage system and attenuation ponds on the wider data centre site before released into Moor Ditch. Oil interceptors are installed within the surface water drains for each generator compound.

Noise

The generators on site are potential sources of noise. The generators are containerised which includes acoustic attenuation. For most of the time (apart from emergencies and periodic testing) the generators and plant will not be operating and so will not generate noise.

The assessment has concluded that relevant noise limits are met at all noise sensitive receptors for all operational scenarios and that therefore noise from the generators will have a low impact without the need for further mitigation.

Best Available Techniques

The application has set out the proposed techniques to be operated and these have been considered against BAT and alternatives. The proposed techniques are considered to meet BAT and the operation of the proposed installation is not expected to give rise to significant effects to the environment or human health.

Contents

Tables

Appendices

1 INTRODUCTION

1.1 Background

1.1.1 This document and associated appendices form the application for an Environmental Permit (EP) to operate an emergency back-up generation installation under the Environmental Permitting Regulations 2016 (as amended).

1.1.2 The installation will operate to provide emergency back-up electricity to the data centre and associated infrastructure should there be a break in supply from the grid. No electricity will be exported to the grid from the installation. The installation will comprise 129 back-up generators with a combined net thermal input of approximately 925 MW_{th}.

1.1.3 The full installation would only be required to operate as emergency back-up in the event of a grid outage. Individual generators would each be test operated up to a maximum of 50 hours per year, although the envisage testing routine is likely to be less (24.5 hours per annum).

1.2 Site Location

1.2.1 The site is located at part of the former Didcot A Power Station in Didcot, Oxfordshire. The approximate post code is OX11 7BF and the site is centred at National Grid Reference SU 51443 91794.

1.2.2 The site covers approximately 23 hectares of former Didcot A Power Station which was used for coal storage and cooling towers. The power station itself has been demolished, and the site has been flattened and subject to remediation ready for development. The eastern area of the site boundary is currently occupied by unused grassland.

1.2.3 The wider site is bounded by the A4130 to the east and Purchas Road at the southern site boundary and crossing north to south through the site.

1.2.4 A business park is located south and east of the site.

1.2.5 The nearest surface water feature is an unnamed stream located on the eastern and western boundaries of the site. Moor Ditch is located 900 m to the east of the Site.

1.2.6 The closest sensitive ecological receptor to the site is an Ancient Woodland located circa 1.2 km northwest from the site. Culham Brake Site of Special Scientific Interest (SSSI) is located approximately 4.5 km north of the site. The Little Wittenham Special Area of Conservation (SAC) and (SSSI) is located approximately 5.5 km to the northeast of the site and Cothill Fen SAC is located approximately 10 km northwest of the site.

1.3 The Applicant

1.3.1 The applicant and operator are Amazon Data Services UK Limited and is listed on Companies House with registered number 09959151.

1.3.2 The Directors, and their dates of birth, as listed on Companies House are provided in application form part A1 in Appendix A.

1.4 Regulated Installation and Applicable Guidance

1.4.1 The total rated thermal input of the installation will be above 50 MW and therefore it will be regulated under the Environmental Permitting Regulations (England and Wales) 2016 (as amended) ("EPR") Schedule 1, Part 2, Section 1.1 A(1)(a) – burning of any fuel in an appliance with a rated thermal input of 50 or more megawatts.

1.4.2 The generators will each have a net thermal input below 15 MW_{th}. Therefore, although the total combined thermal input of all generators is greater than 50 MW, the aggregation rules set out within the Industrial Emissions Directive (IED)[2] do not apply and therefore the installation is not classed as a large combustion plant (LCP). Accordingly, the installation does not fall within Chapter III of the IED and instead is a Chapter II combustion plant. The emission limits relevant to LCPs within the relevant BAT Conclusions do not apply.

1.4.3 Each individual generator will be a medium combustion plant. However, as the total operating hours per year will not exceed 500 hours, the generators will not be required to comply with the emission limits set out in Schedule 25A EPR.

1.4.4 The EA has issued draft guidance titled "Data Centre FAQ Headline Approach"[3] The installation has been assessed against the BAT set out in that draft guidance.

1.4.5 The installation will include all emergency generators, radiators, exhaust stacks, associated fuel storage and fuel delivery areas.

1.4.6 The data centre buildings and Central Industrial Water Building (CIWB) have no technical connection with the emergency back-up generators and therefore will not form part of the permitted installation.

1.4.7 The electricity generation at the facility does not exceed the threshold of 1,500 hours of operation per engine per annum on a 5 year rolling average, and is therefore not required to carry out a cost benefit analysis under Schedule 24 of the Energy Efficiency Directive (2012/27/EU).

1.5 Structure of the Permit Application

1.5.1 This section provides an overview of the proposals. This is supplemented by further details in Sections 2 – 5 as follows:

- Section 2 details the proposed management practices which will be in place at the plant, with specific detail covering:
  - Accident management;
  - Energy efficiency;
  - Efficient use of raw materials and water; and
  - Avoidance, recovery and disposal of wastes.
- Section 3 addresses the operational measures which will be in place to prevent and/or control any potential environmental effects of the proposal.
- Section 4 identifies the nature of emissions from the installation.
- Section 5 summarises the conclusions from the detailed impact assessments undertaken to predict any environmental effects from the installation.
- Section 6 summarises the outcome of the detailed assessments of Best Available Techniques (BAT) for the key plant and abatement systems proposed.

1.5.2 Supporting documents, assessments and application forms are provided within the appendices list as set out in the contents page.

---

[2] –Article 29 - Directive - 2010/75 - EN - EUR-Lex

[3] Data Centre FAQ Headline Approach, version 21.0 to TeckUK for Discussion 15/11/22

2 MANAGEMENT OF ACTIVITIES

2.1 General

2.1.1 An environmental management system (EMS) will be established on site and will cover those elements requiring environmental permitting.

2.1.2 The EMS will operate in a way that is broadly consistent with this environmental management standard ISO14001. For example, the following are in place:

a. senior leadership commitment to continual improvement,

b. established environmental policies, procedures and processes to drive and monitor compliance with applicable regulations,

c. a process and team that conducts internal compliance audits to assess environmental aspects and impacts of our data centre facilities, and

d. supplier code of conduct and contractual requirements that specify environmental compliance requirements and monitoring practices for suppliers.

2.1.3 The EMS will be underpinned by an environmental policy. All staff and external contractors will be made aware of the environmental policy as part of the induction training and a copy will be made available on site.

2.1.4 A system of keeping all relevant records including, but not limited to, the following will be developed and implemented prior to commissioning:

- Records of incidents, accidents and emergencies including details of follow-up;
- Monitoring records, including those required by the environmental permit; and
- Any other record to be kept as part of the permit.

2.1.5 Systems will be developed and implemented for undertaking audits, reporting of environmental performance, objectives, targets and programmes for future improvements.

2.1.6 Prior to commencing hot commissioning of the generators, all key EMS systems will be in place.

2.2 Operations and Maintenance

2.2.1 Management systems will be put in place to ensure that those operations which have the potential to give rise to significant environmental effects are controlled. These systems will cover periods where the generators are not running as well as testing and emergency operation scenarios and start-up and shutdown of the installation.

2.2.2 Operational procedures set out routine testing schedules and procedures for maintaining associated records.

2.2.3 Planned maintenance routines will be established to ensure all key plant components which have the potential to affect the environmental performance of the installation remain in good working order. Maintenance routines will draw on manufacturer’s recommendations, modified as appropriate by operational experience during the lifetime of the installation. Maintenance will be carried out by contractors in accordance with the operator’s maintenance requirements.

2.3 Competence and Training

2.3.1 All subcontractors working on the site will be subject to a competency assessment. In addition, where any subcontractor has any operational input to the site, they must fulfil any relevant obligations under the EMS.

2.3.2 Training will be provided to the subcontractor at the beginning of their contract term in the form of the site induction process; the subcontractor will in turn be responsible for training their own personnel and providing records of such training back to the operator. This will include all maintenance staff carrying out routine maintenance at the installation.

2.3.3 Training will ensure that all staff are aware of relevant elements of the EMS, including relevant operational procedures and the requirements of the environmental permit when issued. Induction procedures will be established for the identification and provision of training and updated knowledge for all personnel engaged in activities affecting environmental performance.

2.3.4 Records of relevant training will be stored and maintained. As a minimum, records will include details relating to the date, type of training and training provider.

2.4 Organisation

2.4.1 Roles and responsibilities will be clearly defined within the management system. The organisation will have established clear lines of communication.

2.5 Accident Management

2.5.1 An Accident Management Plan (AMP) will be established prior to commencing operation of the proposed installation. The AMP will detail those actions required in the event of an emergency or accident/incident. This will include small incidents such as minor spills and leaks and complaints, as well as major incidents such as fire and major spills. In particular, a system for recording and allocating appropriate follow-up for accidents, incidents and non-conformances will be established prior to operation.

2.5.2 The installation is controlled via an onsite control room. Routine daily inspections and maintenance will be carried out by a suitably qualified member of staff and subcontractors.

2.5.3 Each generator will be fitted with a weighted slam-shut valve with a fusible link across the top of each generator. In the event of a fire, the link will melt, and the valve will drop, shutting off the fuel supply. These systems will link to the site security office where personnel will alert relevant employees and call the Fire and Rescue Service to attend if necessary.

2.5.4 Whilst it is expected that a fire would be managed via controlled burn of residual fuel, in the event that firewater is used to manage an incident containment has been included. Any firewater run off would be directed to the surface water drainage system that serves the generator compounds and the wider data centre site. Manual penstock valves on the inlet to the attenuation basins will be closed in the event of a fire and firewater would be held within the drainage system. Following an incident, arrangement will be made to pump out potentially contaminated water and to flush the drains before opening the penstock valves.

2.5.5 Small spillages of fuel would be managed via the interceptor. However, should a significant failure of the unloading station tanks and simultaneously the associated bunding or a complete loss of a fuel delivery vehicle then the penstock valves would be closed and any oil not contained within the interceptor would be held within the drainage system.

2.5.6 Containment of firewater and spillages will comply with CIRIA Guide C736 Containment systems for the prevention of pollution[4].

2.5.7 To support this application, an initial Environmental Risk Assessment (ERA) is provided in Appendix C, which includes an assessment of potential accident risks. This will be reviewed prior to commencing operation and maintained as part of the AMP throughout the operational life of the installation.

[4] CIRIA C736F

2.5.8 As part of the design process, hazards will be identified and reviewed with a view to minimising safety, health and environmental risks.

2.6 Site Security

2.6.1 A security gate and pedestrian controlled entry systems is to be located at the main entrance to the site. The site will be staffed by security personnel at this entrance 24 hours a day.

2.6.2 The site is surrounded by an outer perimeter and inner perimeter both of which are bound by high security fencing. The wider data centre site is surrounded by 2.5 m high weldmesh fencing with 300mm razor wire. The internal fence is a 2.1 m high double wired panel system with 300 mm razor wire. The substation compound, CIWB and generator compounds for the data centre buildings will also have a perimeter fence and gated access which will be locked other than for access.

2.7 Energy Efficiency

2.7.1 The following section provides information on energy consumption and basic energy efficiency measures, for the installation. The emergency back-up reciprocating generators proposed to be installed will have the following electrical efficiency

- Main Generator – 37.3 %
- House Generator - 38.6 %
- Other backup (for CIWB and substation) - 34 %

2.7.2 There is no defined BAT associated with energy efficiency levels relevant to emergency generators such as those proposed at the installation. The efficiency sits above indicative efficiencies stated in the provisional EA guidance for data centres using generators (noting these efficiencies are identified for the purpose of calculating thermal input). Methods for maintaining efficient operations throughout the life of the installation are set out below.

2.7.3 Note the final generators have not been selected at this time, but are expected to be of a similar size and specification to the specifications included in Appendix H which have informed these efficiency calculations.

Basic Energy Requirements

2.7.4 Table 2-1 below provides a breakdown of the energy requirements of the installation. Start-up and shutdown energy requirements have also been included.

Table 2-1: Energy Consumption by Source

Energy Source	Annual Energy Consumption	
	Delivered MWh	Primary MWh
Fuel* **	89,293	89,293

*Usage includes for testing scenario 1, testing scenario 2, testing scenario 3 and 72 hour emergency use

** Ether diesel or HVO will be used as fuel and associated energy consumption would be expected to be broadly similar.

Operations and Maintenance

2.7.5 Operational procedures will be developed for the installation (see section 2.2 above). These procedures will incorporate measures aimed at ensuring the installation operates efficiently and safely. Site maintenance and housekeeping systems will also be developed for the installation and relevant plant will be included within a preventative maintenance schedule.

Energy Management Policy

2.7.6 Energy management will form an integral part of the permitted installation's management. Measures will be in place to minimise energy use as far as possible. Training programmes will be in place to ensure that operational and maintenance staff are aware of relevant procedures for ensuring energy efficiency.

2.7.7 Efficiency parameters will be monitored, and a commissioning test will be carried out, at full load after commissioning and after each modification that could significantly affect the net electrical efficiency, net total fuel utilisation, and/or net mechanical efficiency of the generators. On-site electricity usage will be minimised as far as possible within the constraints of the process optimisation.

Building Services

2.7.8 Energy requirements for the installation will be low with minimal lighting requirements. Energy efficient lighting will be used where possible.

Efficient Use of Raw Materials

2.7.9 Raw material requirements for the installation will be limited in number. The main materials used within the installation will be diesel or HVO for fuel, and lubrication oil. Table 2-2 provides details of raw materials, expected usage, storage and potential environmental effects.

2.7.10 Diesel and HVO as fuel have been selected due to the ability to store sufficient volumes on site to ensure security of supply. The selection of duel fuels has been made on the basis that current HVO supply cannot be guaranteed and therefore diesel may be used. Other fuels have been considered but do not currently provide the same level of security of supply. Natural gas could not be stored in sufficient volumes and would be reliant on the National Transmission System, a contract for uninterruptable supply would be excessively costly given the infrequency of use. Due to the limited hours of operation, any potential benefits from the lower impacts associated with emissions from natural gas are reduced.

2.7.11 The generators will utilise a closed-circuit cooling water (CCCW) system which will utilise a glycol mix. The system will also be dosed with small quantities of corrosion inhibitor. The cooling system, including coolers and CCCW circulating pumps, will be fully within the container for each generator. There will be no need to routinely top up coolant and any spillages or leaks will be quickly identified and dealt with.

Table 2-2: Raw Material Consumption for Installation

Raw Material	Nature	Expected Usage (approx.)	Storage	Fate	Environmental Effects	Alternatives
Diesel or HVO	Liquid fuel	880 m^3 (based on usage for testing scenarios, 1,2,and 3 as well as a single 72 emergency outage. Therefore, usage will be expected to be lower)	Total = 2,428 m^3 Unloading stations 4 x 40 m^3 Generator belly tanks: Main back-up– 122 x 19.3 m^3 House– 4 x 5.6 m^3 CIWB – 2 x 1.3 m^3 Substation – 1 x 0.5 m^3 (1.3 m^3 capacity)	Combusted within generators.	Various emissions to air. Potential impacts arise through acidification, vegetation and health effects and global warming. Potential impacts to ground and ground water in the event of failure of storage tanks.	Natural gas could not be stored in sufficient volumes on site to provide security. Petrol / other petroleum fuels require a greater volume to be stored to provide the equivalent energy output. Heavy fuel oil has been discounted from consideration as it contains more contaminating pollutants and is less efficient than diesel or HVO.
Lubricating Oil	Refined hydrocarbon with additives	Low usage. Within a closed loop system with minimal requirement for top up during routine maintenance.	Not stored	Used primarily within generators and discharged as waste oil for disposal	Harmful to aquatic organisms. May cause long-term adverse effects in the aquatic environment. Not readily biodegradable.	No practical alternative. There is a choice of supplier, but quality is specified by generator manufacturer.
Glycol	Liquid	Used in closed circuit cooling water (CCCW) system	Not stored	No storage, present only within the CCCW system	Harmful to aquatic organisms.	No practical alternative. There is a choice of supplier, but quality is specified by generator manufacturer.
Corrosion Inhibitor	Liquid	Used in closed circuit cooling water (CCCW) system	Not stored	No storage, present only within the CCCW system	Harmful to aquatic organisms.	No practical alternative. There is a choice of supplier, but quality is specified by generator manufacturer.

Water Use

2.7.12 A CCCW system will be installed which has no associated process discharge as the water is re-circulated within the system and does not require replacement or removal. No process waters will be generated by the plant, hence there will be no associated process water releases to surface water or sewer from the installation.

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

2.7.14 System top-up of the water/glycol mixture within the CCCW will periodically be required. Water for top up will be provided by the mains supply. Note there is no connection to the CIWB that serves the 4 data centre buildings.

2.7.15 No fire-fighting water will be stored, within the permit boundary, although a tank and water sprinkler pump is located within the wider Data Centre for site wide fire-fighting purposes. Details of fire detection and suppression systems are provided in paragraph 2.5.3 and fire management procedures will be included within the AMP.

2.8 Avoidance, Recovery and Disposal of Wastes

2.8.1 It is anticipated that waste generation during operation of the facility will be very low, primarily resulting from maintenance activities. Waste generation will be from the following limited sources: used generator air intake filters; and used lubricating oils.

2.8.2 All contractors carrying out maintenance on the plant will be responsible for the management of wastes generated from their immediate activities – which are removed from the site by the vendor upon completion of maintenance. The operator will be supplied with copies of records of waste removed from the site and associated recovery/disposal routes.

2.8.3 The permit requirements in relation to waste minimisation will be complied with and the operator will aim to minimise raw material consumption and therefore prevent the generation of waste.

3 OPERATIONS

3.1 Overview of Installation

3.1.1 The data centre will operate to provide emergency back-up electricity to the data centre should there be a break in supply from the grid. No electricity will be exported to the grid from the installation.

3.1.2 The proposed installation will comprise a total of 129 generators with a combined net thermal input of the facility is approximately 925 MW_{th}. Emergency back up will be provided to four data centre buildings (DCA, DCB, DCC and DCD), the CIWB and the substation.

3.1.3 The generator arrangements will be as follows:

- Building DCA, DCB and DCC each containing 39 generators comprising:
  - 38 x main back-up generators providing main power each with a thermal input of circa 7.5 MW_{th}
  - 1 x house generator each with a thermal input of 1.9 MW_{th}
- Building DCD containing 9 generators
  - 8 x main back-up generators providing main power each with a thermal input of 7.5 MW_{th}
  - 1 x house generator each with a thermal input of circa 1.9 MW_{th}
- A substation containing 1 x backup generator with a thermal input of 1.3 MW_{th}
- CIWB containing 2 x backup generators (440 kW) with thermal input of 1.3 MW_{th}.

3.1.4 Note the final generators have not been selected at this time but are expected to be of a similar size and specification to the specifications included in Appendix H. These specifications are typical for the size of the engine that is being applied for and have informed the emissions to air dispersion modelling and noise assessment. The energy efficiency calculations (see section 2.7) are based on the provided generator specifications.

3.1.5 Under normal operation electricity to the data centre buildings and wider site will be provided from the grid and the generators will not operate other than for testing. Resilience is built into the supply to the grid (see section 6.3), however in the unlikely event of a complete outage/failure of the grid supply to the data centre site, the emergency generators would operate until the connection is restored. To ensure the generators remain in good working order and available should they be required to operate, the testing schedule in Table 3-1 will be implemented. Based on this expected testing schedule, engines will be tested for up to 24.5 hours per annum.

Table 3-1: Testing Schedule

Testing /Maintenance Event 1	Testing / Maintenance Event 2	Testing / Maintenance Event 3
Each generator tested one at a time for up to 15-minutes at 10% load every two weeks.	Each generator tested one at a time for up to 4 hours twice annually. Generators tested at 100% load.	Each generator tested at a time for 10 cumulative hours over a year. Generators tested at 100% load.

3.2 Fuel and Raw Material Supply, Storage and Handling

3.2.1 Fuel will be stored in 4 top-up tanks each holding approximately 40,000 litres. One storage tank will be located in each of the 4 data centre building generator compounds. In addition, each generator will incorporate local storage within generator belly tanks. There are no central top-up tanks for the CIWB and substation.

3.2.2 Lubricating oil will also be used although this will not be stored on-site. Similarly, a dilute solution of ethylene glycol/water will be contained within the closed circuit cooling water (CCCW) system serving each of the engines, however no onsite storage is included. Corrosion inhibitor dosed in the CCCW system will also not be stored within the installation.

3.2.3 There will be no other additional raw materials to be used by the installation.

3.3 Combustion of Fuel and Power Generation

3.3.1 Combustion will take place within up to 129 generators. Either diesel or HVO will be used as fuel.

3.3.2 Each generator will comprise an engine with air intake system, combustion chamber, an exhaust system and an electrical generator, together with common auxiliary plant.

3.3.3 The air intake system will feature filters to remove any contamination present, such as dirt, dust or grit, which could damage or reduce efficiency of the plant.

3.3.4 Within the generator engines, diesel or HVO and air will be combusted. As the burning mixture of fuel and air expands, a piston is pushed transferring energy released from combustion to an engine flywheel, from which a connected alternator is used to generate electricity.

3.3.5 Each generator will have a dedicated exhaust stack. The stacks will be designated as release points A1 – A129.

3.4 Cooling Systems within the Generators

3.4.1 The CCCW system will comprise the main cooler, CCCW pump, system header tank, associated pipework and valves.

3.4.2 The CCCW system will be filled with a water/glycol mix and a corrosion inhibitor added. A manually operated dosing installation with mixing tank and injection pump will be in place to permit periodic top up to maintain cooling water quality.

3.5 Start up and Shut down Procedures

3.5.1 The installation will be capable of rapid start up within approximately 45 seconds when generation is required and a controlled shut down after use. The expected definitions of the start-up and shut-down periods are given below:

3.5.2 As per the EA guidance[5], the generators are regarded as having minimal start-up and shut-down periods and the operational hours start on the first fuel ignition.

3.6 Commissioning

3.6.1 A commissioning plan for the generators will be developed for the installation to outline the commissioning and associated monitoring activities and will be agreed with the EA prior to any commissioning activities taking place.

[5] Data Centre FAQ Headline Approach, version 10.0 H.Tee 01/06/2018

4 EMISSIONS AND MONITORING

4.1 Emissions to Air

4.1.1 Emissions to air from the installation will result from exhaust gases generated from combustion of fuel within the generators. Exhaust gases will primarily comprise water vapour and carbon dioxide, however low levels of the following gases will be present:

- Nitrogen oxides (NOx);
- Particulates;
- Sulphur dioxide (SO_2); and
- Hydrocarbons.

4.1.2 Note the assessment of emissions to air has been competed for emissions arising from the combustion of diesel. Either diesel or HVO will be used as fuel for the generators. Emissions from HVO will be similar or lower than for diesel. On this basis the predicted impacts are considered worst case.

4.1.3 Each of the 129 generators will have its own stack. The location of each point source and associated stack height is included in Table 4-1 below:

Table 4-1: Point Source Emissions

Emission Point	Generator	Easting	Northing	Stack Height (m)
A1	DCA House	451492	191723	33
A2	DCA Main 1	451494	191736	33
A3	DCA Main 2	451492	191729	33
A4	DCA Main 3	451494	191750	33
A5	DCA Main 4	451494	191749	33
A6	DCA Main 5	451496	191756	33
A7	DCA Main 6	451496	191755	33
A8	DCA Main 7	451497	191763	33
A9	DCA Main 8	451497	191762	33
A10	DCA Main 9	451502	191780	33
A11	DCA Main 10	451502	191779	33
A12	DCA Main 11	451503	191786	33
A13	DCA Main 12	451503	191786	33
A14	DCA Main 13	451505	191793	33
A15	DCA Main 14	451505	191792	33
A16	DCA Main 15	451510	191810	33
A17	DCA Main 16	451510	191809	33
A18	DCA Main 17	451512	191817	33
A19	DCA Main 18	451511	191816	33
A20	DCA Main 19	451513	191823	33
A21	DCA Main 20	451513	191822	33
A22	DCA Main 21	451518	191840	33
A23	DCA Main 22	451518	191839	33
A24	DCA Main 23	451519	191847	33

Emission Point	Generator	Easting	Northing	Stack Height (m)
A25	DCA Main 24	451519	191846	33
A26	DCA Main 25	451521	191853	33
A27	DCA Main 26	451521	191853	33
A28	DCA Main 27	451526	191870	33
A29	DCA Main 28	451525	191869	33
A30	DCA Main 29	451527	191877	33
A31	DCA Main 30	451527	191876	33
A32	DCA Main 31	451529	191884	33
A33	DCA Main 32	451529	191883	33
A34	DCA Main 333	451533	191900	33
A35	DCA Main 34	451533	191900	33
A36	DCA Main 35	451535	191907	33
A37	DCA Main 36	451535	191906	33
A38	DCA Main 37	451537	191914	33
A39	DCA Main 38	451537	191913	33
A40	DCB House	451408	191935	33
A41	DCB Main 1	451402	191935	33
A42	DCB Main 2	451395	191936	33
A43	DCB Main 3	451382	191937	33
A44	DCB Main 4	451381	191937	33
A45	DCB Main 5	451375	191939	33
A46	DCB Main 6	451374	191939	33
A47	DCB Main 7	451368	191940	33
A48	DCB Main 8	451367	191941	33
A49	DCB Main 9	451351	191945	33
A50	DCB Main 10	451350	191945	33
A51	DCB Main 11	451344	191947	33
A52	DCB Main 12	451343	191947	33
A53	DCB Main 13	451337	191948	33
A54	DCB Main 14	451336	191948	33
A55	DCB Main 15	451319	191952	33
A56	DCB Main 16	451319	191952	33
A57	DCB Main 17	451313	191954	33
A58	DCB Main 18	451312	191954	33
A59	DCB Main 19	451306	191956	33
A60	DCB Main 20	451305	191956	33
A61	DCB Main 21	451288	191960	33
A62	DCB Main 22	451287	191960	33
A63	DCB Main 23	451282	191962	33
A64	DCB Main 24	451281	191962	33
A65	DCB Main 25	451274	191964	33
A66	DCB Main 26	451274	191964	33
A67	DCB Main 27	451257	191968	33
A68	DCB Main 28	451256	191968	33

Emission Point	Generator	Easting	Northing	Stack Height (m)
A69	DCB Main 29	451250	191969	33
A70	DCB Main 30	451249	191970	33
A71	DCB Main 31	451243	191971	33
A72	DCB Main 32	451242	191971	33
A73	DCB Main 33	451226	191975	33
A74	DCB Main 34	451225	191975	33
A75	DCB Main 35	451219	191977	33
A76	DCB Main 36	451218	191977	33
A77	DCB Main 37	451212	191979	33
A78	DCB Main 38	451211	191979	33
A79	DCC House	451371	191792	33
A80	DCC Main 1	451365	191792	33
A81	DCC Main 2	451358	191793	33
A82	DCC Main 3	451343	191794	33
A83	DCC Main 4	451344	191794	33
A84	DCC Main 5	451336	191796	33
A85	DCC Main 6	451337	191796	33
A86	DCC Main 7	451329	191798	33
A87	DCC Main 8	451330	191797	33
A88	DCC Main 9	451312	191802	33
A89	DCC Main 10	451313	191802	33
A90	DCC Main 11	451305	191804	33
A91	DCC Main 12	451306	191804	33
A92	DCC Main 13	451298	191805	33
A93	DCC Main 14	451299	191805	33
A94	DCC Main 15	451281	191809	33
A95	DCC Main 16	451281	191809	33
A96	DCC Main 17	451274	191811	33
A97	DCC Main 18	451275	191811	33
A98	DCC Main 19	451267	191813	33
A99	DCC Main 20	451268	191812	33
A100	DCC Main 21	451250	191817	33
A101	DCC Main 22	451250	191817	33
A102	DCC Main 23	451243	191819	33
A103	DCC Main 24	451243	191819	33
A104	DCC Main 25	451236	191821	33
A105	DCC Main 26	451236	191820	33
A106	DCC Main 27	451218	191825	33
A107	DCC Main 28	451219	191825	33
A108	DCC Main 29	451212	191827	33
A109	DCC Main 30	451212	191826	33
A110	DCC Main 31	451205	191828	33
A111	DCC Main 32	451205	191828	33
A112	DCC Main 33	451187	191832	33

Emission Point	Generator	Easting	Northing	Stack Height (m)
A113	DCC Main 34	451188	191832	33
A114	DCC Main 35	451181	191834	33
A115	DCC Main 36	451181	191834	33
A116	DCC Main 37	451174	191836	33
A117	DCC Main 38	451174	191836	33
A118	DCD House	451545	191758	18
A119	DCD Main 1	451554	191778	18
A120	DCD Main 2	451554	191779	18
A121	DCD Main 3	451559	191797	18
A122	DCD Main 4	451559	191796	18
A123	DCD Main 5	451564	191816	18
A124	DCD Main 6	451564	191817	18
A125	DCD Main 7	451582	191832	18
A126	DCD Main 8	451581	191832	18
A127	CIWB 1	451304	191848	11.3
A128	CIWB 2	451295	191850	11.3
A129	Substation	451591	191868	9.4

4.1.4 An Air Quality Management Plan (AQMP) will be produced prior to the facility coming into operation. This will be provided as part of an Improvement Condition (IC).

4.2 Emissions to Land

4.2.1 There will be no emissions to land associated with operation of the installation.

4.3 Emissions to Surface Water and Sewer

4.3.1 No process waters will be generated by operation of the installation. There will be no associated process water discharge to surface water or foul sewer from the facility.

4.3.2 Water discharges will result from rainwater surface run-off from roofs, roads and hard standing, but there will be no process water discharges associated with the facility. Small amounts of rainwater may accumulate in the stacks, this water will be discharged to sewer.

4.3.3 Surface water run-off from the facility (roofs, roads, hard standing, etc.) will discharge into the surface water drainage system serving the generator compounds and the wider data centre site before release into the attenuation basins and ultimately Moor Ditch.

4.3.4 Water will flow through an oil/water interceptors to remove any oil and grease. Each compound will have an interceptor within the surface water drains.

4.3.5 Any run off from the delivery will drain into the interceptor and then to the surface water drains. Any rainwater collected in the bunds will be inspected and if clean, discharged into the surface water drains via an interceptor.

4.3.6 Penstock valves will be installed at the inlets to the attenuation pond. These valves would be manually closed in the event of a site incident that could affect discharges to surface water such as a significant spillage or fire.

4.4 Emissions to Groundwater

4.4.1 The facility will not include any point source emissions to ground or groundwater

4.5 Fugitive Emissions to Air

4.5.1 Fugitive emissions to air will be limited to VOCs and odour associated with fuel storage.

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

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

4.6 Fugitive Emissions to Surface Water or Sewer

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

4.6.2 All fuel storage tanks and the engine belly tanks are provided with secondary containment. Containment will be designed in accordance with CIRIA guidance. All tanks will be fitted with leak detection and high-level alarms to avoid overfilling. A full oil retention interceptor with automated closure devices local to point source of pollution risks (fuel storage or delivery areas) will be provided and all surface rainwater will discharge via the interceptor.

4.6.3 Containment of contaminated runoff from a fire event or similar will be via manual penstock valves which will be fitted to attenuation pond inlet headwalls. This will retain any contaminated runoff in the wider campus drainage network. The attenuation pond area is therefore not included in the permit boundary.

4.7 Noise and Vibration

4.7.1 The operation of back-up generators gives rise to noise. A noise impact assessment undertaken to support this permit application has concluded that noise under all operational scenarios will be within acceptable limits.

4.7.2 Noise from the back-up generators is controlled at source by the location of the generators in acoustic enclosures with attenuated inlets and exhausts, following best practice for this type of equipment.

4.7.3 As per section 2.2, planned maintenance will be in place to ensure that the engines remain in good working order throughout the operational life of the facility. Maintaining plant in good working order can assist with avoiding excessive noise build-up over time.

4.7.4 A noise management plan has been produced and is included in Appendix G.

4.8 Monitoring and Reporting of Emissions

Emissions to Air

4.8.1 Due to the classification of the plant as emergency back-up generators, there are no relevant emission limit values (ELVs) and therefore routine monitoring of emissions to air is not required.

Emissions to Water and Land

4.8.2 Routine monitoring of soils and groundwater will be undertaken as part of the operational requirements of the installation every 10 years and 5 years respectively unless otherwise agreed with the EA.

4.8.3 There will be no discharges to land from the facility.

4.8.4 Water discharges will result from rainwater surface run-off from roofs, roads and hard standing, but there will be no process water discharges associated with the facility. Surface water run-off from the facility (roofs, roads, hard standing, etc.) water will discharge into the surface water drainage system serving the generator compounds and the wider data centre site before release into the attenuation basins and ultimately Moor Ditch. No monitoring of surface water run-off is proposed.

Process Monitoring

4.8.5 Key process monitoring will be carried out to monitor the permitted facilities plant performance including water usage, energy consumption (fuel and electricity), hours of operation and power generated. These performance parameters will be reported on an annual basis.

4.8.6 The plant performance and equipment will be continually monitored, and a system will be in place to optimise performance.

5 IMPACTS

5.1.1 To support this application a number of environmental assessments have been performed. The full details of these assessments are appended to this application and a reference to the full assessment is given where relevant for the environmental issues detailed below.

5.2 Emissions to Air

5.2.1 An air quality assessment has been undertaken to support this application and full details of the assessment are reported in Appendix E – Air Quality Assessment.

5.2.2 Dispersion modelling was undertaken using ADMS 6, a version of the ADMS (Atmospheric Dispersion Modelling System) developed by Cambridge Environmental Research Consultants, (CERC) which calculates the mean concentration over flat terrain, whilst allowing for the effect of plume rise, structures, complex terrain and deposition.

5.2.3 Several meteorological parameters were required for the dispersion modelling, including wind speed, wind direction, cloud cover and temperature. Dispersion model simulations have been performed using three years of meteorological data from 2022, 2023 and 2024.

5.2.4 The potential impacts of nitrogen dioxide (NO_2), particulate matter (PM10 & PM2.5), sulphur dioxide (SO_2), carbon monoxide (CO), and hydrocarbons (HC) assessed as benzene will be considered at nearby sensitive human and ecological receptors and across a gridded area for the following scenarios:

- Biweekly service testing;
- Biannual service testing;
- Maintenance testing; and
- A 72-hour emergency scenario.

5.2.5 Emissions from the facility have been assessed against relevant Air Quality Standards for relevant pollutants.

Stack Height Determination

5.2.6 A stack height assessment has been carried out to support the selected stack height. This assessment is provided within Appendix E.

5.2.7 Dispersion Modelling Assessment Results

5.2.8 Once operational, the key sources of emissions to air are the emissions of exhaust gases from the 129 backup generators. Concentrations of NO_2, PM_{10}, SO_2, CO and hydrocarbons (assumed to be benzene) have been predicted at selected sensitive human health and ecological receptors using a detailed atmospheric dispersion model and compared with the relevant long and short-term Air Quality Standards (AQS) objectives.

5.2.9 The backup plant is not anticipated to have significant impacts on human receptors under normal operation (testing).

5.2.10 For the 72 hours emergency power outage scenario, there were no predicted exceedances of the relevant Air Quality Objectives (AQO) for PM_{10}, SO_2, CO. For NO_2 and benzene, the impacts of the backup generators in the 72-hour outage scenario were found to be potentially significant for the 1-hour mean objectives. At the 5% risk percentile, there are no predicted exceedances of the 1-hour mean NO_2 objective, and only one exceedance of the 1- hour mean benzene objective at the 5% risk percentile.

5.2.11 However, the site has two substations and therefore the power supply is resilient to potential outages. Consequently, the potential of a 72-hour outage occurring simultaneously at both is considered highly unlikely. In addition, benzene has been assumed to represent 100% of hydrocarbon emissions from the backup plant. In reality, there will be a combination of other compounds within these emissions and benzene impacts will be a small percentage of the VOCs emitted during the operation of the backup plant. There are no predicted exceedances of the 1-hour mean benzene AQO at any other modelled receptors. As such, the impact of the outage scenarios on the 1-hour mean benzene objective can be considered not significant at all receptors.

5.2.12 These conclusions, plus the unlikelihood of an outage of this duration occurring in the first instance, due to inbuilt data centre resilience and grid reliability, the air quality effects on human sensitive receptors are not considered significant. No specific mitigation in respect of air quality is considered necessary.

5.2.13 Ecological impacts are discussed in section 5.3 below.

5.3 Assessment of Impacts at Ecological Receptors

5.3.1 An assessment of air quality impacts for nearby ecological receptors has been made and can be found within the Air Quality Assessment within Appendix E.

5.3.2 In line with EA guidance for air impact screening for conservation areas[6], the assessment considers the impact of the development of NO_x concentrations, SO_2 concentrations, nutrient nitrogen deposition and acid deposition at designated sites. A search for Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSIs) and Ramsar sites within 15 km of the site and National Nature Reserves (NNRs), Local Nature Reserves (LNRs), Local Wildlife Sites and Ancient Woodlands within 2 km of the site identified the following sensitive ecological receptors:

Table 5-1: Assessed Sensitive Receptors for Air Quality Impacts

Ancient Woodland	Special Area of Conservation	Site of Specific Scientific Interest
Ancient Woodland	Cothill Fen SAC	Appleton Lower Common SSSI
	Little Wittenham SAC	Ashridge Wood SSSI
	Oxford Meadows SAC	Aston Upthorpe Downs SSSI
		Barrow Farm Fen SSSI
		Brasenose Wood and Shotover Hill SSSI
		Cothill Fen SSSI
		Culham Brake SSSI
		Cumnor SSSI -
		Dry Sandford Pit SSSI
		Frilford Heath, Ponds and Fens SSSI
		Holies Down SSSI
		Hurst Hill SSSI
		Iffley Meadows SSSI
		Lamb and Flag SSSI
		Langley's Lane Meadow SSSI
		Lardon Chase SSSI
		Littlemore Railway Cutting SSSI
		Lye Valley SSSI
		Magdalen Grove SSSI
		Moulsford Downs SSSI

[6] Environment Agency (2016), Screening for protected conservation areas. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screening-for-protected-conservation-areas

Ancient Woodland	Special Area of Conservation	Site of Specific Scientific Interest
		New Marston Meadows SSSI
		Port Meadow with Wolvercote Common & Green SSSI
		Rock Edge SSSI
		Streatley Warren SSSI
		Sugworth SSSI -
		Warren Bank SSSI
		Wytham Woods SSSI

5.3.3 The predicted emissions at sensitive receptors surrounding the plant are below the required air quality standards. The assessment of air quality effects at nearby ecological sites concluded that the effects of:

- Annual-mean NO_x;
- Annual-mean SO_2;
- Nutrient nitrogen deposition; and
- Acid deposition;

can all be screened out as insignificant at all relevant sensitive ecological sites for the testing and maintenance scenarios.

5.3.4 Impacts at ecological receptors in the 72-hour outage scenario were found to be potentially significant impacts for the 24- hour mean NOx critical level. Due to the Site having two substations, the likelihood of a 72-hour outage is considered an overly conservative assessment and is considered highly unlikely to occur. However, the very short-term nature of potentially high NOx emissions associated with the use of the backup plant would not reasonably be considered to result in significant changes to the vegetation assemblages of the designated sites, because increased nitrogen uptake would only potentially occur for a few hours at most. It is therefore concluded that effects to the designated sites of the short-term increase in N deposition as a result of NOx emissions from the backup plant would not be significant

5.4 Emissions to Water and Sewer

5.4.1 The facility will not result in process water discharges to surface waters or foul sewer. The only discharges anticipated will arise from rainwaters and their subsequent run-off from rooftops and hardstanding areas. As detailed in section 4.6, surface drainage from each generator compound will pass through an oil interceptor.

5.4.2 As only uncontaminated rainwater will be discharged from the site, this discharge is not considered to present an environmental impact and does not require assessment.

5.4.3 No monitoring of surface water run-off is proposed.

5.5 Noise and Vibration

5.5.1 A Noise Impact Assessment (NIA) to support the application for the Environmental Permit. This is included as Appendix F to this application and provides the details of the assessment of noise effects from the operation of the back-up generators.

5.5.2 Noise level predictions have been carried out using CadnaA 2024 to generate a noise model, allowing for prediction of noise levels at the receivers from source position based on equipment layouts and selections. The assessment has been completed according to the guidance in BS 4142:2014+A1:2019.

5.5.3 The assessment has concluded that proposed noise limits for the normal daytime operation (testing) scenario are met at all noise sensitive receptors and that therefore noise from the generators will have a low impact.

5.5.4 Under the 72 hour emergency scenario of the back-up generators, a potentially significant adverse effect is predicted at two noise sensitive receptor during the night-time in accordance with BS 4142, however predicted noise levels at these receptors were below the WHO threshold for sleep disturbance. Overall the impact is assessed as not significant taking into account the predicted noise levels and contextual factors, including the short duration of any potential occurrence and the unlikelihood of a 72hr outage occurring in the first instance due to the exceptional nature of a grid failure event and the inbuilt resilience in the data centre systems.

6 BAT ASSESSMENT

6.1.1 The following sections provide information to support how the facility will meet BAT in relation to:

- Generator type, configuration and plant sizing;
- Grid reliability and built in redundancy;
- Stack configuration; and
- Energy efficiency.

6.2 Generator Type, Configuration and Plant Sizing

6.2.1 Diesel/HVO fuelled generators have been chosen due to the ability to store the required volumes of fuel on site and therefore maximise energy security in the system. EA draft guidance accepts that diesel generators are currently the default technology for standby generators at data centres[7].

6.2.2 The main back-up generators to be used are designed to either standards 2gTA-Luft as required by the draft EA guidance and EA BAT guidance for Emergency Back-up generators[8], data sheets confirming this are provided in Appendix H. The data sheets also confirm the emissions performance of each of the generator types. The manufacturers specification for the main emergency generator units are shown to have emissions for nitrogen oxides (NOx) of 2,270 mg/Nm^3 (@5% O_2) which are in line with the BAT emissions requirements to achieve around 2000 mg/Nm^3 @5% O_2 and therefore the generator design is concluded to be optimised for NOx control. NOx emissions from combustion of HVO would be similar or lower than from diesel firing.

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

6.2.4 The proposed Didcot data centre campus will comprise 4 data halls; 3 x 3 storey 18 phase data halls and 1 x 1 storey 3 phase data hall. There will be 2 x 2.8MW ‘primary’ standby generators per phase which will be deployed in an emergency scenario to replace the grid supply. In addition there are a further 2 x 2.8MW ‘main’ generators per data centre building which will be deployed and held in reserve to function as a secondary emergency supply should one of the primary generators fail or not provide a stable power supply.

6.2.5 The applicant’s customers rely on 24/7/365 access to their data and related cloud computing services; to meet this demand and to ensure 100% reliability and availability, the applicant has specifically designed the emergency power supply system as described. The reliability of the applicant’s facilities and services is a key feature of their offering and central to their success and growth.

6.2.6 A smaller single 720kW ‘house’ generator will also be installed in each data centre building to supply non-critical loads (eg. Internal & external lights and office fire systems) in the main data centre building as well as surrounding structures (eg. sprinkler house, security gatehouse and MV room) during an emergency.

6.2.7 Similarly the capacity of the 2 x 440 kW back-up generators for the CIWB and 1 x 440 kW back-up generator for the onsite substation have been designed to meet the demands of this plant to ensure uninterrupted supply in the event of mains supply outage.

---

[7] Data Centre FAQ Headline Approach, version 21.0 to TeckUK for Discussion 15/11/22

[8] Emergency backup diesel engines on installations: best available techniques (BAT) - GOV.UK

6.2.8 The decision to install a larger number of smaller back-up generators, rather than a smaller number of larger back-up generators, was made to provide greater flexibility in emergency situations. This configuration helps manage the risk of individual unit failure while ensuring a reliable supply of power. The design solution also ensures the back-up generators operate at their optimal capacity, typically at high loads, which maximizes fuel efficiency and minimizes emissions. Operating a smaller number of larger generators at sub-optimal loads can negatively impact engine performance and longevity if used extensively over long periods.

6.2.9 Additionally, the main back-up generators were chosen to have a 2.8 MW capacity based on the critical power requirements. Units of this size are readily available, can be modularized and containerized, use off-the-shelf components that are easily replaceable, and each unit is self-sufficient.

6.2.10 As to the sizing of the main generators, the facility's MV/LV transformers are sized according to the total power demand for each phase, with two transformers per phase (38 in total at 3 storey full build). Each generator is sized to match the electrical capacity of a single transformer. The transformer/generator capacity selection is ultimately sized to match the base demand for each of the buildings. Selecting smaller generators would require paralleling complexity and ultimately require (best-case) the same MW thermal capacity. A 1:1 transformer to generator ratio would not be possible with a larger generator and use of larger generators would also reduce system redundancy (but not the overall MW thermal capacity of the facility).

6.2.11 The house generators are dedicated to the data centre offices and have been designed to meet the expected electrical demand of the offices during an emergency event. Having a specific emergency generator for the non-DC load is designed to avoid impacting on the demand-load provided by the primary generators. Similarly, the smaller CIWB and substation generators have been specifically designed to meet the CIWB and substation demand.

6.2.12 The size of the generators has also been designed to ensure fast start up and shut down can be achieved as this is a fundamental requirement of the emergency back-up nature of the generators.

6.2.13 The facility also has a UPS system within the facility. This has a critical function of immediately activating and providing almost instantaneous power to the facility when failure or fluctuation in mains/Grid power is detected. The UPS acts as a short-term bridging-power supply while the primary emergency generators are activated and come-up to a stable-load. The UPS system is a core component of the emergency back-up power supply system for the facility but can only function as a short-term solution and does not replace the need for the emergency generators.

6.3 Grid Reliability and Built in Redundancy

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

6.3.2 The overall reliability of supply for the National Grid Electricity Transmission (NGET) System during 2023 – 2024 was 99.999930% with similarly high levels of performance also achieved in 2022-23 and 2021-22.[9.] During 2023-24, there were 627 NGET system events where transmission circuits were disconnected either automatically or by urgent manual switching. The majority of these events had no impact on electricity users with only 17 resulting in loss of supplies to customers.

[9] https://www.nationalgrideso.com/document/153121/download

6.3.3 The power distribution system, on-site, starting from the medium voltage intake substation down to the low voltage distribution, is designed to be safe, reliable, redundant, robust, and efficient and have in- built redundancy.

6.3.4 The operator designs and builds systems with in-built redundancy, based on medium voltage power supply connections from an electricity grid, being the primary power source to the site. The dual redundant circuit provides security of supply in the event of a fault or loss of supply from one source, the other circuit is capable of supplying full load to the site.

6.3.5 To achieve this redundancy, the operator is proposing for the full supply to be split 50%/50% (dual feeds) from alternative supply sources, each capable of supplying the 100%, if required. Essentially, the data centre will be supplied from the Grid by a substation with 2 separate cables from 2 separate feeders; therefore, in the event of a loss of supply from a single source, 50% of the site is still on the alternative source, while the remaining 50% is on back-up emergency generators temporarily until the site's own distribution system can be rearranged to resume supply from the available source . This arrangement stays in place until the failed source has restored supply, at which point power returns to the two supply sources. This arrangement is subject to connection agreement and compliance with transmission and distribution regulations (and providers).

6.3.6 The on-site infrastructure is designed on N+1[10] reliability and concurrently maintainable design. This means that there is redundancy built into the system, so that any one component, or any one distribution path can be out of service without affecting operations. Similarly, for the grid connection to the data centre to fail, it would require a number of failures to the upstream distribution network to occur simultaneously. The requirement to run back-up generators is therefore minimised.

6.3.7 The operator also undertakes a regular and robust infrastructure inspection, preventative maintenance and testing programme involving both their staff and various specialist vendors. Depending on the nature of the infrastructure, some inspections are carried out twice daily. The specific frequency of a maintenance task will be determined by the equipment manufacturer's recommendations (e.g. generator maintenance) or as required by legislation (e.g. fluorinated gases leak testing and maintenance). The operator also replaces all plant and equipment when the warranty period expires.

6.3.8 The Applicant has an integrated Building Management System (BMS) and an Electrical Power Monitoring System (EPMS): these are additional control tools which are used to monitor physical assets and equipment status and performance. The BMS/EPMS presents real time and historical data, providing valuable performance metrics. The BMS is used to monitor that data centre assets are functioning correctly. Alarms are set up in the BMS/EPMS to alert the Operations and Environmental teams of any issues with systems and equipment.

6.3.9 The measures above will minimise the potential for emergency operation of the generators, reducing the overall environmental impact from the installation, in the rare event that they are triggered to operate.

6.3.10 Notwithstanding this, for the purposes of the assessment and in line with EA guidance, a 72 hours back-up generation in the event of a major grid failure has been assumed. However, in the rare event of a loss of utility power to the site, an outage would be expected to be significantly less than the modelled 72 hours.

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

6.4 Stack Configuration

6.4.1 Each generator will be served by an individual stack. The air quality assessment has been carried out on this basis. This arrangement has been justified for various reasons.

6.4.2 For this facility, routine operation of the generators will be for testing only. For the purposes of testing, each generator will be run sequentially in order to minimise air quality and noise impacts. Therefore, a multi-flue stack arrangement would not provide any significant benefit under the testing regime. Further, should a multi-flue arrangement have been selected, the stack height assessment would have been carried out on this basis and the selected stack height would likely have been lower. When testing with only one of the generators in operation, dispersion from a lower stack could result in higher process contributions at receptors.

6.4.3 During emergency operation with multiple generators running benefits to the dispersion from combining flues could potentially be achieved. However, emergency operation is not routinely expected, and where required is expected for no more than 72 hours per annum, limiting the potential for significant benefits.

6.4.4 A multi-flue stack configuration will increase capital costs associated with additional and more complex exhaust gas ducting. Further, for plant maintenance there are operational and safety advantages in providing separate stacks as maintenance on one generator will not prevent the operation of the remaining generators if these are required to be deployed in an emergency scenario. This will allow electricity generation at any time, a significant advantage for a plant designed to provide emergency back-up power at short notice. Furthermore, the footprint of the plant is such that there is insufficient space to accommodate a combined stack structure in one location.

6.4.5 With little potential for any significant environmental benefit from a multi-flue arrangement, combined with additional costs and operational and maintenance complexities, a multi-flue combined stack arrangement is not considered to be BAT.

Energy Efficiency

6.4.6 Whilst the generators to be installed are subject to confirmation, based on data sheets for typical generators they are expected to have net electrical efficiencies of approximately 37.6% (House Generator), 37.2% (Main Generator) and 34 % (Other Backup Generators for CIWB and substation).

6.4.7 The EA guidance refers to an assumed low efficiency of 35%[11]. for diesel generators which the main and house generator models exceed There are no BAT-AEELs that apply to this classification of generator as the installation is not a large combustion plant as defined by the IED. The selected generators are of an industry standard and therefore would be in line with the expectations of the EA given the type of technology being used.

6.5 BAT Summary

6.5.1 The application has set out the proposed techniques to be operated and these have been considered against BAT and alternatives. The design of the facility and the reliability of the grid connection have been optimised to maximise security of supply and therefore minimise the need to operate the generators for power supply to the site. The selected engines and their emissions performance are aligned with EA guidance for emergency back-up generation.

6.5.2 Section 5 has demonstrated that the impacts from operation of the facility for testing and as emergency back-up supply will not give rise to significant environmental effects.

[11] Data Centre FAQ Headline Approach, version 21.0 to TeckUK for Discussion 15/11/22

6.5.3 The proposed techniques are therefore considered to meet BAT and the operation of the proposed facility is not expected to give rise to significant effects to the environment or human health.

Appendix A
APPLICATION FORMS

Appendix B
SITE PLANS

Appendix C
ENVIRONMENTAL RISK ASSESSMENT

Appendix D
IED BASELINE AND SITE CONDITION REPORT

Appendix E
AIR QUALITY ASSESSMENT

Appendix F
NOISE ASSESSMENT

Appendix G
NOISE MANAGEMENT PLAN

Appendix H
GENERATOR DATA SHEETS

MAKING COMPLEX EASY

A TETRA TECH COMPANY